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</tr>
<tr>
<td>BRAVE / ARCHITECTURE</td>
</tr>
<tr>
<td>4200 Montrose Blvd. Suite 400</td>
</tr>
<tr>
<td>Houston, Texas 77006</td>
</tr>
<tr>
<td>Phone: (713) 524-5858</td>
</tr>
<tr>
<td>Fax: (713) 524-5868</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>CIVIL CONSULTANT</strong></td>
</tr>
<tr>
<td>ANDREW LONNIE SIKES, INC.</td>
</tr>
<tr>
<td>1002 East Avenue</td>
</tr>
<tr>
<td>Katy, Texas 77493</td>
</tr>
<tr>
<td>Phone: (281) 561-8118</td>
</tr>
<tr>
<td>Fax: (281) 561-8668</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>MEP CONSULTANT</strong></td>
</tr>
<tr>
<td>JONES ENGINEERING</td>
</tr>
<tr>
<td>9820 Whithorn Dr.</td>
</tr>
<tr>
<td>Houston, Texas 77095</td>
</tr>
<tr>
<td>Phone: (713) 222-7766</td>
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SECTION 03 1119
PERMANENT FORMS - INSULATING CONCRETE FORMS

PART 1 GENERAL
1.1 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including Uniform General Conditions, and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY
   A. Supply and installation of permanent insulating concrete forms as formwork, placement of steel reinforcement and placement of concrete into formwork.

1.3 RELATED SECTIONS
   A. Section 03 3000 - Cast-In-Place Concrete
   B. Section 06 0000 - Wood, Plastics and Composites
   C. Section 07 2710 - Vapor and Air Barrier

1.4 REFERENCES
   A. American Society for Testing and Materials (ASTM)
      1. ASTM E2634 – Standard Specification for Flat Wall Insulating Concrete Form (ICF) Systems
      3. ASTM C 236 – Steady State Thermal Performance of Building Assemblies
      5. ASTM D 1761 – Standard Test Methods for Mechanical Fasteners in Wood
      7. ASTM A 615 – Steel Specifications for Steel Reinforcement
      9. ASTM D 2843 – Standard Test Method for Density of Smoke from the Burning or Decomposition of Plastics

   B. American Concrete Association
      1. ACI 301– Standard Specification for Structural Concrete
      2. ACI 304 -- Guide for Measuring, Mixing, Transporting and Placing Concrete
      3. ACI 305 -- Hot Weather Concreting
      4. ACI 306 -- Cold Weather Concreting
      5. ACI 309 -- Guide for Consolidation of Concrete
      6. ACI 318 -- Building Code Requirements for Reinforced Concrete
      7. ACI 347 -- Guide to Formwork for Concrete

      1. AC 353 -- Acceptance Criteria for Stay-In-Place, Foam Plastic Insulating Concrete Forms

1.5 SYSTEM DESCRIPTION - (ICF) Systems for Solid Concrete Walls
   A. Provide insulating concrete form product which has been manufactured and installed to withstand concrete placement loads without defects, damage, or failure and such that the cast-in-place concrete wall is designed according to ACI 318 “Building Code Requirements for Reinforced Concrete.”
B. Furnish labor, materials, equipment, and services necessary for the complete and proper installation of all insulating concrete framework and related work, as shown on the drawings or specified herein, in accordance with all applicable requirements of the contract documents.

1. Insulating concrete wall formwork consisting of two flat wall panels of flame retardant Type II expanded polystyrene (EPS) manufactured to a nominal 1.5 lbs/cu. ft. minimum density. The two EPS panels to be connected by 6 co-polymer polypropylene plastic tie inserts designed with cross members placed 8” o.c. horizontally and 8” o.c. vertically creating a symmetrical design enhancing installation efficiency and reducing product waste. Plastic tie inserts positioned perpendicular between the EPS panels. The ICF product to be modular or prefabricated factory assembled forms.

2. The ICF formwork to have consistent 2 5/8” thick EPS panels with a single row of rectangular interlocking projections and recesses designed for efficient installation with the modular ICF formwork having no top, bottom, left or right sides; which is a universal type of design. Straight and specialty blocks (90-degree corner, 45-degree corner, etc.) all possess the same design features and characteristics.

3. Plastic tie inserts designed to allow for additional reinforcement placement positions to comply with structural design. The rebar chair supports are two deep with a loose fit for contact splice connections.

4. Wall system to provide a forming cavity width of a minimum 4”, 6”, 8”, 10” or 12” (as design requires). The cavity width shall be a consistent flat rectangular cross section for the full and half blocks.

5. Wall system plastic tie inserts to provide minimum 1.5” wide and 0.23” thick fastening strips @ 8” o.c. Fastening strips to be recessed beneath the EPS panel face 5/8” and run vertically full form height (16” for the standard Fox Block and 8” for the shorter Fox Half Block) to facilitate fastening both interior and exterior.

6. Wall system consisting of two EPS panels, concrete and exterior and interior finishes to provide a minimum R-23 insulation value.

7. EPS foam to provide maximum vapor permeation of 3.5 Perm-in.

C. Conform to the applicable building code requirements of regulatory agencies having jurisdiction.

1.6 SUBMITTALS

A. SUBMITTALS PRIOR TO COMMENCEMENT OF ICF WORK:

1. Product data: Provide data on form materials and installation requirements and procedures.

2. Drawings and Calculations: Submit project drawings, details of construction, structural calculations as required by the local building department, indicate pertinent dimensions, materials and arrangement.

3. Steel Reinforcement: Provide structural calculations reinforcement sizing and placement schedule sealed by a Professional Engineer.

4. Concrete: Submit the concrete mix design as proposed for use.

5. Designer’s printed recommendations for the proper installation of mechanical and electrical component installations, penetrations, interior and exterior finishes and attachment of structural elements.

1.7 QUALITY ASSURANCE

A. ACCEPTABLE PRODUCTS AND MANUFACTURER’S QUALIFICATIONS.

1. A single manufacturer that has been continuously producing ICF products for not less than 5 years in North America.

B. AGENCY APPROVALS. The proposed insulating concrete form product shall have been evaluated to the applicable building code and shown to be in current compliance as evidenced by an evaluation report from one of the following code agencies.

1. Intertek
2. ICC-ES.
3. CCMC.

C. Accredited third-party independent testing and current reporting.

D. SCOPE OF WORK. The work to be performed under this specification shall include but is not limited to the following: Attend necessary job meetings and furnish competent and full time supervisor, labor, all materials, tools, and equipment necessary to complete, in an acceptable manner, the insulating concrete form system.
installation in accordance with this specification. Comply with the application guidelines of the manufacturer of the insulating concrete form products.

E. PRE-APPLICATION INSULATING CONCRETE FORM CONFERENCE:

1. Approximately 2-3 weeks before scheduled commencement of insulating concrete form installation and associated work, meet at project site with contractor, sub-contractors, concrete supplier and other related work that must precede or follow formwork including architect, owner, insulating concrete form manufacturer’s representative and other representatives directly concerned with performance of the work.
   A. Review methods and procedures related to insulating concrete formwork, including but not necessarily limited to the following:
   B. Verify that site conditions are as set out in Part 1 - General Conditions. Insulating concrete form installer is to coordinate provision of access, storage area and protection of ICF product.
   C. Verify footing installation conforms to requirements of ¼” within level and that steps or elevation changes in footings are in 8” or 16” height increments.
   D. Verify that reinforcing steel dowels are in place at specified centers along footing lengths.
   E. Review transitions, special penetration details, area drainage, curbs, proposed openings, structural elements (lintels and bucks) and conditions of other construction that will affect insulating concrete forms.
   F. Review insulating concrete form requirements (drawings, specifications, and other contract documents).
   G. Review required submittals, both completed and yet to be completed.
   H. Review and finalize construction schedule related to insulating concrete formwork and verify availability of materials, installer’s personnel, equipment and facilities needed to make progress and avoid delays.
   I. Review temporary protection requirements for insulating concrete form system during and after installation.
   J. Review weather and forecasted weather conditions and procedures for coping with unfavorable conditions.

1.8 DELIVERY, STORAGE AND HANDLING
   A. Deliver products in original factory packaging, bearing listing and leveling identification of product, manufacturer and lot number.
   B. Handle and store products in a location to prevent damage and soiling.
   C. Ensure that UV protection is provided for material, on-site storage should be required for an extended time period.

1.9 PROJECT CONDITIONS
   A. Use appropriate measures for protection when required to ensure proper concrete curing conditions in accordance with ACI 305 and ACI 306 during periods of weather where temperatures are above or below minimum specified by the governing or local building code for concrete.
   B. Familiarize every member of the application crew with all applicable safety regulations recommended by OSHA and other industry or local governmental groups.

1.10 SEQUENCING AND SCHEDULING
   A. Sequence installation of insulating concrete forms with related work specified in other sections to ensure that wall assemblies, including window and door accessories, trim, service penetrations, transition changes and mechanical services are protected against damage from effects of weather, corrosion and adjacent construction activity.

1.11 WARRANTY
   A. Insulating concrete form manufacturer to provide copies of specified product warranties.

PART 2 PRODUCTS
2.1 INSULATING CONCRETE FORM PRODUCTS

A. INSULATING CONCRETE FORM GENERAL CHARACTERISTICS: Form units with the following characteristics and dimensions to accommodate project criteria:

1. Expanded polystyrene (EPS) plastic foam units.
2. Nominal 1.5 lbs./cu. ft. foam density.
3. Intertek listed 3rd party agency maximum flame spread rating of 25 or less per ASTM E-84 and/or UL 723.
4. Intertek listed 3rd party agency maximum smoke development rating 450 or less per ASTM E-84 and/or UL 723.
5. Universal and reversible interlock design for successive courses to provide wall integrity and single corner form.
6. Form Units to comply with following out to out dimensions and concrete core widths:
   i. 11.25" Straight Forms (Full & Half Blocks):
      1.6" Concrete Width: 48" L x 11.25" W x 16" H - 2 5/8" Thick EPS
   ii. 11.25" 90-degree Corners (Full & Half Blocks):
      1.6" Concrete Width 40" x 24" L x 11.25" W x 16" H - 2 5/8" Thick EPS
   iii. 11.25" Taper Top Form
   iv. 11.25" T-Block (Short and Long)
   v. 11.25" radius block (radius 5’, 6’, 7’, 8’, 9’ & 10’)
   vi. Height Adjuster 4” Tall x 48” L x 2 5/8” Thick EPS

B. BRACING, ALIGNMENT AND SCAFFOLD SYSTEM

1. As an integral installation component of an insulating concrete form system, an adjustable metal scaffolding support and wall alignment system shall be provided.
2. A device with adequate degrees of adjustment to ensure the completed insulating concrete form system walls are plumb after the placement and consolidation of concrete.
3. An OSHA compliant scaffold support system to facilitate proper stacking of forms and placement of concrete.
4. System adequate to reinforce and protect completed insulating concrete form installation prior to the attachment of structural elements to protect from wind damage.

2.2 CONCRETE

A. Concrete supplied under Section 03 3000 shall be of strength as specified in S.101 by the design engineer (measured at 28 days). Reference S.101 for the recommended aggregate size.
B. Recommended concrete slump is specified on S.101.
C. Perform the required concrete consolidation per ACI 304 and ACI 309 to be manufactured as specified or detailed by the structural engineer in conjunction with the insulating concrete form manufacturer’s installation manual guidelines.
D. In extreme temperatures concrete shall be placed in accordance with ACI 305 Cold Weather Concrete Placement or ACI 306 Hot Weather Concrete Placement

2.3 STEEL REINFORCEMENT

A. Steel reinforcement shall be as specified in S.101 and Section 03 3000 and shall be supplied under that section for placement by the insulating concrete form installer.
B. LINTEL DESCRIPTION
Lintels to be installed as specified or detailed by the structural engineer in conjunction with the insulating concrete form manufacturer’s installation manual guidelines or per IRC/IBC or the NBC of Canada model codes. Size and placement of top and bottom reinforcing steel, stirrups for shear reinforcement and corner reinforcing to be verified with engineering design prior to concrete placement.
C. STRUCTURAL STEEL STIRRUP SUPPORT FOR CORBEL LEDGE FORM
Reinforcing steel stirrup to be placed in accordance with Structural Engineers Specifications and details for the given project installation parameters.
2.4 DAMPPROOFING or WATERPROOFING
   C. Sheet or fluid-applied waterproofing membrane materials to be supplied under this section and installed according to manufacturer’s recommendations as specified under Section 07 2500 Weather Barrier.
   D. Waterproofing materials to be compatible with EPS foam form units.
   E. Drainage or protection board material to be installed adjacent to waterproofing installation and temporarily fixed or adhered in place prior to back-fill. Material Supplied shall be as specified.

2.5 PARGING
   A. Exposed exterior wall surface from waterproofing to grade line shall be covered with a durable, weather resistant covering in accordance with code requirements or a specific research report. Stucco type material or equivalent supplied under this section and installed according to manufacturer’s requirements and recommendations.
   B. Alternate acrylic finish supplied and installed under Section 07 2400 (Exterior Insulation and Finish Systems).

2.6 ACCESSORIES
   A. Masonry anchor
   B. Window or Door Opening Buck Materials
      a. Fox Buck supplied by Fox Blocks
      b. Extruded vinyl, wood, EPS foam or metal buck material.
   C. Steel Reinforcement for Corbel Ledge Form.
      a. #3 Rebar Hook – Stirrup supplied by Fox Blocks to be exclusively used in the Corbel Ledge Form, approved by the Engineer of Record

PART 3 EXECUTION
3.1 PREPARATION
   A. Remove all loose aggregate and foreign substances prior to commencement of insulating concrete form system installation.

3.2 INSTALLATION OF FORM UNITS
   A. Installation of forms to be in accordance with manufacturer’s installation guidelines as submitted in evidence under Section 1.08.
   B. The installer shall ensure the following accepted ICF construction practices are utilized on site as outlined in the manufacturer’s installation guidelines:
      1. Footing Foundation Construction
      2. Staging Materials
      3. Wall Layout
      4. Course Placement
      5. Horizontal Reinforcement Placement
      6. Door and Window Opening Construction (See 3.04 Below)
      7. Utility Service Penetration (See 3.03 Below)
      8. Bracing, Alignment and Scaffolding
      9. Vertical Reinforcement Placement
      10. Lintel Construction (see applicable code and/or engineering design)
      11. Checklist Prior to Concrete Placement
      12. Concrete Placement
         a. Placement Methods/Types (Pumping, etc.)
         b. Mix Design
         c. Concrete Consolidation Methods
         d. Post Placement Methods
      13. Below Grade Waterproofing Application
      14. Parging/Exterior Finishes
15. Clean-up (See 3.05 Below)  
16. Protection (See 3.06 Below)  
17. Drainage tile  
18. Backfilling  

3.3 SERVICE PENETRATIONS  
A. Service penetrations (electrical service conduits, water service pipes, air supply, exhaust ducts, etc.) shall be placed at the required locations as indicated by the appropriate trades.  
B. Penetrations shall be reinforced as required by the structural engineer.  
C. Provide and install material such as metal and PVC Schedule 40 pipe sleeves at service penetrations prior to placing concrete to create voids where services can be passed through at a later date.  

3.4 ACCESSORY PRODUCT INSTALLATIONS  
A. Buck Material. Refer to the manufacturer’s guidelines for installation of appropriate bucking materials.  
B. #3 Reinforcing Stirrups for use in the corbel block to be installed as specified or detailed by the structural engineer in conjunction with the insulating concrete form manufacturer’s installation manual guidelines.  
C. tieKey adjustable masonry anchor  

3.5 CLEANUP  
A. Clean up and properly dispose of all debris remaining on job site related to the installation of the insulating concrete forms.  
C. Clean forms as installation proceeds, to remove foreign matter within forms.  
D. Clean formed cavities of debris prior to placing concrete.  
E. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.  
F. During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out forms, unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter.  
G. All formwork should be free and clear of concrete overspills. All bucks and openings should be clean and bracing removed after concrete cures as per engineer specifications. All floors should be scraped and cleaned of concrete spills.  

3.6 PROTECTION  
A. Consult with exterior finish contractor concerning exposure to ultraviolet light to ensure proper finish to ICF walls.  
B. Protect the interlocking teeth prior to concrete placement if additional forms are to be stacked after concrete placement.  

END OF SECTION
SECTION 03 3000
CAST-IN-PLACE CONCRETE

PART 1 PART 1 GENERAL

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

1.2 SECTION INCLUDES
A. Concrete formwork.
B. Concrete reinforcement.
C. Joint devices associated with concrete work.
D. Concrete curing.

1.3 RELATED REQUIREMENTS
A. Section 07 9200 - Joint Sealants: Sealants for saw cut joints and isolation joints in slabs.
B. Section 32 1313 - Concrete Paving: Sidewalks, curbs and gutters.

1.4 REFERENCE STANDARDS
A. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials; American Concrete Institute International; 2010.
B. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; American Concrete Institute International; 1991 (Reapproved 2002).
C. ACI 301 - Specifications for Structural Concrete for Buildings; American Concrete Institute International; 2010.
D. ACI 302.1R - Guide for Concrete Floor and Slab Construction; American Concrete Institute International; 2004 (Errata 2007).
E. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; American Concrete Institute International; 2000.
F. ACI 305R - Hot Weather Concreting; American Concrete Institute International; 2010.
G. ACI 306R - Cold Weather Concreting; American Concrete Institute International; 2010.
H. ACI 308R - Guide to Curing Concrete; American Concrete Institute International; 2001 (Reapproved 2008).
I. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; American Concrete Institute International; 2011.
J. ACI 347 - Guide to Formwork for Concrete; American Concrete Institute International; 2004.
V. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2012.
AA. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs; 2011.

1.5 SUBMITTALS
A. Product Data: Submit manufacturers’ data on manufactured products showing compliance with specified requirements and installation instructions.
   1. For curing compounds, provide data on method of removal in the event of incompatibility with floor covering adhesives.
B. Verification Samples: Submit sample chips of specified colors indicating pigment numbers and required dosage rates, for subsequent comparison to installed concrete.
C. Samples: Submit samples of underslab vapor retarder to be used.
D. Manufacturer's Installation Instructions: For concrete accessories, indicate installation procedures and interface required with adjacent construction.
E. Project Record Documents: Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.

1.6 QUALITY ASSURANCE
A. Perform work of this section in accordance with ACI 301 and ACI 318.
   1. Maintain one copy of each document on site.
B. Follow recommendations of ACI 305R when concreting during hot weather.
C. Follow recommendations of ACI 306R when concreting during cold weather.

PART 2 PART 2 PRODUCTS
2.1 FORMWORK
A. Formwork Design and Construction: Comply with guidelines of ACI 347 to provide formwork that will produce concrete complying with tolerances of ACI 117.
B. Form Materials: Contractor's choice of standard products with sufficient strength to withstand hydrostatic head without distortion in excess of permitted tolerances.
   1. Form Facing for Exposed Finish Concrete: Contractor's choice of materials that will provide smooth, stain-free final appearance.
   2. Earth Cuts: Earth cuts may be used as forms for vertical surfaces of spread and continuous footings and the unexposed portions of grade beams provided a stable vertical edge can be maintained.
   3. Form Coating: Release agent that will not adversely affect concrete or interfere with application of coatings.
   4. Form Ties: Cone snap type that will leave no metal within 1-1/2 inches of concrete surface.

2.2 REINFORCEMENT
A. Reinforcing Steel: ASTM A615/A615M Grade 60 (420).
   1. Type: Deformed billet-steel bars.
   2. Finish: Unfinished, unless otherwise indicated.
B. Reinforcement Accessories:
   1. Tie Wire: Annealed, minimum 16 gage.
2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.
3. Provide stainless steel, galvanized, plastic, or plastic coated steel components for placement within 1-1/2 inches of weathering surfaces.

2.3 CONCRETE MATERIALS
A. Cement: ASTM C150, Type I - Normal Portland type.
   1. Acquire all cement for entire project from same source.
C. Fly Ash: ASTM C618, Class C or F.
D. Water: Clean and not detrimental to concrete.

2.4 CHEMICAL ADMIXTURES
A. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.
C. High Range Water Reducing Admixture: ASTM C494/C494M Type F.

2.5 ACCESSORY MATERIALS
A. Underslab Vapor Retarder: Multi-layer, fabric-, cord-, grid-, or aluminum-reinforced polyethylene or equivalent, complying with ASTM E1745, Class A; stated by manufacturer as suitable for installation in contact with soil or granular fill under concrete slabs. The use of single ply polyethylene is prohibited.
   1. Accessory Products: Vapor retarder manufacturer's recommended tape, adhesive, mastic, prefabricated boots, etc., for sealing seams and penetrations in vapor retarder.
   2. Products:
      e. Substitutions: See Section 01 6000 - Product Requirements.
B. Non-Shrink Cementitious Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.
   1. ASTM C1107/C1107M; Grade A, B, or C.
   2. Minimum Compressive Strength at 28 Days: 7,000 psi.
   3. Flowable Products:
      d. Substitutions: See Section 01 6000 - Product Requirements.
   4. Low-Slump, Dry Pack Products:
      c. Substitutions: See Section 01 6000 - Product Requirements.
C. Non-Shrink Epoxy Grout: Moisture-insensitive, two-part; consisting of epoxy resin, nonmetallic aggregate, and activator.
   1. Products:

2.6 BONDING AND JOINTING PRODUCTS
A. Latex Bonding Agent: Non-redispersable acrylic latex, complying with ASTM C1059 Type II.
   1. Products:
a. Substitutions: See Section 01 6000 - Product Requirements.

B. Waterproofing Admixture Slurry: Slurry coat of Portland cement, sand, and crystalline waterproofing additive, mixed with water in proportions recommended by manufacturer to achieve waterproofing at cold joints in concrete.

1. Additive Manufacturers:
   a. Aquafin, Inc: [www.aquafin.net](http://www.aquafin.net)
   c. Xypex Chemical Corporation: [www.xypex.com](http://www.xypex.com)
   d. Substitutions: See Section 01 6000 - Product Requirements.

C. Slab Isolation Joint Filler: 1/2 inch thick, height equal to slab thickness, with removable top section that will form 1/2 inch deep sealant pocket after removal.

2. Products:
   b. Substitutions: See Section 01 6000 - Product Requirements.

D. Slab Contraction Joint Device: Preformed linear strip intended for pressing into wet concrete to provide straight route for shrinkage cracking.

1. Products:
   a. W.R. Meadows, Inc; Speed-E-Joint: [www.wrmeadows.com](http://www.wrmeadows.com)
   b. Substitutions: See Section 01 6000 - Product Requirements.

E. Slab Construction Joint Devices: Combination keyed joint form and screed, galvanized steel, with minimum 1 inch diameter holes for conduit or rebars to pass through at 6 inches on center; ribbed steel stakes for setting.

1. Provide removable plastic cap strip that forms wedge-shaped joint for sealant installation.
2. Height: To suit slab thickness.

### 2.7 CURING MATERIALS

A. Curing and Sealing Compound, Low Gloss: Liquid, membrane-forming, clear, non-yellowing acrylic; complying with ASTM C1315 Type 1 Class A.

3. Products:
   a. SpecChem, LLC; Cure and Seal WB 25: [www.specchemllc.com](http://www.specchemllc.com)
   c. Substitutions: See Section 01 6000 - Product Requirements.

B. Water: Potable, not detrimental to concrete.

### 2.8 CONCRETE MIX DESIGN

A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.

1. Replace as much Portland cement as possible with fly ash, ground granulated blast furnace slag, silica fume, or rice hull ash as is consistent with ACI recommendations.

B. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI 301.

1. For trial mixtures method, employ independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.

C. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended by manufacturer.

D. Normal Weight Concrete:
1. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: As indicated on drawings.
2. Fly Ash Content: Maximum 25 percent of cementitious materials by weight.
3. Water-Cement Ratio: As indicated on drawings.
4. Total Air Content: 5.5 percent, determined in accordance with ASTM C173/C173M.
5. Maximum Slump: 4 inches plus or minus 1 inch.

1. MIXING
   A. Transit Mixers: Comply with ASTM C94/C94M.

PART 3 EXECUTION

3.1 EXAMINATION
   A. Verify lines, levels, and dimensions before proceeding with work of this section.

3.2 PREPARATION
   A. Formwork: Comply with requirements of ACI 301. Design and fabricate forms to support all applied loads until concrete is cured, and for easy removal without damage to concrete.
   B. Verify that forms are clean and free of rust before applying release agent.
   C. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.
   D. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning with steel brush and applying bonding agent in accordance with manufacturer's instructions.
      1. Use latex bonding agent only for non-load-bearing applications.
   E. Where new concrete with integral waterproofing is to be bonded to previously placed concrete, prepare surfaces to be treated in accordance with waterproofing manufacturer's instructions. Saturate cold joint surface with clean water, and remove excess water before application of coat of waterproofing admixture slurry. Apply slurry coat uniformly with semi-stiff bristle brush at rate recommended by waterproofing manufacturer.
   F. Interior Slabs on Grade: Install vapor retarder under interior slabs on grade. Lap joints minimum 6 inches. Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions. Repair damaged vapor retarder before covering.

3.3 INSTALLING REINFORCEMENT AND OTHER EMBEDDED ITEMS
   A. Comply with requirements of ACI 301. Clean reinforcement of loose rust and mill scale, and accurately position, support, and secure in place to achieve not less than minimum concrete coverage required for protection.
   B. Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with concrete placement.

3.4 PLACING CONCRETE
   A. Place concrete in accordance with ACI 304R.
   B. Place concrete for floor slabs in accordance with ACI 302.1R.
   C. Notify Architect not less than 48 hours prior to commencement of placement operations.
   D. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.
   E. Ensure reinforcement, inserts, waterstops, embedded parts, and formed construction joint devices will not be disturbed during concrete placement.
   F. Place concrete continuously without construction (cold) joints wherever possible; where construction joints are necessary, before next placement prepare joint surface by removing laitance and exposing the sand and sound surface mortar, by sandblasting or high-pressure water jetting.
   G. Finish floors level and flat, unless otherwise indicated, within the tolerances specified below.

3.5 SLAB JOINTING
A. Locate joints as indicated on the drawings.
B. Anchor joint fillers and devices to prevent movement during concrete placement.
C. Isolation Joints: Use preformed joint filler with removable top section for joint sealant, total height equal to thickness of slab, set flush with top of slab.
   1. Install wherever necessary to separate slab from other building members, including columns, walls, equipment foundations, footings, stairs, manholes, sumps, and drains.
D. Load Transfer Construction and Contraction Joints: Install load transfer devices as indicated; saw cut joint at surface as indicated for contraction joints.
E. Saw Cut Contraction Joints: Saw cut joints before concrete begins to cool, within 4 to 12 hours after placing; use 3/16 inch thick blade and cut at least 1 inch deep but not less than one quarter (1/4) the depth of the slab.
F. Construction Joints: Where not otherwise indicated, use metal combination screed and key form, with removable top section for joint sealant.

3.6 FLOOR FLATNESS AND LEVELNESS TOLERANCES
A. An independent testing agency, as specified in Section 01 4000, will inspect finished slabs for conformance to specified tolerances.
B. Minimum F(F) Floor Flatness and F(L) Floor Levelness Values:
   1. Exposed to View and Foot Traffic: F(F) of 20; F(L) of 15, on-grade only.
   2. Under Raised Access Flooring: F(F) of 20; F(L) of 15, on-grade only.
   3. Under Thick-Bed Tile: F(F) of 20; F(L) of 15, on-grade only.
   4. Under Carpeting: F(F) of 25; F(L) of 20, on-grade only.
   5. Under Thin Resilient Flooring and Thinset Tile: F(F) of 35; F(L) of 25, on-grade only.
   6. Parking Structure: F(F) of 20; F(L) of 15, on-grade only.
C. Measure F(F) and F(L) in accordance with ASTM E1155, within 48 hours after slab installation; report both composite overall values and local values for each measured section.
D. Correct the slab surface if composite overall value is less than specified and if local value is less than two-thirds of specified value or less than F(F) 13/F(L) 10.
E. Correct defects by grinding or by removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.

3.7 CONCRETE FINISHING
A. Repair surface defects, including tie holes, immediately after removing formwork.
B. Unexposed Form Finish: Rub down or chip off fins or other raised areas 1/4 inch or more in height.
C. Exposed Form Finish: Rub down or chip off and smooth fins or other raised areas 1/4 inch or more in height. Provide finish as specified in Architectural Drawings.
D. Concrete Slabs: Finish to requirements of ACI 302.1R, and as follows:
   1. Surfaces to Receive Thin Floor Coverings: "Steel trowel" as described in ACI 301.1R; thin floor coverings include carpeting, resilient flooring, seamless flooring, thin set quarry tile, and thin set ceramic tile.
   2. Decorative Exposed Surfaces: "Steel trowel" as described in ACI 302.1R; use steel-reinforced plastic trowel blades instead of steel blades to avoid black-burnished marks; decorative exposed surfaces include surfaces to be stained or dyed, pigmented concrete, surfACES to be polished, and all other slab surfaces.
E. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains at 1:100 nominal.

3.8 CURING AND PROTECTION
A. Comply with requirements of ACI 308R. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for
hydration of cement and hardening of concrete.

1. Normal concrete: Not less than 7 days.

C. Formed Surfaces: Cure by moist curing with forms in place for full curing period.

D. Surfaces Not in Contact with Forms:
   1. Slabs and Floors To Receive Adhesive-Applied Flooring: Curing compounds and other surface coatings are usually considered unacceptable by flooring and adhesive manufacturers. If such materials must be used, either obtain the approval of the flooring and adhesive manufacturers prior to use or remove the surface coating after curing to flooring manufacturer's satisfaction.
   2. Initial Curing: Start as soon as free water has disappeared and before surface is dry. Keep continuously moist for not less than three days by water ponding, water-saturated sand, water-fog spray, or saturated burlap.
   3. Final Curing: Begin after initial curing but before surface is dry.
      a. Curing Compound: Apply in two coats at right angles, using application rate recommended by manufacturer.

3.9 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 4000.

B. Provide free access to concrete operations at project site and cooperate with appointed firm.

C. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.

D. Tests of concrete and concrete materials may be performed at any time to ensure conformance with specified requirements.

E. Compressive Strength Tests: ASTM C39/C39M. For each test, mold and cure three concrete test cylinders. Obtain test samples for every 100 cu yd or less of each class of concrete placed.
   a. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.

F. Perform one slump test for each set of test cylinders taken, following procedures of ASTM C143/C143M.

3.10 DEFECTIVE CONCRETE

A. Test Results: The testing agency shall report test results in writing to Architect and Contractor within 24 hours of test.

B. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.

C. Repair or replacement of defective concrete will be determined by the Architect. The cost of additional testing shall be borne by Contractor when defective concrete is identified.

D. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect for each individual area.

3.11 PROTECTION

A. Do not permit traffic over unprotected concrete floor surface until fully cured.

END OF SECTION
SECTION 03 3500
CONCRETE SEALER

PART 1 GENERAL

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

1.2 SUMMARY
A. Section includes concrete densifier and sealer application on exposed concrete floors where indicated.

1.3 RELATED SECTIONS
A. Coordinate work of this Section with work of other sections, including Division 01 Sections and Drawings, as required to properly execute the work and as necessary to maintain satisfactory progress of the work.

1.4 SUBMITTALS
A. Product Data: Submit manufacturer's product data, including surface preparation and application instructions.
B. Manufacturer's Certification: Submit manufacturer's ISO 9001/9002 certification.

1.5 QUALITY ASSURANCE
A. This Section outlines only minimum standards and requirements. Refer to the Drawings, and other specification sections for additional requirements. Bring all conflicts and discrepancies to the attention of the Architect, Engineer, and Owner, and do not start work until such conflicts and discrepancies are clarified and corrected.
B. Manufacturer's Qualifications: ISO 9001/9002 registered or provide proof of documented quality assurance system. Quality assurance system shall be registered by independent registrar accredited by ANSI Registrar Accreditation Board (ANSI-RAB) or by another internationally recognized body.

1.6 DELIVERY, STORAGE, AND HANDLING
A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
B. Store materials in clean, dry area in accordance with manufacturer's instructions. Keep containers sealed until ready for use. Keep from freezing.
C. Protect materials during handling and application to prevent damage or contamination.

1.7 ENVIRONMENTAL REQUIREMENTS
A. Do not apply sealer when concrete or air temperatures are below 40 degrees F or above 135 degrees F

PART 2 PRODUCTS

2.1 CONCRETE SEALER
A. F.SC.1:
1. Product/Manufacturer: EUCO Diamond Hard manufactured The Euclid Chemical Company, or Architect or Engineer approved equal. Other manufacturers must have a minimum of five (5) years experience manufacturing equivalent products to those specified and comply with Division 01 requirements regarding substitutions to be considered.
2. Finish: Sealed concrete with hardener.
4. Remarks: Concrete to be cleared of all paint, dirt, and debris before sealing.
5. Location: As indicated on Drawings.
2.2 Manufacturer shall have ISO 9001 Quality Certification. To ensure compatibility all products shall be from the same manufacturer.
PART 3 EXECUTION

3.1 EXAMINATION
   A. Examine concrete surfaces to receive sealer. Notify Architect, Engineer, and Owner if surfaces are not acceptable.
   B. Do not begin surface preparation or application until unacceptable conditions are corrected.

3.2 SURFACE PREPARATION
   A. Prepare concrete surfaces in accordance with manufacturer's instructions.
   B. New Concrete: Cure concrete in accordance with manufacturer's instructions.
   C. Existing Cured Concrete: Ensure surfaces are clean, dry, and free of coatings and contaminants.

3.3 APPLICATION
   A. Apply sealer to concrete surfaces in accordance with manufacturer's instructions.
   B. Do not leave excess sealer residue on treated concrete surfaces. Remove excess hardened sealer.
   C. Do not use as a curing compound.
   D. Do not dilute sealer.

END OF SECTION
SECTION 05 5500
METAL FABRICATIONS

PART 1 GENERAL

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

1.2 SUMMARY
A. Section includes:
   1. Rough hardware, loose bearing plates, miscellaneous framing, bracing, supports, anchors, lintels, angles, clips, and plates.
   2. Ladders, as applicable, such as elevator pit ladder.
   3. Steel framing and supports for mechanical and electrical equipment.
   4. Steel framing and supports for applications where perimeter and intermediate framing and supports are not specified in other Sections.
   5. Pipe bollards.

1.3 RELATED SECTIONS
A. Coordinate work of this Section with work of other sections, including Division 01 Sections and Drawings, as required to properly execute the work and as necessary to maintain satisfactory progress of the work.

1.4 REFERENCES
A. Conform to the following reference standards as applicable to the work:
   1. American Institute of Steel Construction (AISC)
   2. American Iron and Steel Institute (AISI)
   3. ASTM International (ASTM)
      a. A36, Specification for Structural Steel
      b. A123, Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
      d. A307, Standard Specification for Carbon Steel Bolts and Studs 60,000 psi Tensile Strength
      e. B209, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
      g. B221, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
   4. American Welding Society (AWS)
   5. Federal Specifications (FS)
      a. TT-P-636, Ferrous Metal Primers
   6. Texas Government Code, Title 10, Subchapter F, § 2252.201-2252.205

1.5 SUBMITTALS
A. Submit under provisions of Division 01 Section "Substitution and Submittal Procedures".
B. Certificate:
   a. Provide documentation that all iron and steel products are produced in the United States and comply with Texas Government Code, Title 10, Subchapter F, § 2252.201-2252.205.
C. Shop Drawings:
   1. For off-the-shelf items: Show all layouts, sizes, methods of construction and installation, including sizes and types of all fastening devices.
   2. For custom fabricated items: Submit design calculations for the materials and their connections designed by the Contractor, prior to or with the shop drawings. Calculations shall bear the seal of a Registered
Professional Engineer, licensed in the State where the Project is located. Shop drawings containing connections for which calculations have not been received will be returned unchecked as an incomplete submittal. Design Calculations will be retained for the Architect’s file, and will not be approved or returned.

D. Samples: As noted or requested.

1.6 CONTRACTOR’S RESPONSIBILITIES

A. As scope and performance documents, the Drawings and Specifications do not necessarily indicate or describe all the work required for the performance and completion of the Work. Contracts will be let on the basis of such documents with the understanding that the Contractor shall furnish and install the items required for proper completion of the Work without adjustment to price or schedule. Work shall be of sound, quality construction and the Contractor shall be solely responsible for the inclusions of adequate labor and materials to cover the proper and timely fabrication and installation of the miscellaneous metal items indicated, described, or implied.

B. As a performance specification, the criteria for the solution of structurally sound miscellaneous metal items indicated on the Drawings or specified herein are the sole purpose of defining the design intent and performance requirements. The details shown are intended to emphasize the acceptable profiles and performance requirements for this Project. To avoid any misunderstanding or lack of interpretation, the Contractor is hereby advised that the responsibility for the miscellaneous metal items are totally his and that designs and resolutions proposed in the Contractor's shop drawings, structural calculations, and related documentation shall be demonstrated throughout the Work and warranty period specified or required.

C. Design proposal submissions which follow exactly the details indicated on the Drawings, will not relieve the Contractor of his responsibility for the design, fabrication, erection, or performance of the Work of this Section.

D. In the event of a controversy over the design, the decision of the Architect will take precedence.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Specifications are based on specified product and manufacturer, or Architect/Engineer or Owner approved equal. Other manufacturers must have a minimum of five (5) years experience manufacturing products meeting or exceeding the specifications and comply with Division 01 requirements regarding substitutions to be considered.

2.2 MATERIALS

A. Steel:
   1. Plates, Shapes and Bars: ASTM A 36.
   2. Pipe: ASTM A53, Type E or S, Grade B.
   3. Tubing: ASTM A 500 (cold formed) or ASTM A 513, Type 5 (mandrel drawn).
   5. Steel Sheet, Cold Rolled: ASTM A 1008, either commercial steel, Type B, or structural steel, Grade 25, exposed.

B. Castings: Either gray or malleable iron, unless otherwise indicated.
   1. Gray Iron: ASTM A 48, Class 30, unless another class is indicated or required by structural loads.


D. Bolts:
   2. Size: 3/4 inch, unless otherwise noted.

E. Anchors:
   1. Expansion bolts:
      a. 1/4 inch or less, Rawl Calk-Ins or Arrow Series 4000.
      b. Greater than 1/4 inch: Rawl Multi-Calks. Top shall be 1/2 inch below concrete surface.
2. Molly screw anchors:
   a. In walls 1/16 inch to 5/8 inch thick, use "S" length
   b. In walls 5/8 inch to 1/4 inch thick, use "L" length
   c. In walls 1-1/4 inch to 1-3/4 inch thick, use "XL": length.

F. Shop Priming:
   1. Shop coat ungalvanized ferrous metal with primer, except for those to receive application of spray-applied fireproofing, if applicable, shall be free of primer and paint.
   2. Clean iron and metal to be primed of scale, dirt and dust by steel scrapers, wire brushes or sandblasting. Remove oil and grease with petroleum naphtha.
   3. Thoroughly work paint into all joints by brush. Overall application of brush or spray coat of red oxide primer in accordance with FS TT-P-636.
   4. Give any painted built-in portions one field coat of primer on all abraded parts after installation.

G. Galvanized Metal:
   1. Comply with ASTM A123.
   2. General: Galvanize all steel sections which are fully or partially exposed to weather, regardless if they are scheduled to receive a finish coat of paint or not.
   3. Galvanized items to be painted shall be primed as outlined in Painting and Staining Section.
   4. Hot-dip galvanized after fabrication.
   5. Silicone protective coating shall not be used at galvanized items scheduled to receive paint.

H. Stainless Steel:
   1. General: Comply with ASTM Standards as applicable to the work.
   2. Type: Type 302 or 304 as applicable to the work.
   3. Finish:
      a. Concealed: No. 2D finish
      b. Exposed: No. 4, unless noted otherwise.

I. Aluminum:
   1. General: Comply with ASTM Standards as applicable to work.
   2. Type: 6061 or 6063 as applicable to work.
   3. Finish:
      a. Concealed: Mill finish
      b. Exposed: Mill finish, or Anodized or Kynar 500 or Hylar 5000 finish a specified in color selected by Architect from manufacturer’s standard colors.

2.3 MISCELLANEOUS METAL ITEMS
   A. The following is a list of the principal miscellaneous metal items to be furnished under this section. This list is offered only as a guide and Contractor shall thoroughly check plans for other miscellaneous metals. All items exposed to the exterior shall be hot-dip galvanized after fabrication, unless indicated or directed otherwise.
   1. Pipe Bollards:
      a. Straight Pipe Bollards: Furnish and install 6 inch O.D. Schedule 40 steel pipe bollards, with closure plate welded to bottom of steel pipe and placed in 18 inch diameter, 3,000 PSI concrete footing 3 feet-0 inches, unless indicated otherwise. Exposed portion of pipe shall be 3 feet-0 inches above paving, unless indicated otherwise. Fill pipe with 2,500 PSI concrete after installation and round off concrete top.
      b. Hairpin Pipe Bollards: Furnish and install 4 inch O.D. Schedule 80 steel pipe bollards, with closure plate welded to bottom of steel pipe and placed in 16 inch diameter, 3,000 PSI concrete footing 3 feet-6 inches, unless indicated otherwise. Exposed portion of pipe shall be 3 feet-0 inches above paving, unless indicated otherwise, and paint pipe traffic yellow.
2. Frame Supports: Furnish and install above ceiling frame supports for aluminum entrances and storefronts, and hollow metal frames; fabricate of channels and include all fastener and anchorage devices as detailed and required.

3. Below and Above-Ceiling Supports: Construct of “UNISTRUT”, “POWER-STRUT”, “Hilti Strut” members, as approved by Architect to size and shape detailed. All work shall be accurate to 1/8 inch plus or minus. Provide supports complete with fastenings to structure for overhead equipment.

4. Steel Ladders: Fabricate from 2-1/2 inch x 3/8 inch flat bar steel stringer spaced 1 foot-4 inches apart, with 1 inch diameter steel pipe rungs let into stringers at 12 inches o.c., welded and ground smooth. Extend stringers 3 inches from center of top rung to top of stringer. Hot dip galvanize after fabrication. Provide all angle supports and anchoring devices for bolting to wall, floor, or structure as required. Install at elevator pit where indicated on Drawings.

5. Bar Grating: Furnish and install SAFE-T-GRID® Bar Grating, Aluminum/Type 6063-T6, TB-940 Grooved Surface, Swage Locked Construction, 1-1/4 inches x 0.94 inch Bearing Bars, 1-3/16 inches on Center, Regular Cross Bars 4 inches on Center, 36.5620 inch Width x 288.0000 inch Length (Span) manufactured by McNICHOLS, Houston, Texas; (877) 884-4653, or Architect approved equal. 

B. Other Miscellaneous Items: Miscellaneous metal items and their related components are not necessarily individually described. Miscellaneous items not described shall be furnished and installed in accordance with the intent of the drawings and specifications and as required to complete the work. Hot dip galvanize steel items at exterior conditions, unless indicated or directed otherwise.

2.4 WORKMANSHIP CLASSES

A. Class 1:
   1. Exposed Surfaces: Sandblast surfaces smooth with pits, mill marks, nicks, and scratches filled or ground off. Defects shall not show when painted.
   2. Welds: Conceal welds where possible. Where exposed, grind welds to small radius with uniform sized cove. When painted, welds shall be undetectable.
   3. Bolts: Use only flat head countersunk bolts in exposed locations.
   4. Straightness: Distortions visible to the eye will be rejected.
   5. Joints: Fit joints to hairline finish.

B. Class 2:
   1. Exposed Surfaces: Moderate irregularities not visible at 30 feet may remain. Mill marks may remain.
   2. Welds: Grind welds to small radius with uniform sized cove.
   3. Bolts: Use only flat or oval head, countersunk bolts where exposed to view.
   4. Straightness: Minor distortions will be permitted.
   5. Joints: Provide maximum gap of 1/16 inch.

C. Class 3:
   1. Exposed Surfaces: No improvement from mill finish required except preparation for galvanizing or priming.
   2. Welds: Grinding not required.

2.5 FABRICATION TOLERANCES

A. Squareness: 1/8 inch maximum difference in diagonal measurements.
B. Maximum Offset Between Faces: 1/16 inch.
C. Maximum Misalignment of Adjacent Members: 1/16 inch.
D. Maximum Bow: 1/8 inch in 48 inches.
E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.
3.2 PREPARATION
   A. Clean and strip primed steel items to bare metal where site welding is required.
   B. Supply steel items required to be cast into concrete or embedded in masonry with setting templates to appropriate sections.

3.3 INSTALLATION
   A. General: Install items where indicated in accordance with manufacturer’s instructions.
   B. Install bollards in bored holes with post set 2 feet into ground with 3 inch concrete cover under post, unless indicated or directed otherwise. Place concrete around bollard.
   C. Install bar grating at the second floor terrace underneath the planters.
   D. Perform cutting, drilling, and fitting required for the installation of the miscellaneous metal items. Set the work accurately in location, alignment and elevation, plumb, level, true, and free of rack, measured from established lines and levels. Provide temporary bracing or anchors in formwork for items which are to be built into concrete masonry of similar construction.
   E. Comply with AWS D1.1 procedures of manual shielded metal-arc welding, appearance and quality of welds, and methods used in correcting weld.
   F. Where welding is exposed to view, welds shall be executed neatly then ground smooth. Pits and blemishes are not acceptable.
   G. For manufactured items, adhere to printed manufacturer’s installation instructions.
   H. Separate dissimilar materials.
   I. Cleaning and touch-up painting of field welds, bolted connections, and abraded areas of the shop paint on miscellaneous metal.
   J. Refer to Drawings for items that are to receive paint under Division 09 Section “Painting”.

END OF SECTION
SECTION 06 1000
ROUGH CARPENTRY

PART 1 GENERAL

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

1.2 SUMMARY
   A. Section Includes:
      1. Miscellaneous rough carpentry items including, but not limited to the following where indicated or required to complete work:
         a. Miscellaneous framing with dimension lumber.
         b. Wood blocking, furring, and nailers for support within walls and at roofing.

1.3 RELATED SECTIONS
   A. Coordinate work of this Section with work of other sections, including Division 01 Sections and Drawings, as required to properly execute the work and as necessary to maintain satisfactory progress of the work.

1.4 QUALITY ASSURANCE
   A. This Section outlines only minimum standards and requirements. Refer to the Drawings, and other specification sections for additional requirements. Bring all conflicts and discrepancies to the attention of the Architect/Engineer and Owner, and do not start work until such conflicts and discrepancies are clarified and corrected.

1.5 SUBMITTALS
   A. Product Data: Submit manufacturer’s product data and installation instructions for each material and product used.
      1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
      2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
      3. For fire-retardant treatments specified to be High-Temperature (HT) type, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
      4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
      5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

1.6 DELIVERY, STORAGE, AND HANDLING
   A. Delivery and Storage: Keep materials under cover and dry. Protect against exposure to weather and contact with damp or wet surfaces. Stack material above ground level on uniformly spaced supports to prevent deformation.
      1. For material pressure treated with waterborne chemicals, place spacers between each bundle for air circulation.

PART 2 PRODUCTS

2.1 MANUFACTURERS
   A. Products/Manufacturers: Subject to compliance with requirements, provide products by one (1) of those specified, or Architect approved equal. Other manufacturers must have a minimum of five (5) years
experience manufacturing products meeting or exceeding the specifications and comply with Division 01 Sections for requirements regarding substitutions to be considered.

2.2 LUMBER, GENERAL
A. Standards: Furnish lumber manufactured to comply with PS 20 "American Softwood Lumber Standard" and with applicable grading rules of inspection agencies certified by American Lumber Standards Committee's (ALSC) Board of Review.
B. Grade Stamps: Furnish lumber with each piece factory-marked with grade stamp of inspection agency that indicates grading agency, grade, species, moisture content at time of surfacing, and mill.
  1. For exposed lumber, furnish pieces marked on ends or back of each piece.
C. Sizes: Provide nominal sizes indicated, complying with PS 20 except where actual sizes are specifically noted as being required.
D. Surfacing: Dressed lumber, S4S, unless otherwise indicated.

2.3 DIMENSION LUMBER FOR CONCEALED CONDITIONS
A. Species: Southern yellow pine or Douglas fir, unless indicated or directed otherwise.
B. Moisture Content: S-DRY, KD 19 or MC 19 (19 percent maximum moisture content).
C. Grade: No. 3 or utility grade, unless indicated or directed otherwise.

2.4 DIMENSION LUMBER FOR EXPOSED CONDITIONS
A. Species: Southern yellow pine or Douglas fir, unless indicated or directed otherwise.
B. Moisture Content: S-DRY, KD 19 or MC 19 (19 percent maximum moisture content).
C. Grade: No. 2 or standard grade.

2.5 BOARDS FOR CONCEALED CONDITIONS
A. Species: Southern yellow pine or Douglas fir, unless indicated or directed otherwise.
B. Moisture Content: S-DRY, KD 19 or MC 19 (19 percent maximum moisture content).
C. Grade: No. 2, 2 Common, or Construction Boards.

2.6 BOARDS FOR EXPOSED CONDITIONS
A. Species: Any one of the following:
   1. Douglas fir.
   2. Southern pine.
   3. Hem-fir.
B. Moisture Content: S-DRY, KD 19 or MC 19 (19 percent maximum moisture content).
C. Grade: No. 1, 1 Common, Construction Heart, or Select Merchantable Boards.

2.7 CONSTRUCTION PANELS
   1. Trademark: Furnish construction panels that are each factory-marked with APA trademark for grade specified.
B. Miscellaneous Concealed Plywood: C-C Plugged Exterior, thickness as indicated but not less than 1/2 inch nominal.
C. Miscellaneous Exposed Plywood: A-D Interior, thickness as indicated but not less than 1/2 inch nominal.

2.8 FASTENERS
A. General: Where miscellaneous carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with a hot-dip zinc coating per ASTM A 153 or of AISI Type 304 stainless steel.
C. Bolts: ASTM A 307, Grade A; with ASTM A 563 hex nuts and flat washers.

2.9 PRESERVATIVE WOOD TREATMENT BY PRESSURE PROCESS
A. General: Obtain preservative-treated lumber complying with AWPA Standard C2. Mark each treated item
with AWPB or SPIB Quality Mark Requirements. Coat surfaces cut after treatment to comply with AWPA M4.

B. Above-Ground Wood Treatment: Pressure treat with waterborne preservatives to a minimum retention of 0.25 pcf.
   1. Kiln-dry interior dimension lumber after treatment to 19 percent maximum moisture content.
   2. Treat wood items indicated and in the following circumstances:
      a. In contact with roofing, flashing, or waterproofing.
      b. In contact with masonry or concrete.
      c. Within 18 inches of grade.

C. Ground-Contact Wood Treatment: Pressure treat with waterborne preservatives to a minimum retention of 0.40 pcf.

2.10 FIRE-RETARDANT TREATMENT BY PRESSURE PROCESS

A. General: Identify treated wood with appropriate classification marking of Underwriters' Laboratories Inc. or other testing and inspection agency acceptable to authorities having jurisdiction.

B. Dimension Lumber: Comply with AWPA C20.
   1. Treatment Types: Interior Type A for protected wood and Exterior Type for wood exposed to weather.

C. Plywood: Comply with AWPA C27.
   1. Treatment Types: Interior Type A for protected wood and Exterior Type for wood exposed to weather.

D. Application: Treat items indicated on Drawings, and the following:
   1. Concealed blocking.
   2. Roof construction.
   3. Plywood backing panels.

E. Inspect each piece after drying and discard damaged or defective pieces.

F. Products/Manufacturers: Subject to compliance with requirements, provide one(1) of the following, or Architect approved equal in accordance with requirements of Paragraph 2.1:
   1. Interior Type A Fire-Retardant-Treated Wood:
      b. "Pyro-Guard," Hoover Treated Wood Products.
   2. Exterior Type Fire-Retardant-Treated Wood:

PART 3 EXECUTION

3.1 INSTALLATION, GENERAL

A. Discard units of material with defects that impair quality of miscellaneous carpentry and in sizes that would require an excessive number or poor arrangement of joints.

B. Cut and fit miscellaneous carpentry accurately. Install members plumb and true to line and level.

C. Coat cut edges of preservativetreated wood to comply with AWPA M4.

D. Securely fasten miscellaneous carpentry as indicated and according to applicable codes and recognized standards.

E. Countersink nail heads on exposed carpentry work and fill holes.

F. Use fasteners of appropriate type and length. Predrill members when necessary to avoid splitting wood.

3.2 WOOD GROUNDS, NAILERS, BLOCKING, AND SLEEPERS

A. Install where shown and where required for screeding or attachment of other work. Cut and shape to required size. Coordinate location with other work involved.

B. Attach to substrates as required to support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise indicated.

3.3 WOOD FURRING
A. General: Install at spacing indicated, with closure strips at edges and openings. Shim with wood as required for tolerance of finished work.

3.4 CONSTRUCTION PANELS

A. Comply with applicable installation recommendations in APA FormE30 "Design/Construction Guide--Residential & Commercial".

END OF SECTION
SECTION 07 2119

FOAMED-IN-PLACE INSULATION

PART 1 GENERAL

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

1.2 REFERENCE STANDARDS

1.3 ADMINISTRATIVE REQUIREMENTS
   A. Preinstallation Meeting: Convene one week prior to commencing work of this section.

1.4 SUBMITTALS
   A. Product Data: Provide product description, insulation properties, overcoat properties, and preparation requirements.
   B. Certificates: Certify that products of this section meet or exceed specified requirements.
   C. ABAA Field Quality Control Submittals: Submit third-party reports of testing and inspection required by ABAA QAP.
   D. Manufacturer's Installation Instructions: Indicate special procedures, and perimeter conditions requiring special attention.
   E. ABAA Manufacturer Qualification: Submit documentation of current evaluation of proposed manufacturer and materials.
   F. ABAA Installer Qualification: Submit documentation of current contractor accreditation and current installer certification. Keep copies of all contractor accreditation and installer certification on site during and after installation. Present on-site documentation upon request.
   G. Sample warranty

1.5 QUALITY ASSURANCE
   A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with not less than three years of documented experience.
   B. Manufacturer’s Qualifications: Product produced in an ISO9001 registered factory.
   C. Applicator Qualifications: Company specializing in performing work of the type specified, with minimum three years documented experience.
   D. Air Barrier Association of America (ABAA) Quality Assurance Program (QAP); www.airbarrier.org/#sle:
      1. Installer Qualification: Use accredited contractor, certified installers, evaluated materials, and third-party field quality control audit.
      2. Manufacturer Qualification: Use evaluated materials from a single manufacturer regularly engaged in air barrier material manufacture. Use secondary materials approved in writing by primary material manufacturer.

1.6 FIELD CONDITIONS
   A. Do not apply foam when temperature is below that specified by the manufacturer for ambient air and substrate.
   B. Do not apply foam when temperature is within 5 degrees F of dew point.
   C. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
PART 2 PRODUCTS

2.1 MATERIALS
A. Foamed-In-Place Insulation: Low-density, flexible, open celled, water vapor permeable polyurethane foam; foamed on-site, using blowing agent of water or non-ozone-depleting gas.
   1. Regulatory Requirements: Conform to applicable code for flame and smoke limitations.
   2. Thermal Resistance: R-value of 3.0, minimum, per 1 inch thickness at 75 degrees F mean temperature when tested in accordance with ASTM C518.
   3. Air Permeance: 0.004 cfm/sq ft, maximum, when tested at intended thickness in accordance with ASTM E2178 or ASTM E283 at 1.5 psf.
   4. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/450, maximum, when tested in accordance with ASTM E84.
   5. Manufacturers:
      b. Substitutions: Not permitted.

2.2 ACCESSORIES
A. Primer: As required by insulation manufacturer.
B. Protective Coating: Intumescent coating of type recommended by insulation manufacturer and as required to comply with applicable codes.

PART 3 EXECUTION

3.1 EXAMINATION
A. Verify work within construction spaces or crevices is complete prior to insulation application.
B. Verify that surfaces are clean, dry, and free of matter that may inhibit insulation or overcoat adhesion.

3.2 PREPARATION
A. Mask and protect adjacent surfaces from over spray or dusting.
B. Apply primer in accordance with manufacturer's instructions.

3.3 APPLICATION
A. Apply insulation in accordance with manufacturer's instructions.
B. Apply insulation by spray method, to a uniform monolithic density without voids.
C. Apply insulation full thickness of wall.
D. Apply overcoat monolithically, without voids to fully cover foam insulation, to achieve fire rating required.
E. Patch damaged areas.
F. Where applied to voids and gaps assure space for expansion to avoid pressure on adjacent materials that may bind operable parts.
G. Trim excess away for applied trim or remove as required for continuous sealant bead.

3.4 FIELD QUALITY CONTROL
A. Field inspections and tests will be performed by an independent testing agency.
B. Inspection will include verification of insulation and overcoat thickness and density.
C. Coordination of ABAA Tests and Inspections:
   1. Provide testing and inspection required by ABAA QAP.
   2. Notify in ABAA writing of schedule for air barrier work. Allow adequate time for testing and inspection.
   3. Cooperate with ABAA testing agency.
   4. Allow access to air barrier work areas and staging.
   5. Do not cover air barrier work until tested, inspected, and accepted.

3.5 PROTECTION
A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where insulation is subject to abuse.
B. Do not permit subsequent construction work to disturb applied insulation.

END OF SECTION
SECTION 07 2500 - WEATHER BARRIERS

PART 1 PART 1 GENERAL

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

1.7 SECTION INCLUDES
A. Air Barriers: Materials that form a system to stop passage of air through exterior walls, joints between exterior walls and roof, and joints around frames of openings in exterior walls.

1.8 RELATED REQUIREMENTS
A. Section 06 1000 - Rough Carpentry: Sheathing with integral water-resistive and air barrier.
B. Section 07 6200 - Sheet Metal Flashing and Trim: Metal flashings installed in conjunction with weather barriers.

1.9 DEFINITIONS
A. Weather Barrier: Assemblies that form either water-resistive barriers, air barriers, or vapor retarders.
B. Air Barrier: Air tight barrier made of material that is relatively air impermeable but water vapor permeable, both to the degree specified, with sealed seams and with sealed joints to adjacent surfaces. Note: For the purposes of this specification, vapor impermeable air barriers are classified as vapor retarders.
C. Vapor Retarder: Air tight barrier made of material that is relatively water vapor impermeable, to the degree specified, with sealed seams and with sealed joints to adjacent surfaces.
   1. Water Vapor Permeance: For purposes of conversion, 57.2 ng/(Pa s sq m) = 1 perm.
D. Water-Resistant Barrier: Water-shedding barrier made of material that is moisture resistant, to the degree specified, intended to be installed to shed water without sealed seams.

1.10 REFERENCE STANDARDS

1.11 SUBMITTALS
A. Product Data: Provide data on material characteristics, performance criteria, and limitations.
B. Shop Drawings: Provide drawings of special joint conditions, penetration details and transitions to other materials.
C. ABAA Field Quality Control Submittals: Submit third-party reports of testing and inspection required by ABAA QAP.
D. Manufacturer's Installation Instructions: Indicate preparation, installation methods, and storage and handling criteria.
E. ABAA Manufacturer Qualification: Submit documentation of current evaluation of proposed manufacturer and materials.
F. ABAA Installer Qualification: Submit documentation of current contractor accreditation and current installer certification; keep copies of each contractor accreditation and installer certification on site during and after installation, and present on-site documentation upon request.
G. Testing Agency Qualification Statement.

1.12 QUALITY ASSURANCE
A. Air Barrier Association of America (ABAA) Quality Assurance Program (QAP); www.airbarrier.org/#sle:
   1. Installer Qualification: Use accredited contractor, certified installers, evaluated materials, and third-party field quality control audit.
2. Manufacturer Qualification: Use evaluated materials from a single manufacturer regularly engaged in air barrier material manufacture, and use secondary materials approved in writing by primary material manufacturer.

### 1.13 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by the materials manufacturers before, during and after installation.

B. Air barrier exposure not to exceed manufacturers recommended limits.

### PART 2 PRODUCTS

#### 2.1 WEATHER BARRIER ASSEMBLIES

A. Air Barrier:
   1. On outside surface of sheathing of exterior walls use air barrier sheet, mechanically fastened type.

#### 2.2 AIR BARRIER MATERIALS (WATER VAPOR PERMEABLE AND WATER-RESISTIVE)

A. Air Barrier Sheet, Mechanically Fastened:
   1. Air Permeance: 0.004 cubic feet per minute per square foot, maximum, when tested in accordance with ASTM E2178.
   2. Water Vapor Permeance: 5 perms, minimum, when tested in accordance with ASTM E96/E96M Procedure A (desiccant procedure).
   3. Ultraviolet (UV) and Weathering Resistance: Approved in writing by manufacturer for up to 270 days of weather exposure.
   4. Surface Burning Characteristics: Flame spread index of 25 or less, and smoke developed index of 50 or less, when tested in accordance with ASTM E84.
   5. Seam and Perimeter Tape: Polyethylene self adhering type, mesh reinforced, 2 inches wide, compatible with sheet material; unless otherwise specified.
   6. Manufacturers:

#### 2.3 ACCESSORIES

A. Sealants, Tapes, and Accessories for Sealing Weather Barrier and Sealing Weather Barrier to Adjacent Substrates: As specified or as recommended by weather barrier manufacturer.

   1. Thickness: 30 mil, 0.030 inch, nominal; exception from ASTM D1970/D1970M.
   2. Manufacturers:

C. Stainless Steel Flashing: Flexible flashing with 8 mils, 0.008 inch thick sheet of Type 304 stainless steel, 8 mils, 0.008 inch of butyl adhesive and a siliconized release liner. Provide drip edge on exterior edge of flashing.
   1. Roll Length: 50 feet long.
   2. Width: 6 inch wide.
   3. Overlap joints at least 2 inch.
   4. Manufacturers:
      b. Substitutions: See Section 01 6000 - Product Requirements.

### PART 3 EXECUTION
3.1 EXAMINATION
A. Verify that surfaces and conditions are ready to accept the work of this section.

3.2 2 PREPARATION
A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.
B. Clean and prime substrate surfaces to receive adhesives and sealants in accordance with manufacturer's instructions.

3.3 INSTALLATION
A. Install materials in accordance with manufacturer's instructions.
B. Air Barriers: Install continuous airtight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.
C. Apply sealants and adhesives within recommended application temperature ranges. Consult manufacturer if temperature is out of this range.
D. Mechanically Fastened Sheets - On Exterior:
   1. Install sheets shingle-fashion to shed water, with seams generally horizontal.
   2. Overlap seams as recommended by manufacturer but at least 6 inches.
   3. Overlap at outside and inside corners as recommended by manufacturer but at least 12 inches.
   4. Attach to framed construction with fasteners extending through sheathing into framing. Space fasteners at 12 to 18 inches on center along each framing member supporting sheathing.
   5. For applications specified to be air tight, seal seams, laps, penetrations, tears, and cuts with self-adhesive tape; use only large-headed, gasketed fasteners recommended by the manufacturer.
   6. Where stud framing rests on concrete or masonry, extend lower edge of sheet at least 4 inches below bottom of framing and seal to foundation with sealant.
   7. Install water-resistive barrier over jamb flashings.
   8. Install air barrier and vapor retarder UNDER jamb flashings.
   9. Install head flashings under weather barrier.
  10. At openings to be filled with frames having nailing flanges, wrap excess sheet into opening; at head, seal sheet over flange and flashing.
E. Self-Adhered Sheets:
   1. Prepare substrate in manner recommended by sheet manufacturer; fill and tape joints in substrate and between dissimilar materials.
   2. Lap sheets shingle-fashion to shed water and seal laps air tight.
   3. Once sheets are in place, press firmly into substrate with resilient hand roller; ensure that laps are firmly adhered with no gaps or fishmouths.
   4. Use same material, or other material approved by sheet manufacturer for the purpose, to seal to adjacent construction and as flashing.
   5. At wide joints, provide extra flexible membrane allowing joint movement.
F. Openings and Penetrations in Exterior Weather Barriers:
   1. Install flashing over sills, covering entire sill frame member, extending at least 5 inches onto weather barrier and at least 6 inches up jambs; mechanically fasten stretched edges.
   2. At openings to be filled with frames having nailing flanges, seal head and jamb flanges using a continuous bead of sealant compressed by flange and cover flanges with sealing tape at least 4 inches wide; do not seal sill flange.
   3. At openings to be filled with non-flanged frames, seal weather barrier to each side of opening framing, using flashing at least 9 inches wide, covering entire depth of framing.
   4. At head of openings, install flashing under weather barrier extending at least 2 inches beyond face of jambs; seal weather barrier to flashing.
5. At interior face of openings, seal gap between window/door frame and rough framing, using joint sealant over backer rod.
6. Service and Other Penetrations: Form flashing around penetrating item and seal to weather barrier surface.
7. Install flashing behind cladding fasteners per Weather Barriers manufacturers recommendations.

3.4 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.
B. Coordination of ABAA Tests and Inspections:
   1. Provide testing and inspection required by ABAA QAP.
   2. Notify ABAA in writing of schedule for air barrier work, and allow adequate time for testing and inspection.
   3. Cooperate with ABAA testing agency.
   4. Allow access to air barrier work areas and staging.
   5. Do not cover air barrier work until tested, inspected, and accepted.
C. Do not cover installed weather barriers until required inspections have been completed.
D. Obtain approval of installation procedures by the weather barrier manufacturer based on a mock-up installed in place, prior to proceeding with remainder of installation.
E. Take digital photographs of each portion of the installation prior to covering up.

3.5 PROTECTION

A. Do not leave materials exposed to weather longer than recommended by manufacturer.
B. Do not leave paper- or felt-based barriers exposed to weather for longer than one week.

END OF SECTION
SECTION 073011

ROOFING UNDERLAYMENT

PART 1 GENERAL

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

1.2 SUMMARY
   A. This Section specifies a self-adhering sheet membrane used as underlayment for sloped roofs.
      1. High temperature application, 260F resistance, Grace Ice & Water Shield® HT.
   B. Related Sections: Refer to the following specification sections for coordination:
      1. Section 06 1000 - Rough Carpentry.
      2. Section 07 6100 - Sheet Metal Roofing.
   C. Referenced Standards: Comply with the requirements of the following standards published by ASTM International to the extent referenced in this section.
      7. ASTM G90 – EMAqua test.

1.3 SUBMITTALS
   A. Product Data: Submit manufacturer's product data and installation instructions.

1.4 QUALITY ASSURANCE
   A. Regulatory Requirements: Comply with requirements of authorities having jurisdiction and applicable codes at the location of the project.
   B. Manufacturer: Minimum 10 years experience producing roofing underlayment.
   C. Installer: Minimum 2 years experience with installation of similar underlayment.

1.5 DELIVERY, STORAGE AND HANDLING
   A. Deliver materials and products in unopened factory labeled packages. Protect from damage.
   B. Cover materials and store in dry condition between temperatures of 40 and 90 degrees F (5 and 32 degrees C). Use within one year of date of manufacture. Do not store at elevated temperatures as that will reduce the shelf life of the product.

PART 2 PRODUCTS

2.1 MANUFACTURER

2.2 MATERIALS
   A. Self-Adhering Sheet Membrane Roof Underlayment: Provide Grace Ice and Water Shield HT by GCP Applied Technologies, Inc with the following characteristics:
      1. Material: Cold applied, self adhering membrane composed of an innovative and proprietary rubberized asphalt adhesive and interwound with a disposable release sheet. An embossed, slip resistant surface is provided on the high performance film with UV barrier properties.
2. Membrane Thickness: 40 mils (1.02 mm) per ASTM D3767 Method A.
3. Membrane Tensile Strength: MD 33 lb/in, CD 31 lb/in per ASTM D412 Die C Modified.
5. Low Temperature Flexibility: Unaffected at -20 degrees F (-29 degrees C) per ASTM D1970.
6. Adhesion to Plywood: 5.0 lb/in. width (876 N/m) per ASTM D903.
7. Maximum Permeance: 0.05 perms (2.9 ng/sqms Pa) per ASTM E96.
8. Maximum Material Weight Installed: 0.22 pounds/sqft (1.1 kg/sqm) per ASTM D461.
9. Service Temperature: 260 degrees F (115.6 degrees C) per ASTM D1204.
10. Compatibility: Suitable for use under all types of sloped roofing with the exception high altitude climates where zinc, copper or Cor-Ten roof coverings are used.
11. Adhesive: Rubberized asphalt adhesive containing post-consumer recycled content, contains no calcium carbonate, sand or fly ash.
12. Exposure: Can be left exposed for a maximum of 120 days from date of installation per ASTM G90 – EMMAqua test.
14. Code and Standards Compliance: Grace Ice and Water Shield HT meets the following requirements:
   b. ICC-ES ESR-3121, per AC 48 Acceptance Criteria for Roof Underlayments used in Severe Climate Areas.
   c. Underwriters Laboratories Inc. R13399 - Class A fire classification under fiber-glass shingles and Class C under organic felt shingles (per ASTM E108/UL 790).
   e. Miami-Dade County Code Report NOA #15-0728.11
   f. Florida State Approval Report No. FL289-R3
   g. CCMC Approval No. 13671-L.

PART 3 EXECUTION

3.1 EXAMINATION

   A. Prior to start of installation, inspect existing conditions to ensure surfaces are suitable for installation of roofing underlayment. Verify flashing has been installed. Starting work indicates installers acceptance of existing conditions.

3.2 INSTALLATION

   A. Installation: Install roofing underlayment on sloped surfaces at locations indicated on the Drawings, but not less than at hips, ridges, eaves, valleys, sidewalls and chimneys, and surfaces over interior space within 36 inches (914 mm) from the inside face of the exterior wall. Strictly comply with manufacturer’s installation instructions including but not limited to the following:
      1. Schedule installation such that underlayment is covered by roofing within the published exposure limit of the underlayment.
      2. Do not install underlayment on wet or frozen substrates.
      3. Install when surface temperature of substrate is a minimum of 40 degrees F (5 degrees C) and rising.
      4. Remove dust, dirt, loose materials and protrusions from deck surface.
      5. Install membrane on clean, dry, continuous structural deck. Fill voids and damaged or unsupported areas prior to installation.
      6. Prime concrete and masonry surfaces using specified primer at a rate of 500-600 square feet per gallon (12-15 sqm/L). Priming is not required for other suitable clean and dry surfaces.
      7. Install membrane such that all laps shed water. Work from the low point to the high point of the roof at all times. Apply the membrane in valleys before the membrane is applied to the eaves. Following placement along the eaves, continue application of the membrane up the roof. Membrane may be installed either vertically or horizontally after the first horizontal course.
8. Side laps minimum 3-1/2 inches (89 mm) and end laps minimum 6 inches (152 mm) following lap lines marked on underlayment.

9. Patch penetrations and damage using manufacturer’s recommended methods.

3.3 CLEANING AND PROTECTION

A. Protection: Protect from damage during construction operations and installation of roofing materials. Promptly repair any damaged or deteriorated surfaces.

B. Repair minor damage to eliminate all evidence of repair. Remove and replace work which cannot be satisfactorily repaired in the opinion of the Architect.

C. Provide temporary protection to ensure work being without damage or deterioration at time of final acceptance. Remove protective film and reclean as necessary immediately before final acceptance.

END OF SECTION
SECTION 07 4610
FIBER-CEMENT SIDING

PART 1 - GENERAL

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

1.2 SUMMARY
A. Section includes fiber-cement lap siding, with all fasteners and attachments required to complete work indicated.
B. Related Sections: Work of all sections, including Division 01 Sections, as required to properly execute the work and as necessary to maintain satisfactory progress of the work.
1. Related Sections include:
   a. Section 07 2500 Weather Barriers
   b. Section 07 9200 Joint Sealants
   c. Section 09 9000 Painting

1.3 SUBMITTALS
A. Product Data:
   1. Manufacturer's specifications and other data needed to prove compliance with specified requirements.
   2. Manufacturer's installation instructions.
B. Shop Drawings: Indicate size, material, and construction details. Show locations and installation procedure of each item. Include details of joints, attachments, and clearances.
C. Samples: Manufacturer's full range of colors, patterns, and textures for Architect's selection.
D. Warranties.

1.4 QUALITY ASSURANCE
A. This Section outlines only minimum standards and requirements. Refer to the Drawings and other sections of the specifications for additional requirements. Bring all conflicts and discrepancies to the attention of the Architect and do not start work until such conflicts and discrepancies are clarified and corrected.

1.5 WARRANTY
B. Warrant the work specified herein against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials and workmanship.
1. Fiber-Cement Siding: 30 years
C. Installation Workmanship Warranty: 2 years

PART 2 - PRODUCTS

2.1 MANUFACTURERS
A. Specifications are based on named products manufactured by James Hardie Building Products, Inc.; Mission Viejo, CA; (866) 274-3464, or Architect approved equal. Other manufacturers must have a minimum of five (5) years experience manufacturing equivalent products to those specified and comply with Division 01 Section requirements regarding substitutions to be considered.

2.2 MATERIALS
A. Material, General: Non-asbestos fiber-cement siding to comply with ASTM C1186 Grade II, Type A. Non-asbestos fiber-cement siding shall be non-combustible when tested in accordance with ASTM test method E136.
B. Fiber-Cement Lap Siding:
   1. Type: Horizontal.
   2. Thickness: 0.312 inch
   3. Length: 12 feet-0 inch planks.
   4. Width: As indicated on Drawings.
   5. Pattern/Texture: As indicated on Drawings.
6. Finish: Factory primed and field painted as specified under Section 099000 Painting. Color shall be as selected by Architect from paint manufacturer’s standard colors.

7. Approved Product/Manufacturer: Specifications are based on HardiePlank® Lap Siding manufactured by James Hardie Building Products, Inc.; Mission Viejo, CA; (866) 274-3464, or Architect or Owner approved equal. Other manufacturers must have a minimum of five (5) years experience manufacturing equivalent products to those specified and comply with Division 01 Section requirements regarding substitutions to be considered.

C. Fasteners and Accessories: Stainless steel of type and size recommended by the manufacturer to suit application.

PART 3 - EXECUTION

3.1 EXAMINATION

A. If framing preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

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

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

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

3.3 FIBER-CEMENT SIDING INSTALLATION

A. Install fiber-cement siding horizontally over air and vapor barrier over ICF in accordance with manufacturer’s recommendations.

B. The first course of all walls shall be installed over a 1/4 inch lath strip to ensure a consistent plank angle.

C. Install fiber-cement siding in compliance with local building code requirements for clearance between the bottom edge of siding/framing and the adjacent finished grade.

D. At the juncture of the roof and vertical surfaces, flashing and counterflashing shall be provided in accordance with the roofing manufacturer's instructions. Provide a one (1) inch - two (2) inch clearance between the roofing and bottom edge of siding or as recommended by the roofing manufacturer.

E. Fasten siding using a pneumatic tool. Set air pressure so that the fastener is driven snug with the siding surface. Use a flush mount attachment on pneumatic tool. This will help control the depth that the nail is driven. This will be especially helpful when more than one pneumatic tool is driven off the same compressor.

F. Fastening Requirements:
   1. Drive fasteners perpendicular to siding and framing.
   2. Fastener heads shall fit snug against siding (no air space).
   3. Do not over-drive nail heads or drive nails at an angle. If nail is countersunk, caulk nail hole and add a nail.

3.3 FINISHING

A. Patching: Dents, chips and cracks can be filled with a cementitious patching compound.

B. Caulking: A high quality, paintable Latex caulk complying with ASTM C834. Caulking should be applied in accordance with caulking manufacturer's written application instructions. Refer to Division 07 Section "Joint Sealants".

C. Painting: Finish paint as specified in Division 09 Section "Painting".

3.4 CLEANING

A. Remove debris and clean siding in accordance with manufacturer’s written instructions.

3.5 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION
SECTION 07 4100
METAL ROOF & WALL PANELS

PART 1 GENERAL

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

1.2 SUMMARY
A. Section Includes: Factory-formed metal roof and wall panels, including fascia, soffit and liner panels and includes:
   1. Factory-formed panels in vertical installation.
   2. Factory-formed panels in horizontal installation.
   3. Metal flashings and trim.
B. Related Sections: Section(s) related to this section include:
   1. Section 05 5500: Metal Fabrication.
   2. Section 06 1000: Rough Carpentry.
   3. Section 07 6200: Sheet Metal Flashing and Trim.

1.3 REFERENCES
A. American Society for Testing and Materials (ASTM):
   2. ASTM A653/A653M Standard Specification for Steel Sheets, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

1.4 SYSTEM DESCRIPTION
A. Panel Performance Requirements: Provide panels, which have been manufactured, fabricated and installed to withstand structural and thermal movement, wind loading and weather exposure to maintain manufacturer’s performance criteria without defects, damage, failure or infiltration of water.

1.5 SUBMITTALS
A. Product Data: Submit manufacturer’s product data for specified products.
B. Shop Drawings: Submit shop drawings showing layout, profiles and product components, including anchorage, accessories, finish colors and textures.
   1. Indicate layout of panels and panel sizes, including custom-fabricated panels if indicated; indicate each item of trim and accessories.
   2. Indicate in detailed drawings profile and gauge of interior and exterior sheets, and locations and types of fasteners; indicate locations, gauges, shapes and methods of attachment of panels, trim and accessory items.
3. Indicate products/materials required for construction activities of this section not supplied by manufacturer of products of this section.

C. Samples: Submit selection and verification samples for finishes, colors and textures.

D. Quality Assurance Submittals: Submit the following:

E. Closeout Submittals: Submit the following:
   1. Warranty: Warranty documents specified herein.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Installer experienced in performing work of this section who has specialized in the installation of work similar to that required for this project.


1.7 DELIVERY, STORAGE & HANDLING

A. General: Comply with Division 1 Product Requirements Sections.

   1. Ordering: Comply with manufacturer’s ordering instructions and lead time requirements to avoid construction delays.

B. Delivery: Deliver materials in manufacturer’s original, unopened, undamaged containers with identification labels intact. Identify fabricated components with UL 90 label where appropriate.

C. Packing, Shipping, Handling and Unloading:

   1. Upon receipt of panels and other materials, installer shall examine the shipment for damage and completeness.

   2. Bundle panels in waterproof wrapping paper when nested, or wooden crates when panels cannot be nested.

   3. Package trim and accessories in waterproof wrapping paper.

D. Storage and Protection: Store materials protected from exposure to harmful conditions. Store material in dry, above-ground location.

   1. Stack prefinished material to prevent twisting, bending, abrasion, scratching and denting. Elevate one end of each skid to allow for moisture run off.

   2. Store products of this section in manufacturer’s unopened packaging until installation of products.

   3. Maintain dry, heated storage area for products of this section until installation of products.

1.8 PROJECT CONDITIONS

A. Field Measurements: Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements, fabrication schedule with construction progress to avoid construction delays.

1.9 WARRANTY

A. Project Warranty: Refer to Conditions of the Contract for project warranty provisions.

B. Manufacturer’s Warranty: Submit, for Owner’s acceptance, a sample of manufacturer’s standard warranty document.

C. Galvalume material shall have a twenty five-year warranty against failure due to corrosion, rupture or perforation.

PART 2 PRODUCTS

2.1 BASIS OF DESIGN

A. Acceptable Manufacturer: McElroy Metal, Inc.

   1. Contact: 1500 Hamilton Rd., Bossier City, LA 71111; Telephone: (800) 562-3576, (318) 747-8097; Fax: (318) 747-8099; E-mail: info@mcelroymetal.com; website: www.mcelroymetal.com.

B. Substitutions shall fully comply with specified requirements.

2.2 MANUFACTURED UNITS

A. Basic of Design: McElroy Metal Multi-Cor Corrugated Panels:

1. Profile: Longitudinal ribs 7/8" (22.2 mm) deep, spaced 2.67" (68 mm) on center, 35 1/2" (902 mm) sheet width.
2. Size: 31 3/8" (813 mm) cover width, lengths indicated on drawings.
3. Material: Galvalume steel sheet conforming to ASTM A792, AZ55 coating for bare; AZ50 coating for painted; 24 gauge sheet thickness.
4. Finish: Acrylic Coated Galvalume

B. Trim:

1. Manufacturer’s standard sheet metal matching panel material and finish, break-formed to profiles indicated on drawings, and including, but not limited to:
   a. Gutters and downspouts.
   b. Termination and transition strips.
2. Color: Match panel finish.

C. Clips and Fasteners: Supply items required for installation of panels in accordance with manufacturer’s installation instructions and other indicated items; supply galvanized clips and fasteners.

2.3 MATERIALS

A. Aluminum Sheet: ASTM B209, aluminum and aluminum alloy 3105 with H14 temper in accord with manufacturer’s standard to suit forming operations and finish specified.

B. Galvanized Steel Sheet: ASTM A653, G90 steel sheet, zinc coated (galvanized) by hot dip process, structural quality.

2.4 SOURCE QUALITY

A. Source Quality: Obtain metal panel products from a single manufacturer.

PART 3 EXECUTION

3.1 MANUFACTURER’S INSTRUCTIONS

A. Compliance: Comply with manufacturer’s product data, recommendations and installations instructions for substrate verification, preparation requirements and installation.

1. Strippable Film: Remove manufacturer’s protective film, if any, from surfaces of roofing panels.

3.2 EXAMINATION

A. Site Verification of Conditions: Verify substrate conditions, which have been previously installed under other sections, are acceptable for product installation in accordance with manufacturer’s instructions.

1. Verification of Conditions:
   a. Examine deck to ensure proper attachment to framing.
   b. Verify roof openings, curbs, pipes, sleeves, ducts or vents through roof are solidly set, cant strips and reglets in place, and nailing strips located.
   c. Inspect roof deck to verify deck is clean and smooth, free of depressions, waves or projections, level to ¼" in 20’ and properly sloped.
   d. Panel support systems are ready for construction activities of this section and within specified tolerances.
   e. Rough-in utilities are in correct locations.
   f. Verify underlayment ice & water shield membrane on metal deck.

2. Installer’s Examination:
   a. Have installer of this section examine conditions under which construction activities of this section are to be performed, then submit written notification if such conditions are unacceptable.
b. Transmit 2 copies of installer’s report to Architect within 24 hours of receipt.
c. Delay construction activities of this section until unacceptable conditions have been corrected.
d. Beginning construction activities of this section indicates installer’s acceptance of conditions.

3.3 PREPARATION
A. Coordination: Coordinate metal roofing with other work including drainage, flashing and trim, deck substrates, parapets, copings, walls and other adjoining work to provide a noncorrosive and leakproof installation.
B. Dissimilar Metals: Prevent galvanic action of dissimilar metals.

3.4 INSTALLATION
A. General: Install metal roofing panels to profiles, patterns and drainage indicated and required for leakproof installation. Provide for structural and thermal movement of work. Seal joints for leakproof installation.
   1. Seams: Provide uniform, neat seams.
   2. Fasteners: Conceal fasteners where possible in exposed work. Cover and seal fasteners and anchors for watertight and leakproof installation.
   3. Sealant-Type Joints: Provide sealant-type joint where indicated. Form joints to conceal sealant. Comply with Division 7 Joint Sealants Section for sealant installation.
B. Panel Installation:
   1. Install panels plumb, true and in correct alignment with structural framing, in accordance with shop drawings and manufacturer’s printed installation instructions.
   2. Install panels in horizontal installations using manufacturer’s concealed fastening system only; sight-exposed fasteners are prohibited.
   3. Install panels in vertical installations using manufacturer’s concealed fastening system or non-corroding fasteners color-matched to panel.
   4. Install trim using concealed fasteners where possible; sight-exposed non-corroding fasteners color-matched to trim are permitted on vertical surfaces only.
C. Installation Tolerances:
   1. Variation from Plumb: Maximum 1/8" (3.2 mm) in 20 feet (6.096 m).
   2. Variation from Level: Maximum 1/8" (3.2 mm) in 20 feet (6.096 m).
   3. Variation from True Plane: Maximum 1/8" (3.2 mm) in 20 feet (6.096 m).

3.5 FIELD QUALITY REQUIREMENTS
A. Site Tests (Post-Installation Testing): Owner reserves right to perform post-installation testing of installed metal panel installation.
B. Manufacturer’s Field Services: Upon Owner’s request, provide manufacturer’s field service consisting of product use recommendations and periodic site visit for inspection of product installation in accordance with manufacturer’s instructions.

3.6 CLEANING
A. Cleaning: Remove temporary coverings and protection of adjacent work areas. Repair or replace damaged installed products. Clean installed products in accordance with manufacturer’s instructions prior to Owner’s acceptance. Remove construction debris from project site and legally dispose of debris.
   1. Remove strippable coating and perform dry wipe-down cleaning of panels as erected.

3.7 PROTECTION
A. Protection: Protect installed product’s finish surfaces from damage during construction.
   1. Protect installed products from damage by subsequent construction activities.
   2. Replace products having damage other than minor finish damage.
   3. Repair products having minor damage to finish in accordance with panel manufacturer’s recommendations.
4. Architect shall be sole judge of acceptability of repair to damaged finishes; replace products having rejected repairs.

END OF SECTION
SECTION 07 6200
SHEET METAL FLASHING AND TRIM

PART I - GENERAL

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

1.2 SUMMARY
A. Section Includes:
   1. Gutters and downspouts.
   2. Other sheet metal work associated with roofing system, except items specified therein.
B. Related Sections: Work of all sections, including Division 01 Sections, as required to properly execute the work and as necessary to maintain satisfactory progress of the work.
   1. Related Sections include:
      a. Section 06 1000: Rough Carpentry.
      b. Section 07 4100: Metal Roof & Wall Panels.
      c. Section 07 9200: Joint Sealants.

1.3 GENERAL REQUIREMENTS
A. All sheet metal work shall be in conformance with details and recommendations of the Sheet Metal and Air Conditioning Contractor's National Association (SMACNA), Architectural Sheet Metal Manual (latest edition).
B. All work shall comply with the more stringent requirements of the Texas Windstorm Insurance Association (TWIA) Building Code for Windstorm Resistant Construction, Texas Department of Insurance (TDI) Windstorm Resistant Construction Guide, or wind loads specified in ASCE 7 or FM Global Property Loss Prevention Data Sheet 1-28, as applicable to project location, or requirements of this Section or local building code, whichever is the more stringent.

1.4 SUBMITTALS
A. Product Data: Manufacturer's specifications and other data needed to prove compliance with specified requirements.
B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.
C. Samples: Submit samples of color chips and materials for all specified materials for Architect's review and approval. Submit two samples, 12x12 inch in size illustrating material, finish, and fabrication details of typical bayonet seam and junction to vertical dissimilar surface.
D. Warranties.

1.5 QUALITY ASSURANCE
A. This Section outlines only minimum standards and requirements. Refer to the Drawings, and other sections of the specifications for additional requirements. Bring all conflicts and discrepancies to the attention of the Architect and Owner, and do not start work until such conflicts and discrepancies are clarified and corrected.
B. Comply with governing codes and regulations.
C. Provide products of acceptable manufacturers in satisfactory use in similar service for minimum of three (3) years. Use experienced installers.

1.6 DELIVERY, STORAGE AND HANDLING
A. Deliver, handle and store materials in accordance with manufacturer's instructions.
B. Handle and store materials and equipment in such a manner as to avoid damage.

1.7 WARRANTIES
A. Manufacturer's Product Warranty: Submit manufacturer's standard limited product warranty signed by the manufacturer's authorized official, guaranteeing to correct failures in product which may occur during the warranty period, without reducing or otherwise limiting any other rights to correction which the Owner may have under the Contract Documents. Failure is defined to include product failure which leads to interruption
of a water-tight installation. Correction may include repair or replacement of failed product. Warranty period:
For roofing flashing, match period of applicable roofing systems, starting from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SHEET MATERIALS
A. Galvalume steel sheet conforming to ASTM A792, AZ55 coating for bare; AZ50 coating for painted; 24 gauge sheet thickness.

2.2 ACCESSORIES
A. Fasteners: Galvanized steel fasteners. Finish exposed fasteners same as flashing metal.
B. Gutters: Type and location as directed by Architect, fabricated from prefinished aluminum seamless roll-type system in color selected by Architect from manufacturer's full range. Confer with Drawings for sizes at unit buildings. Gutters sized to SMACNA requirements. Provide gutter screen, rain chain, gravel basin, or other Owner approved materials.
C. Other Materials: Provide other materials, not specifically described, but required for a complete and proper installation.

2.3 FABRICATION
A. Form sections true to shape, accurate in size, square and free from distortion or defects.
B. Fabricate cleats and starter strips of same material as sheet, interlockable with sheet.
C. Form pieces in longest practical lengths.
D. Hem exposed edges on underside 1/2 inch miter and seam corners.
E. Form material with flat lock seam.
F. Solder and seal metal joints. After soldering, remove flux. Wipe and wash solder joints clean.
G. Fabricate corners from one piece with minimum 18 inch long legs; rigidity, seal with sealant.
H. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.
I. Fabricate flashings to allow toe to extend beyond roofing. Return and brake edges.

PART 3 - EXECUTION

3.1 PREPARATION
A. Field measure site conditions prior to fabricating work.
B. Install starter and edge strips, and cleats before starting installation.
C. Install reglets true to lines and levels. Seal top of reglets with sealant.
D. Insert flashings into reglets to form tight fit. Secure in place with lead wedges at maximum 8 inches. Seal flashings into reglets with sealant.
E. Secure flashings in place using non-corrosive fasteners.
F. Apply plastic cement compound between metal flashings and felt flashings.
G. Fit flashings tight in place. Make corners square, surfaces true and straight in planes and lines accurate to profiles. Vertical legs of counterflashings to be minimum 6 inches above horizontal surfaces.
H. Fabricate gutter and downspout accessories; seat watertight.

3.2 INSTALLATION
A. Sheet metal exposed to weather shall be installed to be permanently water and weathertight with seams installed in direction of water flow. All materials installed in accordance with SMACNA appropriate plate details.
B. Install gutters, rain chain, and accessories in accordance with manufacturer's instructions. Join lengths with seams watertight. Flash and seal gutters to accessories. Provide expansion joints on sides of a hip roof and on runs of more than 40 feet in length. Slope gutters 1/8 inch per foot minimum, Gutter hangers installed by using two 1-1/4 inch saw shank nails secured to solid wood.
C. Provide metal flashing kickers at all wall to roof edges and also at valley/cricket conditions to direct water flow away from structure.

3.3 CLEANING AND PROTECTION
A. Remove flux and residual acid immediately by neutralizing with baking soda and washing with clean water.
Leaves work clean of stains.
B. Remove scraps and debris and leave work area clean.
C. Clean exposed metal surfaces, removing substances which might cause corrosion of metal or deterioration of finishes, or soiled with bitumen. Paint areas where finish is damaged on prefinished metal by painting with a compatible paint in color to match undamaged finish.
D. Clean other work damaged or soiled by work of this Section.
E. Protect finished work from damage.

END OF SECTION
SECTION 07 9200
JOINT SEALANTS

PART 1 GENERAL

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

1.2 SUMMARY
A. Section Includes:
   1. Exterior sealants and sealants for moving joints.
   2. Interior sealants and caulking.
B. Related Sections: Work of all sections, including Division 01 Sections as required to properly execute the work and as necessary to maintain satisfactory progress of the work.

1.3 SUBMITTALS
A. Product Data:
   1. Manufacturer's specifications and other data needed to prove compliance with specified requirements.
   2. Manufacturer's installation instructions.
B. Sample: Match adjacent material and submit samples of color chips and materials for all specified materials for Architect's review and approval.

1.4 QUALITY ASSURANCE
A. This Section outlines only minimum standards and requirements. Refer to the Drawings and other sections of the specifications for additional requirements. Bring all conflicts and discrepancies to the attention of the Architect and do not start work until such conflicts and discrepancies are clarified and corrected.
B. Installer's Qualifications: Company having a minimum of three (3) years experience in installation of sealants and caulks of the type specified for this Project.

1.5 WARRANTY
A. Manufacturer's Warranty: Submit manufacturer's standard warranty for materials to be free of defects in materials.
B. Installer's Warranty: Submit installer's warranty that work specified herein will not become unserviceable or cause an objectionable appearance resulting from either defective workmanship for a period of two (2) years from date of Substantial Completion.
   1. Defects shall include, but not be limited to:
      a. Leaking
      b. Cracking, splitting or releasing from substrate
      c. Deterioration or color change

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS
A. Specifications are based on the products or materials of the named manufacturer, otherwise selection may be made from any manufacturer whose products meet or exceed the specifications. Other manufacturers must have a minimum of five (5) years experience manufacturing the products meeting or exceeding the specifications and comply with Division 01 requirements regarding substitutions to be considered.

2.2 MATERIALS
A. Caulking for Exposed Non-Working Interior Locations:
   1. Type: Paintable Acrylic Latex conforming to ASTM C 834, vertical grade.
   2. Approved Manufacturers, or Architect approved equal in accordance with Paragraph 2.1:
      a. Bostik, Inc.
      b. Pecora, Inc.
c. BASF Sonneborn
d. Sika
e. Tremco Incorporated

B. Sealant for All Working Joints and Exposed Exterior Locations:
   1. Type: Two component, polyurethane, non-sag, conforming to FS TT-S-00227E, Type II, Class A and
      ASTM C 920, Type M, Grade NS, Class 25.
   2. Refer to drawings and other sections of the specifications for locations.
   3. Colors: As selected by Architect from manufacturer’s full range.
   4. Approved Manufacturers, or Architect approved equal in accordance with Paragraph 2.1.
      a. Bostik, Inc.
      b. Pecora, Inc.
      c. BASF Sonneborn
d. Sika
e. Tremco Incorporated

C. Mildew-Resistant Silicone Rubber Sealant: Silicone rubber based, one-part, non-sag, elastomeric sealant,
   resistant to mildew; complying with ASTM C 920, Type 8, and with resistance for mold growth;
   recommended by manufacturer for interior applications, including seal around bath tubs, food service
   equipment and similar applications subjected to attack by mildew. Provide type recommended by
   manufacturer for porosity of joint surfaces.
   1. Colors: As selected by Architect from manufacturer’s full range.
   2. Products: Subject to compliance with requirements, provide one of the following systems, or Architect
      approved equal in accordance with Paragraph 2.1:
         a. Dow Corning 786 Mildew Resistant Silicone Sealant; Dow Corning Corp.
         b. Sanitary 1700: General Electric
   3. Locations: Sanitary seal at plumbing fixtures and countertops, and tile.

D. Sealant for Horizontal Exposed Exterior Paving Locations: Refer to Division 32 for paving specifications and
   Civil or Structural Drawings, as applicable.

E. Primers, Cleaners, Top Coats: Use only materials listed as suitable in resistance to staining, compatibility
   and durability before proceeding.

F. Expanded Polyethylene Joint Filler: Provide flexible, compressible, closed-cell, polyethylene of not less than
   10 psi compression deflection (25 percent); except provide higher compression deflection strength as may
   be necessary to withstand installation forces and provide proper support for sealants, surface water
   absorption of not more than 0.1 pounds per square foot, as manufactured by Sonneborn, or Architect
   approved equal.

G. Sealant Backer Rod: Provide compressible rod stack of polyethylene foam, polyurethane foam, polyethylene
   jacketed polyurethane foam, butyl rubber foam, neoprene foam or other flexible, permanent, durable, non-
   absorptive material as recommended by sealant manufacturer for back-up of and compatibility with sealant.
   Where used with hot-applied sealant, provide heat-resistant type which will not be deteriorated by sealant
   application temperature as indicated.

H. Bond Breaker Tape: Provide polyethylene tape or other plastic tape as recommended by sealant
   manufacturer, to be applied to sealant-contact surfaces where bond to substrate or joint filler must be
   avoided for proper performance of sealant. Provide self-adhesive tape where applicable.

PART 3 EXECUTION

3.1 INSPECTION
   A. Require installer to inspect joints indicated to receive joint sealants for compliance with requirements for joint
      configuration, installation tolerances and other conditions affecting joint sealant performance. Obtain
      installer’s written report listing any conditions detrimental to performance of joint sealant work. Do not allow
      joint sealant work to proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION
   A. At Contractor's direction, installer, joint sealant manufacturers' representatives, and other trades whose work
affects installation of joint sealants shall meet at Project Site to review procedures and time schedule proposed for installation of joint sealants which is coordinated with other, related work.

B. Clean out joints immediately before installing joint sealants to comply with recommendations of joint sealant manufacturers and the following requirements:

1. Remove all foreign material from joint substrates which 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; oil; grease; waterproofing; water repellants; water; surface dirt and frost.

2. Clean concrete, masonry, unglazed surfaces of ceramic tile and similar porous joint substrate surfaces, by brushing, grinding, blast cleaning, mechanical abrading, acid washing or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.

3. Remove laitance and form release agents from concrete.

4. Clean metal, glass, porcelain enamel, glazed surfaces of ceramic tile and other non-porous surfaces by chemical cleaners or other means which are not harmful to substrates or leave residues capable of interfering with adhesion of joint sealants.

C. Prime joint substrates where indicated or where recommended by joint sealant manufacturer based on preconstruction joint sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's recommendations. Confine primers to areas of joint sealant bond, do not allow spillage or migration onto adjoining surfaces.

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

3.3 INSTALLATION OF JOINT SEALANTS

A. Comply with joint sealant manufacturers' printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply.

B. Comply with recommendations of ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Comply with the recommendations of ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications and conditions indicated.

D. Install sealant backings to comply with the following requirements:

1. Install joint fillers of type indicated to provide support of sealants during application and at position required to produce the crosssectional shapes and depths of installed sealants relative to joint widths which allow optimum sealant movement capability.
   a. Do not leave gaps between ends of joint-fillers.
   b. Do not stretch, twist, puncture or tear joint-fillers.
   c. Remove absorbent joint-fillers which have become wet prior to sealant application and replace with dry material.

2. Install bond breaker tape between sealants and joint-fillers, compression seals or back of joints where required to prevent third-side adhesion of sealant to back of joint.

E. Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration and providing uniform, cross-sectional shapes and depths relative to joint widths which allow optimum sealant movement capability.

F. Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated, to eliminate air pockets and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents which discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

1. Concave joint configuration per Figure 6A in ASTM C 1193, unless otherwise indicated.

2. Flush joint configuration per Figure 6B in ASTM C 1193, where indicated.
   a. Use masking tape to protect adjacent surfaces of recessed tooled joints.
3. Recessed joint configuration per Figure 6C in ASTM C 1193, of recess depth and at locations indicated.

3.4 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Field-test joint-sealant adhesion to joint substrates as follows:

1. Extent of Testing: Test completed elastomeric sealant joints as follows:
   a. Perform 10 tests for the first 1000 feet of joint length for each type of elastomeric sealant and joint substrate.
   b. Perform one test for each 1000 feet of joint length thereafter or one test per each floor per elevation.

2. Test Method: Test joint sealants by hand-pull method described below:
   a. Make knife cuts from one side of joint to the other, followed by two cuts approximately 2 inches long at sides of joint and meeting cross cut at one end. Place a mark 1 inch from cross-cut end of 2-inch piece.
   b. Use fingers to grasp 2-inch piece of sealant between cross-cut end and 1-inch mark; pull firmly at a 90-degree angle or more in direction of side cuts while holding a ruler along side of sealant. Pull sealant out of joint to the distance recommended by sealant manufacturer for testing adhesive capability, but not less than that equaling specified maximum movement capability in extension; hold this position for 10 seconds.
   c. For joints with dissimilar substrates, check adhesion to each substrate separately. Do this by extending cut along one side, checking adhesion to opposite side, and then repeating this procedure for opposite side.

3. Inspect joints for complete fill, for absence of voids, and for joint configuration complying with specified requirements. Record results in a field adhesion test log.

4. Inspect tested joints and report on the following:
   a. 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 type of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.
   b. Whether sealants filled joint cavities and are free from voids.
   c. Whether sealant dimensions and configurations comply with specified requirements.

5. Record test results in a field adhesion test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.

6. Repair sealants pulled from test area by applying new sealants following same procedures used to originally seal joints. Ensure that original sealant surfaces are clean and new sealant contacts original sealant.

B. Evaluation of Field-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements, will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 PROTECTION AND CLEANING

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

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

END OF SECTION
SECTION 08 1113
HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL
1.1 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including Uniform General Conditions, and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY
   A. Section includes hollow-metal steel doors and frames where indicated.
   B. Related Sections: Work of all sections, including Division 01 Sections as required to properly execute the work and as necessary to maintain satisfactory progress of the work.
      1. Related sections include:
         a. Section 08 7100: Door Hardware.
         b. Section 09 9000: Painting.

1.3 SUBMITTALS
   A. Product Data:
      1. Manufacturer's standard details and catalog data demonstrating compliance with specifications and referenced standards.
      2. Manufacturer's installation instructions.
   B. Shop Drawings:
      1. Indicate complete schedule in detail for each steel door and frame using the same reference number for details and openings as those on the Contract Drawings. If any door is not by the steel door manufacturer only the door opening number should be shown along with the type of door (wood, plastic laminate faced, etc.).
      2. Show details of construction, installation, connections, anchors, hardware reinforcement, hardware preparation, louvers, and floor and threshold clearances.
   C. Glazing:
      1. Samples: For the following products, in the form of 12 inch square Samples for glass and of 12 inch long Samples for sealants. Install sealant Samples between two strips of material representative in color of the adjoining framing system
         a. Each type of glass.
         b. Insulating glass for each designation indicated.
         c. For each color (except black) of exposed glazing sealant indicated.
      2. Glazing Schedule: Use same designations indicated on Drawings for glazed openings in preparing a schedule listing glass types and thicknesses for each size opening and location.
      3. Product Certificates: Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements.
         a. For solar-control Low-E-coated glass, provide documentation demonstrating that manufacturer of coated glass is certified by coating manufacturer.
      4. Qualification Data: For installers.
      5. Preconstruction Adhesion and Compatibility Test Report: From glazing sealant manufacturer indicating glazing sealants were tested for adhesion to glass and glazing channel substrates and for compatibility with glass and other glazing materials.
      6. Product Test Reports: For each of the following types of glazing products:
         a. Insulating glass.
         b. Glazing sealants.
         c. Glazing gaskets.
      7. Warranties: Special warranties specified in this Section
1.4 QUALITY ASSURANCE

A. This Section outlines only minimum standards and requirements. Refer to the Drawings, and other sections of the specifications for additional requirements. Bring all conflicts and discrepancies to the attention of the Architect and do not start work until such conflicts and discrepancies are clarified and corrected.

B. Manufacturer Qualifications: If other than a manufacturer listed under Paragraph 2.1 is proposed for use on the Project, it shall be a company specializing in the manufacturer of steel doors and frames of the type specified for this Project with a minimum of five (5) years experience.

C. All steel doors and frames shall be by a single manufacturer.

1.5 PERFORMANCE REQUIREMENTS

A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Glass Design: Glass thickness designations indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites in the thickness designations indicated for various size openings, but not less than thicknesses and in strengths, annealed, heat strengthened, or fully tempered, required to meet or exceed the Building Code and the following:

1. Glass Thicknesses: Select minimum glass thicknesses to comply with ASTM E 1300 according to the following requirements:
   a. Indicated or specified design wind loads.
   b. Maximum Lateral Deflection: For the following types of glass supported on all 4 edges, provide thickness required that limits center deflection at design wind pressure to 1/50 times the short side length or 1 inch, whichever is less.
      1) For insulating glass.
   c. Minimum Glass Thickness for Exterior Lites: Not less than 1/4 inch thick.

C. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

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

D. Thermal and Optical Performance Properties: Provide glass with performance properties specified based on manufacturer's published test data, as determined according to procedures indicated below:

1. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
2. Center-of-Glass Values: Based on using LBL-44789 WINDOW 5.0 computer program for the following methodologies:
   a. U-Factors: NFRC 100 expressed as Btu/ sq. ft. x h x deg F (W/sq. m x K).

1.6 COORDINATION

A. Coordinate the Work of this Section with work in which hollow metal work is installed.

B. Coordinate hardware installation with opening construction. Finish hardware is specified in Section 08 7100 Door Hardware.

C. Coordinate doors and frames with painting specified in Section 09 9000 Painting.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver and store products in accordance with manufacturer’s instructions, and as follows:

1. In manufacturer's original, clearly labeled, undamaged containers or wrappers.
2. Containers or wrappers shall list the name of the manufacturer and product.
B. Deliver materials to allow for minimum storage time at the project site. Coordinate delivery with the scheduled time of installation.

C. Protect products from moisture, construction traffic, and damage.
   1. Store under cover in a clean, dry place, protected from weather and abuse.
   2. Store in a manner that will prevent rust or damage.
   3. Store doors in a vertical position, spaced with blocking to permit air circulation.
   4. Do not use non-vented plastic or canvas shelters.
   5. Should containers or wrappers become wet, remove immediately.

A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
B. For insulating-glass units that will be exposed to substantial altitude changes, comply with insulating-glass manufacturer's written recommendations for venting and sealing to avoid hermetic seal ruptures.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

A. Manufacturers listed below whose products meet or exceed the specifications are approved for use on the Project. Other manufacturers must comply with Paragraph 1.5, B, Manufacturer Qualifications, must manufacture equivalent products to those specified and comply with requirements of Division 01 regarding substitutions to be considered.
   1. Black Mountain Door, LLC.
   2. Ceco Door Products; an Assa Abloy Group company.
   3. Curries Company; an Assa Abloy Group company.
   5. Door Pro Systems, Inc.
   6. Mesker Door Inc.
   7. P-W Metal Products, Inc.
   8. Pearland Industries, Inc.
   10. Republic Steel Doors and Frames.
   11. Steelcraft; an Ingersoll-Rand Company

2.2 GLASS PRODUCTS

A. Insulating-Glass Units, General: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, and complying with requirements specified in this Article and in Paragraph 2.7 for "Insulating-Glass Units".
   1. Provide Kind HS (heat-strengthened) float glass in place of annealed glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in Part 1 "Performance Requirements" Article.
   2. Provide Kind FT (fully tempered) glass lites where safety glass is indicated.
   3. Overall Unit Thickness and Thickness of Each Lite: Dimensions indicated for insulating-glass units are nominal and the overall thicknesses of units are measured perpendicularly from outer surfaces of glass lites at unit's edge.
   4. Sealing System: Dual seal, with primary and secondary sealants as follows:
      a. Manufacturer's standard sealants.
      b. Corner Construction: Manufacturer's standard corner construction.

2.3 GLAZING GASKETS
A. Dense Compression Gaskets: Molded or extruded gaskets of material indicated below, complying with standards referenced with name of elastomer indicated below, and of profile and hardness required to maintain watertight seal:
   1. EPDM, ASTM C 864.
B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned gaskets of material indicated below; complying with ASTM C 509, Type II, black; and of profile and hardness required to maintain watertight seal:
   1. EPDM.
C. Lock-Strip Gaskets: Neoprene extrusions in size and shape indicated, fabricated into frames with molded corner units and zipper lock-strips, complying with ASTM C 542, black.

2.4 GLAZING SEALANTS
A. General: Provide products of type indicated, complying with the following requirements:
   1. Compatibility: Select glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
   2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
   3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.
B. Glazing Sealants: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 100/50, Use NT..
   1. Products: Subject to compliance with requirements, provide one (1) of the following, or Architect approved equal in accordance with Paragraph 2.01:
      a. BASF; "Omniseal".
      b. Dow Corning Corporation; "790".
      c. GE Silicones; "SilPruf LM SCS2700".
      d. Pecora Corporation; "890".
      e. Polymeric Systems Inc.; "PSI-641".
      f. Tremco; "Spectrem 1".

2.5 GLAZING TAPES
A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based elastomeric tape with a solids content of 100 percent; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; packaged on rolls with a release paper backing; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
   1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
   2. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.
B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; packaged on rolls with release liner protecting adhesive; and complying with AAMA 800 for the following types:
   1. Type 1, for glazing applications in which tape acts as the primary sealant.
   2. Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.6 FABRICATION OF GLAZING UNITS
A. Fabricate glazing units in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites in a manner that produces square edges with slight kerfs at junctions with outdoor and indoor faces.
C. Grind smooth and polish exposed glass edges and corners.
D. Glass Types: As scheduled on Drawings.

2.7 MATERIALS
A. Hot-Rolled Steel Sheets: ASTM A 569, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
B. Cold-Rolled Steel Sheets: ASTM A 366, Commercial Steel (CS), or ASTM A 620, Drawing Steel (DS), Type B; stretcher-leveled standard of flatness.
C. Metallic-Coated Steel Sheets: ASTM A 653, Commercial Steel (CS), Type B, with an A60 zinc-iron-alloy (galvannealed) coating; stretcher-leveled standard of flatness.
D. Electrolytic Zinc-Coated Steel Sheet: ASTM A 591, Commercial Steel (CS), Class B coating; mill phosphatized; suitable for unexposed applications; stretcher-leveled standard of flatness where used for face sheets.
E. Glazing: Comply with requirements in Division 08 Section "Glazing".

2.8 FRAME FABRICATION
A. Minimum Gauges:
   1. Interior Openings: 16 gauge
   2. Exterior Openings: 16 gauge
B. Design and Construction:
   1. Frames shall be custom made, welded units with integral trim of sizes and shapes shown on approved shop drawings. Hinge jambs that butt adjacent 90 degree walls shall have at least four (4) inch wide frame face to assure the door trim will not strike the wall prior to the door opening at least 90 degrees. Frame profile shall match wall thickness where practical.
   2. Frames shall be strong and rigid, neat in appearance, square, true and free of defects, warp and buckle. Moulded members shall be clean cut, straight and of uniform profile throughout their length.
   3. Jamb depths, trim, profile and backbends shall be as shown on approved shop drawings.
   4. Corner joints shall have contact edges closed tight, with trim faces mitered and continuously welded, and stops butted. The use of gussets shall not be permitted.
   5. Minimum depth of stops shall be 5/8 inch, except at fire windows where minimum depth of stops shall be 3/4 inch.
   6. Frames for multiple openings shall have mullion and rail members which are closed tubular shapes having no visible seams or joints. Joints between faces of abutting members shall be securely welded and finished smooth. Mullions shall be key locked removable type. Keys shall be master keyed to Owner’s keying system.
   7. Hardware Reinforcements:
      a. Frames shall be mortised, reinforced, drilled and tapped at factory for fully templated mortised hardware in accordance with approved hardware schedule and templates provided by Section 08 71 11. Where surface-mounted hardware is to be applied, frames shall have reinforcing plates only.
      b. Minimum thickness of hardware reinforcing plates shall be as follows:
         1) Hinge and pivot reinforcements (1-1/4 inch x 10 inch minimum size): 7 gauge
         2) Strike reinforcements: 12 gauge
         3) Flush bolt reinforcements: 12 gauge
         4) Closer reinforcements: 12 gauge
         5) Reinforcements for surface-mounted hardware, hold-open arms, surface panic devices: 12 gauge
   8. Floor Anchors: Minimum 14 gauge, securely welded inside each jamb, with holes for floor anchorage.
   9. Jamb Anchors:
      a. Frames for installation in masonry walls shall be provided with adjustable jamb anchors of the T-Strap type. Anchors shall be not less than 16 gauge steel. The number of anchors provided at each jamb shall be as follows:
         1) Frames up to 7 feet-6 inch height - Three (3) anchors
         2) Frames 7 feet-6 inch to 8 feet-0 inch height - Four (4) anchors
3) Frames over 8 feet-0 inch height - One (1) anchor for each 2 feet or fraction thereof in height.

b. Frames for installation in wood or metal stud partitions shall be provided with steel anchors of suitable approved design, not less than 16 gauge thickness, securely welded inside each jamb as follows:
   1) Frames up to 7 feet-6 inch height - Four (4) anchors
   2) Frames 7 feet-6 inch to 8 feet-0 inch height - Five (5) anchors
   3) Frames over 8 feet-0 inch height - Four (4) anchors plus one (1) additional for each 2 feet or fraction thereof over 8 feet-0 inches.

c. Frames to be anchored to previously placed concrete, masonry or structural steel shall be provided with anchors of suitable design as shown on approved shop drawings.

10. Dust Cover Boxes: Shall be of not less than 26 gauge steel and shall be provided at all mortised hardware items.

11. Steel Spreader: Shall be provided on all frames, temporarily attached to bottoms of both jambs for bracing during shipping and handling.

12. Loose Glazing Stops: Shall be of cold rolled steel, not less than 20 gauge, butted at corner joints and secured to the frame with countersunk cadmium or zinc-plated screws. Loose stops at exterior frames shall be placed on the exterior side of the frames, unless otherwise shown.

C. Frame Finish: Field painted under Division 09 Section "Painting".

2.9 DOOR FABRICATION

A. Minimum Gauges:
   1. Exterior Doors: 16 gauge

B. Design and Construction:
   1. Types: Doors shall be custom fabricated, of types and sizes shown on approved shop drawings, and shall be fully welded seamless construction with no visible seams or joints on faces or vertical edges. Thickness: Shall be 1-3/4 inch, unless specifically noted or shown otherwise.
   2. Fabrication:
      a. Doors shall be strong, rigid and neat in appearance, free from warpage and buckle.
      b. Corner bends shall be true and straight and of minimum radius for gage of metal used.
      c. Provide 22 gauge steel stiffeners spaced maximum six (6) inches o.c. and extending full height of door.
      d. Fill interior with noncombustible fiberglass insulation. Use mineral board filler as required for labeled doors.
      e. Faces shall be joined at vertical edges of door by a continuous weld extending full height of door. Welds shall be ground, filled and dressed smooth to provide a smooth flush surface.
      f. Top and bottom edges of doors shall be closed with a continuous recessed steel channel not less than 16 gauge, extending full width of door and spot weld to both faces. Exterior doors shall have an additional flush closing channel at top and bottom edges. Openings shall be provided in the bottom closure channel at top and bottom edges. Openings shall be provided in the bottom closure of exterior doors to permit the escape of entrapped moisture.
      g. Edge profile shall be provided on both vertical edges of door as follows:
      h. Hardware Reinforcements:
         1) Doors shall be mortised, reinforced, drilled and tapped at factory for fully templated hardware, in accordance with the approved hardware schedule and templates provided by Section 08 71 00. Where surface-mounted hardware is to be applied, doors shall have reinforcing plates only.
         2) Minimum gauges for hardware reinforcing plates shall be as follows:
            a) Hinge & pivot reinforcements: 7 gauge
            b) Reinforcements for lock face, flush bolts, concealed holders, concealed or surface-mounted closers: 12 gauge
c) Reinforcements for lock face, flush bolts, concealed holders, concealed or surface-mounted closers: 12 gauge

3. Glass Mouldings and Stops: Loose stops shall be not less than 20 gauge steel, with butt corner joints, secured to frame opening by countersunk screws. Snap-on attachments will not be acceptable.

4. Edge Clearances:
   a. Between Door and Frame at Head and Jambs: 1/8 inch
   b. At Door Sills with No Threshold: 5/8 inch to 3/4 inch above finished floor.
   c. At Door Sills with Threshold: As required to suit threshold
   d. Between Meeting Edges of Double Doors: 1/8 inch

C. Finish:
   1. Shop paint steel (whether galvanized or ungalvanized) stops and accessories as follows:
      a. Clean surfaces free of mill scale, rust, oil, grease, dirt and other foreign matter.
      b. Chemically treat surfaces and apply one (1) coat of an approved baked-on rust-inhibitive primer paint to provide a minimum 0.5 mil dry film thickness.
   2. Field painted under Division 09 Section "Painting".

D. Labeled Doors and Frames:
   1. Labeled doors and frames shall be provided for openings requiring fire protection ratings as scheduled and to comply with NFPA 80. Such doors and frames shall be constructed as tested and approved by UL, WHI, or other nationally recognized testing agency having a factory inspection service and approved by code authorities having jurisdiction and shall bear the appropriate permanent label.
   2. If any door or frame scheduled to be fire-rated cannot qualify for appropriate labeling because of its size, design, hardware or other reason; the Architect shall be so advised before fabrication work on that item is started.

PART 3 EXECUTION

3.1 GLAZING EXAMINATION

A. Examine framing glazing, with Installer present, for compliance with the following:
   1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
   2. Presence and functioning of weep system.
   3. Minimum required face or edge clearances.
   4. Effective sealing between joints of glass-framing members.

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

3.2 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications and those required by TWIA and TDI to meet specified requirements.

B. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where length plus width is larger than 50 inches as follows:
1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.

2. Provide 1/8 inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.3 INSTALLATION

A. Separate dissimilar metals. Protect against galvanic action.

B. Frames:
   1. Anchorage and Connections: Secure to adjacent construction. Where practical, interior door frames shall be flush with the pull side wall to minimize or eliminate the reveal and allow full 180 degree door swing.
   2. Install frames in accordance with manufacturer’s instructions, install labeled frames in accordance with NFPA 80.
   3. Frame Spreader Bars: Leave intact until frames are set perfectly square and plumb and anchors are securely attached.
   4. Remove hardware, with the exception of prime-coated items, tag box, and reinstall after finish paint work is completed. Do not remove or paint over labels on labeled frames.

C. Doors:
   1. Install hardware in accordance with hardware manufacturer's templates and instructions.
   2. Install doors in accordance with manufacturer’s instructions, install labeled doors in accordance with NFPA 80.
   3. Adjust operable parts for correct function.
   4. Remove hardware, with the exception of prime-coated items, tag, box, and reinstall after finish paint work is completed. Do not remove or paint over labels on labeled doors.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including standard steel doors or frames that are warped, bowed, or otherwise unacceptable.

B. Clean and restore soiled surfaces.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying primer.

D. Remove scraps and debris, and leave site in clean condition.

3.5 GLAZING CLEANING AND PROTECTION

A. Protect glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended by glass manufacturer.
C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

E. Wash glass on both exposed surfaces in each area of Project not more than four (4) days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION
SECTION 08 5213
ALUMINUM-CLAD-WOOD WINDOWS

PART 1 GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including Uniform General Conditions, and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
B. Aluminum-Clad-Wood Windows and Patio Doors:
   1. Awning windows.
   2. Fixed Windows

1.2 REFERENCES
2. WDMA I.S.4; Water Repellent Preservative Non-Pressure treatment for Millwork
A. National Fenestration Rating Council (NFRC):
   1. NFRC 100 - Procedure for Determining Fenestration Product U-Factors.

1.3 SUBMITTALS
A. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.
B. Shop Drawings: Submit shop drawings indicating details of construction, flashings and relationship with adjacent construction.
C. Selection Samples: For each factory-finished product specified, two complete sets of color chips representing manufacturer's full range of available finishes.
D. Verification Samples: For each factory-finished product specified, two samples, minimum size 6 inches (150 mm) square, representing actual finishes.
E. Design Data, Test Reports: Provide manufacturer test reports indicating product compliance with indicated requirements.

1.1 QUALITY ASSURANCE
A. Installer Qualifications: Minimum 2 years installing similar assemblies.

1.2 DELIVERY, STORAGE, AND HANDLING
A. Deliver, store and handle materials and products in strict compliance with manufacturer's instructions and recommendations and industry standards.
B. Deliver and store assembly materials and components in manufacturer's original, unopened, undamaged containers with identification labels intact. Protect from damage.

1.3 PROJECT CONDITIONS
A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by Manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.4 WARRANTY
A. Manufacturer's Standard Warranty: Assemblies will be free from defects in materials and workmanship from the date of manufacture for the time periods indicated below:
   1. Window Units: 20 years.
2. Clad Finishes: 10 years against peeling, checking, cracking caulk or color change.
3. AAMA 2605 Clad Finishes: 20 years against peeling, checking, cracking or color change.
4. Glazing:
   a. Insulated Glass: 20 years against seal breakage.
   b. Laminated Glass: 5 years against delamination.
   c. Specialty Glazing: 5 years.

PART 2 PRODUCTS

2.1 BASIS OF DESIGN

A. Acceptable Manufacturer: 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

2.2 ALUMINUM-CLAD WOOD WINDOWS - GENERAL

A. Design Requirements:
   1. Compliance: Provide assemblies capable of complying with requirements indicated, based on testing manufacturer's units that are representative of those specified.
   2. Test Size: In compliance with requirements of AAMA/WDMA/CSA 101/I.S2/A440.
   3. Structural Requirements: Provide assemblies complying with requirements indicated:
      a. Performance Class: As indicated on drawings.
      b. Performance Grade: As indicated on drawings.
   4. NFRC Requirements: Provide assemblies complying with the following total window ratings:
      a. U-Factor: 0.40 maximum in accordance with NFRC 100.
      b. Solar Heat Gain Coefficient (SHGC): 0.25 maximum in accordance with NFRC 200.
      c. Visible Transmittance (VT): 0.5 minimum in accordance with NFRC 200.

A. Installation Accessories:
   1. Flashing: Refer to Section 07 6200 - Sheet Metal Flashing and Trim.
   2. Sealants: OSI Sealants by Henkel Corporation.
   3. Sealants: Refer to Section 07 9200 - Joint Sealants.
   4. Sealants: Manufacturer recommended sealants to maintain watertight conditions.

B. Materials:
   2. Interior Wood:
      b. AuraLast is a trademarked preservative treatment by JELD-WEN and is distinguished from traditional preservation methods by its minimum treatment penetration of 92 percent.

C. Finishes:
   1. Interior Finishes for Windows:
      b. Finish: Pine.
   2. Exterior Finishes for Windows:
      a. Standard Color:
         2) Color: Chestnut Bronze
      b. AAMA 2605 PVDF Optional Color for Windows:
         1) Color: Chestnut Bronze

2.3 ALUMINUM-CLAD-WOOD WINDOW ASSEMBLIES (SITELINE)

A. Basis of Design: Siteline Series aluminum-clad-wood windows assemblies as manufactured by JELD-WEN, Inc.
1. Window Type: Siteline EX.

B. Window Fabrication:

1. Window Type: Awning windows.
   a. Frame: Head corner joints mechanically fastened over silicone injected nylon corner key. Sill corner joints sealed with foam gasket and screw boss construction.
   b. Sash: Corner joints slot-and-tenoned, and mechanically fastened.
   c. Glass: Mounted using silicone glazing compound and secured with interior applied profiled wood stops.
      1) Glazing Bead: Traditional Beveled.
      2) Glazing Bead: Contemporary Square

2. Window Type: Fixed windows.
   a. Frame: Head corner joints mechanically fastened over silicone injected nylon corner key. Sill corner joints sealed with foam gasket and screw boss construction.
   b. Sash: Corner joints slot-and-tenoned, and mechanically fastened.
   c. Glass: Mounted using silicone glazing compound and secured with interior applied profiled wood stops.
      1) Glazing Bead: Traditional Beveled.
      2) Glazing Bead: Contemporary Square.

C. Frames:

1. Material: Select kiln-dried pine AuraLast treated wood.
2. Awning and Picture Windows Base Frame: 3-3/16 inch (81 mm).
3. Jamb Width: 4-9/16 inches (116 mm).
4. Cladding: 0.050 inch (1.27 mm) extruded aluminum.

D. Sashes: Select kiln-dried pine AuraLast treated wood.

1. Sash Thickness: 1-7/16 inches (36.5 mm)
2. Cladding: 0.045 inch (1.2 mm) extruded aluminum.

E. Exterior Trim:

1. Nailing Fin and Drip Cap: Integral extruded aluminum on all four sides of frame.
2. As selected from Manufacturer’s standard offering
3. Casing, Standard: 2 inch (51 mm) brickmould.
4. Casing, Optional: 3-1/2 inches (88.9 mm) flat casing.
6. Casing, Optional: 2 inch (51 mm) beaded brickmould
8. Sill Nosing: 1/2 inch (12 mm).
9. Sill Nosing: 1 inch (25 mm).
10. Sill Nosing: 2 inches (51 mm).

F. In-Sash Interior Radius Trim:

2. Pattern: As scheduled and indicated on Drawings.
3. Casing: As scheduled and indicated on Drawings.

G. Factory Applied Extension Jambs:

1. Configuration: On four sides of frame interior, 21/32 inch (16.7 mm) up to 12 inches (304.8 mm).
2. Configuration: On 3 sides of frame interior in preparation for stool by others.

H. Weatherstripping:

1. Awning Windows: Flexible hinged leaf applied to sash and foam filled bulb at full perimeter of frame.
2. Fixed Windows

I. Glazing for Windows:
1. Strength: Optional tempered glass.
2. Glazing Type: Insulated glass.
   a. Description: Two panes of glass utilizing continuous roll formed stainless steel spacer and dual seal
      sealants.
   b. Overall Nominal Thickness: 3/4 inch (19 mm).
   d. Glass Protection: Plastic preserve film on interior and exterior of glass.
   e. Air Space: Standard Argon-filled airspace.

J. Exterior Insect Screens:
   1. Material: Charcoal fiberglass screen cloth (18 by 16 mesh) set in painted roll formed aluminum frame.
   2. Frame Color: Matched exterior cladding.

K. Interior Insect Screens:
   1. Material: Charcoal fiberglass screen cloth (18 by 16 mesh) set in painted roll formed aluminum frame.
      a. Finish: As selected by Architect.

PART 3 EXECUTION

3.1 EXAMINATION AND PREPARATION
A. Inspect and prepare openings and substrates using the methods recommended by the manufacturer for
   achieving best result for the substrates under project conditions.
   1. Inspect assembly components prior to installation.
   2. Verify rough opening conditions are within recommended tolerances.
   3. Form sheet metal sill pan in accordance with manufacturer's recommendations.
   4. Prepare assembly components for installation in accordance with manufacturer's recommendations.

B. Do not proceed with installation until openings and substrates have been prepared using the methods
   recommended by the manufacturer and deviations from manufacturer's recommended tolerances are
   corrected. Commencement of installation constitutes acceptance of conditions.

C. If preparation is the responsibility of another installer, notify Architect in writing of deviations from
   manufacturer's recommended installation tolerances and conditions.

3.2 INSTALLATION
A. Install assemblies in accordance with manufacturer's installation guidelines and recommendations including
   the following.

B. Installation of Windows With Nailing Fins: Insert windows into rough opening.
   1. Shim side jambs straight.
   2. Inspect window for square, level and plumb.
   3. Fasten window through nailing fins around entire window.
   4. Test and adjust for smooth operation of window.
   5. Set all nails below wood surface.

3.3 FIELD QUALITY CONTROL
A. Manufacturers' Field Services: Perform field inspections as recommended by manufacturer.

3.4 CLEANING AND PROTECTION
A. Clean the exterior surface and glass with mild soap and water.
B. Protect installed windows from damage.
C. Remove and dispose of protective film from glass; touch-up, repair or replace damaged components and
   assemblies before Substantial Completion.

END OF SECTION
SECTION 08 7100
DOOR HARDWARE

PART 4 GENERAL

1. RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Door hardware.
2. Cylinders for doors fabricated with locking hardware.

B. Specific Omissions: Hardware for the following is specified or indicated elsewhere.
1. Windows.
2. Cabinets, including open wall shelving and locks.
3. Signs, except where scheduled.
4. Toilet accessories, including grab bars.
5. Installation.
6. Rough hardware.
7. Conduit, junction boxes & wiring.
11. Welded steel gates and supports.

1.3 REFERENCES:

A. Use date of standard in effect as of Bid date.
   b. ANSI A156.18 Materials and Finishes
2. ADA – Americans with Disabilities Act of 1990 BHMA – Builders Hardware Manufacturers Association
3. DHI – Door and Hardware Institute
4. NFPA – National Fire Protection Association
   a. NFPA 80 – Fire Doors and Windows
   b. NFPA 105 – Smoke and Draft Control Door Assemblies
   c. NFPA 252 – Fire Tests of Door Assemblies
5. UL – Underwriters Laboratories
   a. UL10C – Positive Pressure Fire Tests of Door Assemblies.
   b. UL 305 – Panic Hardware
6. WHI – Warnock Hersey Incorporated
7. Local applicable codes
8. SDI – Steel Door Institute
9. WI – Woodwork Institute
10. AWI – Architectural Woodwork Institute
11. NAAMM – National Association of Architectural Metal Manufacturers

B. Abbreviations
1. Manufacturers: see table at 2.1.A of this section
2. Finishes: see 2.7 of this section.
1.4 SUBMITTALS & SUBSTITUTIONS

A. SUBMITTALS: Submit six copies of schedule per Section 01330. Only submittals printed one sided will be accepted and reviewed. Organize vertically formatted schedule into “Hardware Sets” with index of doors and headings, indicating complete designations of every item required for each door or opening. Minimum 10pt font size. Include following information:
   1. Type, style, function, size, quantity and finish of hardware items.
   2. Use BHMA Finish codes per ANSI A156.18.
   3. Name, part number and manufacturer of each item.
   4. Fastenings and other pertinent information.
   5. Location of hardware set coordinated with floor plans and door schedule.
   6. Explanation of abbreviations, symbols, and codes contained in schedule.
   7. Mounting locations for hardware.
   8. Door and frame sizes, materials and degrees of swing.
   9. List of manufacturers used and their nearest representative with address and phone number.
  10. Catalog cuts.
  11. Point-to-point wiring diagrams.
  12. Manufacturer’s technical data and installation instructions for electronic hardware.
B. Bid and submit manufacturer’s updated/improved item if scheduled item is discontinued.
C. Deviations: Highlight, encircle or otherwise identify deviations from “Schedule of Finish Hardware” on submittal with notations clearly designating those portions as deviating from this section.
D. If discrepancy between drawings and scheduled material in this section, bid the more expensive of the two choices, note the discrepancy in the submittal and request direction from Architect for resolution.
E. Substitutions per Division 1. Include product data and indicate benefit to the Project. Furnish operating samples on request.
F. Items listed with no substitute manufacturers have been requested by Owner to meet existing standard.
G. Furnish as-built/as-installed schedule with closeout documents, including keying schedule, riser and point-to-point wiring diagrams, manufacturers’ installation, adjustment and maintenance information, and supplier’s final inspection report.

1.5 QUALITY ASSURANCE:

A. Qualifications:
   1. Hardware supplier: direct factory contract supplier who employs a certified architectural hardware consultant (AHC), available at reasonable times during course of work for project hardware consultation to Owner, Architect and Contractor.
      a. Responsible for detailing, scheduling and ordering of finish hardware. Detailing implies that the submitted schedule of hardware is correct and complete for the intended function and performance of the openings.
   B. Hardware: Free of defects, blemishes and excessive play. Obtain each kind of hardware (latch and locksets, exit devices, hinges and closers) from one manufacturer.
   C. Exit Doors: Operable from inside with single motion without the use of a key or special knowledge or effort.
   D. Fire-Rated Openings: NFPA 80 compliant. Hardware UL10C Standard 7-2 (positive pressure) compliant for given type/size opening and degree of label. Provide proper latching hardware, non-flaming door closers, approved-bearing hinges, and resilient seals. Coordinate with wood door section for required intumescent seals. Furnish openings complete.
   E. Furnish hardware items required to complete the work in accordance with specified performance level and design intent, complying with manufacturers’ instructions and code requirements.

1.6 DELIVERY, STORAGE AND HANDLING:

A. Delivery: coordinate delivery to appropriate locations (shop or field).
   1. Permanent keys and cores: secured delivery direct to Owner’s representative.
B. Acceptance at Site: Items individually packaged in manufacturers’ original containers, complete with proper fasteners and related pieces. Clearly mark packages to indicate contents, locations in hardware schedule and door numbers.

C. Storage: Provide securely locked storage area for hardware, protect from moisture, sunlight, paint, chemicals, dust, excessive heat and cold, etc.

1.7 PROJECT CONDITIONS AND COORDINATION:

A. Where exact types of hardware specified are not adaptable to finished shape or size of members requiring hardware, provide suitable types having as nearly as practical the same operation and quality as type specified, subject to Architect’s approval.

B. Coordination: Coordinate hardware with other work. Furnish hardware items of proper design for use on doors and frames of the thickness, profile, swing, security and similar requirements indicated, as necessary for proper installation and function, regardless of omissions or conflicts in the information on the Contract Documents. Furnish related trades with the following information:

a. Location of embedded and attached items to concrete.

b. Location of wall-mounted hardware, including wall stops.

c. Location of finish floor materials and floor-mounted hardware.

d. At masonry construction, coordinate with the anchoring and hollow metal supplier prior to frame installation by placing a strip of insulation, wood, or foam, on the back of the hollow metal frame behind the rabbet section for continuous hinges, as well as at rim panic hardware strike locations, silencers, coordinators, and door closer arm locations. When the frame is grouted in place, the backing will allow drilling and tapping without dulling or breaking the installer’s bits.

e. Locations for conduit and raceways as needed for electrical, electronic and electro-pneumatic hardware items. Fire/life-safety system interfacing. Point-to-point wiring diagrams plus riser diagrams to related trades.

g. Manufacturers’ templates to door and frame fabricators.

C. Check Shop Drawings for doors and entrances to confirm that adequate provisions will be made for proper hardware installation.

D. Environmental considerations: segregate unused recyclable paper and paper product packaging, uninstalled metals, and plastics, and have these sent to a recycling center.

1.8 WARRANTY:

A. Part of respective manufacturers’ regular terms of sale. Provide manufacturers’ written warranties:

1. Extra Heavy Duty Cylindrical Lock: Seven Years

2. Closers: Thirty years mechanical

   Two years electrical

3. Hinges: One year

4. Other Hardware Two years

1.9 COMMISSIONING:

A. Conduct these tests prior to request for certificate of substantial completion:

1. With installer present, test door hardware operation with climate control system and stairwell pressurization system both at rest and while in full operation.

2. With installer, access control contractor and electrical contractor present, test electrical, electronic and electro-pneumatic hardware systems for satisfactory operation.

3. With installer and electrical contractor present, test hardware interfaced with fire/life-safety system for proper operation and release.

PART 5 PRODUCTS
2.1 MANUFACTURERS:
   A. Manufacturers and their abbreviations used in this schedule:
      
      | Manufacturer | Abbreviation |
      |--------------|--------------|
      | H. B. Ives   | IVE          |
      | LCN Closers  | LCN          |
      | Schlage Lock Company | SCH |
      | Zero International | ZER |

2.2 HINGING METHODS:
   A. Drawings typically depict doors at 90 degrees, doors will actually swing to maximum allowable. Use wide-throw conventional or continuous hinges as needed up to 8 inches in width to allow door to stand parallel to wall for true 180-degree opening. Advise architect if 8-inch width is insufficient.
   B. Conform to manufacturer’s published hinge selection standard for door dimensions, weight and frequency, and to hinge selection as scheduled. Where manufacturer’s standard exceeds the scheduled product, furnish the heavier of the two choices, notify Architect of deviation from scheduled hardware.
   C. Conventional Hinges: Steel or stainless steel pins and concealed bearings. Hinge open widths minimum, but of sufficient throw to permit maximum door swing.
      1. Outswinging exterior doors: non-ferrous with non-removable (NRP) pins and security studs.
      2. Non-ferrous material exteriors and at doors subject to corrosive atmospheric conditions.

2.3 LOCKSETS, LATCHSETS, DEADBOLTS:
   A. Mortise Locksets and Latchsets: as scheduled.
      1. Chassis: cold-rolled steel, handing field-changeable without disassembly.
      2. Universal lock case – 10 functions in one case.
      3. Floating mounting tabs automatically adjusts to fit a beveled door edge.
      4. Latchbolts: 0.75 inch throw stainless steel anti-friction type.
      5. Lever Trim: through-bolted, accessible design, cast lever or solid extruded bar type levers as scheduled. Filled hollow tube design unacceptable.
         a. Spindles: security design independent breakaway. Breakage of outside lever does not allow access to inside lever’s hubworks to gain wrongful entry.
         b. Inside lever applied by screwless shank mounting – no exposed trim mount screws.
         c. Levers rotate up or down for ease of use.
      6. Furnish solid cylinder collars with wave springs. Wall of collar to cover rim of mortise cylinder.
      7. Thumbturns: accessible design not requiring pinching or twisting motions to operate.
      9. Electric operation:
         a. Manufacturer-installed continuous duty solenoid.
         b. 12/24 volt compatibility – auto detect
         c. Fail Safe/Secure – customer selectable
         d. .04 amp - maximum current draw, any voltage
         e. .010 amp - holding current
         f. RX switch modular – field reversible
      10. Strikes: 16 gage curved steel, bronze or brass with 1 inch deep box construction, lips of sufficient length to clear trim and protect clothing.
      12. Certifications:
         a. ANSI A156.13, 1994, Grade 1 Operational, Grade 1 Security.
         b. ANSI/ASTM F476-84 Grade 31 UL Listed.
      13. Accepted substitutions: None, Match Existing Standard.

2.4 CLOSERS
   A. Surface Closers: LCN 4040 XP
1. Full rack-and-pinion type cylinder with removable non-ferrous cover and cast iron body. Double heat-treated pinion shaft, single piece forged piston, chrome-silicon steel spring.
2. ISO 2000 certified. Units stamped with date-of-manufacture code.
3. Independent lab-tested 10,000,000 cycles.
5. Plates, brackets and special templating when needed for interface with particular header, door and wall conditions and neighboring hardware.
7. Extra-duty arms (EDA) solid forged steel main arms and factory assembled heavy-duty forged forearm for parallel arm closers with parallel arm units at doors scheduled with parallel arm units.
8. Exterior door closers: tested to 100 hours of ASTM B117 salt spray test, furnish data on request.
9. Exterior doors: seasonal adjustments not required for temperatures from 120 degrees F to -30 degrees F, furnish checking fluid data on request.
10. Non-flaming fluid, will not fuel door or floor covering fires.
11. Pressure Relief Valves (PRV) not permitted.
12. Accepted substitutions: None, Match Existing Owner Standard.

2.5 OTHER HARDWARE

A. Automatic Flush Bolts: Low operating force design.
B. Overhead Stops: Non-plastic mechanisms and finished metal end caps. Field-changeable hold-open, friction and stop-only functions.
C. Kick Plates: Four beveled edges, .050 inches minimum thickness, height and width as scheduled. Sheet-metal screws of bronze or stainless steel to match other hardware.
D. Door Stops: Provide stops to protect walls, casework or other hardware.
   1. Unless otherwise noted in Hardware Sets, provide floor type with appropriate fasteners. Where floor type cannot be used, provide wall type. If neither can be used, provide overhead type.
   1. Proposed substitutions: submit for approval.
G. Automatic door bottoms: low operating force units. Doors with automatic door bottoms plus head and jamb seals cannot require more than two pounds operating force to open when closer is disconnected.
H. Thresholds: As scheduled and per details. Substitute products: certify that the products equal or exceed specified material's thickness. Proposed substitutions: submit for approval.
   1. Saddle thresholds: 0.200 inches minimum thickness.
I. Exteriors: Seal perimeter to exclude water and vermin. Use sealant complying with requirements in Division 7 "Thermal and Moisture Protection". Minimum 0.25 inch diameter fasteners and lead expansion shield anchors, or Red-Head #SFS-1420 (or approved equivalent) Flat Head Sleeve Anchors (SS/FHSL).
J. Fire-rated openings, 3-hour duration: Thresholds, where scheduled, to extend full jamb depth.
K. Acoustic openings: Set units in full bed of Division-7-compliant, leave no air space between threshold and substrate.
L. Plastic plugs with wood or sheet metal screws are not an acceptable substitute for specified fastening methods.
M. Fasteners: Generally, exposed screws to be Phillips or Robertson drive. Pinned TORX drive at high security areas. Flat head sleeve anchors (FHSL) may be slotted drive. Sheet metal and wood screws: full-thread. Sleeves nuts: full length to prevent door compression.
N. Through-bolts: Verify with Architect. Coordinate with wood doors; ensure provision of proper blocking to support wood screws for mounting panic hardware and door closers. Coordinate with metal doors and...
frames; ensure provision of proper reinforcement to support machine screws for mounting panic hardware and door closers.

2. Exception: surface-mounted overhead stops, holders, and friction stays.

O. Silencers: Interior hollow metal frames, 3 for single doors, 4 for pairs of doors. Leave no unfilled/uncovered pre-punched silencer holes. Intent: door bears against silencers, seals make minimal contact with minimal compression – only enough to effect a seal.

P. Key Control Software: Same manufacturer as key cylinders, supply to Owner.

Q. Key Cabinet: Provide a Telkee (302) 678-7800 key control system, or equivalent by Lund Equipment Co., Inc., Cleveland, OH (Tel) 330-659-4800. Include envelopes, labels, tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal wall cabinet, all as recommended by system manufacturer, with capacity for 150% of the number of locks required for the Project. Hardware supplier to assist Owner in setting up key control system. Organize keys by room, by master, grand master and key blanks, in key envelopes with neatly marked room numbers, as determined at key meeting.

R. Wall- & Floor-mounted electromagnetic door holders: LCN's SEM series or approved equivalent. Incorporate into U.L. listed fire & life-safety system, doors release to allow closure and latching when door's zone is in alarm state. Use minimum projection required to allow door to open as widely as allowed by wall conditions and projection of door hardware.

2.6 FINISH:

A. Generally: BHMA 626 Satin Chromium Steel OR BHMA 630 Satin Stainless Steel.

   1. Areas using BHMA 626: furnish push-plates, pulls and protection plates of BHMA 630, Satin Stainless Steel, unless otherwise scheduled.

B. Door closers: factory powder coated to match other hardware, unless otherwise noted.

   1. Provide satin-chrome plated arms, tracks and covers where scheduled bright metallic powder coat (MTLPC) not available.

C. Finish designators used in appended hardware schedule:

<table>
<thead>
<tr>
<th>ANSI</th>
<th>US</th>
<th>Description</th>
<th>Base Metal</th>
</tr>
</thead>
<tbody>
<tr>
<td>626</td>
<td>US26D</td>
<td>Satin Chromium Plated Over Nickel</td>
<td>Brass, Bronze</td>
</tr>
<tr>
<td>630</td>
<td>US32D</td>
<td>Satin Stainless Steel</td>
<td>Stain. Steel 300 Ser</td>
</tr>
<tr>
<td>652</td>
<td>US26D</td>
<td>Satin Chromium Plated Over Nickel</td>
<td>Steel</td>
</tr>
<tr>
<td>689</td>
<td>US28</td>
<td>Aluminum Painted</td>
<td>Any</td>
</tr>
<tr>
<td>AL</td>
<td>US28</td>
<td>Aluminum Mill Finish</td>
<td>Aluminum</td>
</tr>
<tr>
<td>BLK</td>
<td>US28</td>
<td>Black</td>
<td>Any</td>
</tr>
</tbody>
</table>

D. Seal color to be as selected by Architect.

2.7 KEYING REQUIREMENTS:

A. Key System: Match existing Schlage keyway, conventional cylinders. For estimate use factory GMK charge. Initiate and conduct meetings(s) with Owner and Allegion representatives to determine system keyway(s), structure and degree of geographic exclusivity. Furnish Owner’s written approval of the system; do not order keys or cylinders without written confirmation of actual requirements from the Owner. Contractor will install permanent cylinders/cores.

B. Keys

   1. Existing factory registered master key system

C. Non-I.C. construction keying: furnish inserted type partial key. At substantial completion, remove inserts in Owner’s presence; demonstrate consequent non-operability of construction key. Give all removed inserts and all construction keys to Owner, provide accounting for all the pieces.

D. Temporary cylinders/cores remain supplier’s property.
E. Furnish 10 construction keys.
F. Furnish 2 construction insert extractor tool 35-057.
G. Furnish 2 construction control keys.
H. Key Cylinders: furnish utility patented, 6-pin solid brass construction.
I. Cylinders/Cylinder cores: furnish keyed at factory of lock manufacturer where permanent records are maintained. Locks and cylinders same manufacturer.
J. Permanent keys: furnish secured shipment direct from point of origination to Owner.
1. For estimate: 3 keys per lock, 5 master keys per group, 5 grand-master keys, 3 control keys.
K. For estimate: VKC stamping plus “DO NOT DUPLICATE”.
L. Bitting List: furnish secured shipment direct from point of origination to Owner upon completion.

PART 6 EXECUTION
3.1 ACCEPTABLE INSTALLERS:
A. Can read and understand manufacturers’ templates, suppliers’ hardware schedule and printed installation instructions. Can readily distinguish drywall screws from manufacturers’ furnished fasteners. Available to meet with manufacturers’ representatives and related trades to discuss installation of hardware.

3.2 PREPARATION:
A. Ensure that walls and frames are square and plumb before hardware installation. Make corrections before commencing hardware installation. Installation denotes acceptance of wall/frame condition.
B. Locate hardware per SDI-100 and applicable building, fire, life-safety, accessibility, and security codes.
1. Notify Architect of code conflicts before ordering material.
2. Where new hardware is to be installed near existing doors/hardware scheduled to remain, match locations of existing hardware.
C. Overhead stops: before installing, determine proposed locations of furniture items, fixtures, and other items to be protected by the overhead stop's action.

3.3 INSTALLATION
A. Install hardware per manufacturer’s instructions and recommendations. Do not install surface-mounted items until finishes have been completed on substrate. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate for proper installation and operation. Remove and reinstall or replace work deemed defective by Architect.
1. Gaskets: install jamb-applied gaskets before closers, overhead stops, rim strikes, etc.; fasten hardware over and through these seals. Install sweeps across bottoms of doors before astragals, cope sweeps around bottom pivots, trim astragals to tops of sweeps.
2. When hardware is to be attached to existing metal surface and insufficient reinforcement exists, use RivNuts, NutSerts or similar anchoring device for screws.
3. Use manufacturers’ fasteners furnished with hardware items, or submit Request for Substitution with Architect.
4. Replace fasteners damaged by power-driven tools.
B. Locate floor stops no more than 4 inches from walls and not within paths of travel. See paragraph 2.2 regarding hinge widths, door should be well clear of point of wall reveal. Point of door contact no closer to the hinge edge than half the door width. Where situation is questionable or difficult, contact Architect for direction.
C. Core concrete for exterior door stop anchors. Set anchors in approved non-shrink grout.
D. Locate overhead stops for minimum 90 degrees at rest and for maximum allowable degree of swing.
E. Install closers inside building, stairs, and rooms as scheduled.
F. Drill pilot holes for fasteners in wood doors and/or frames.
G. Lubricate and adjust existing hardware scheduled to remain. Carefully remove and give to Owner items not scheduled for reuse.

1.1 ADJUSTING
A. Adjust and check for proper operation and function. Replace units, which cannot be adjusted to operate freely and smoothly.
   1. Hardware damaged by improper installation or adjustment methods: repair or replace to Owner’s satisfaction.
   2. Adjust doors to fully latch with no more than 1 pound of pressure.
   3. Adjust delayed-action closers on fire-rated doors to fully close from fully-opened position in no more than 10 seconds.
   4. Adjust door closers per 1.9 this section.
B. Fire-rated doors:
   1. Wood doors: adjust to 0.125 inches clearance at heads, jambs, and meeting stiles.
   2. Steel doors: adjust to 0.063 inches minimum to 0.188 inches maximum clearance at heads, jambs, and meeting stiles.
   3. Adjust wood and steel doors to 0.75 inches maximum clearance (undercut) above threshold or finish floor material under door.
C. Adjust closers to meet ADA
D. Final inspection: Installer to provide letter to Owner that upon completion installer has visited the Project and has accomplished the following:
   1. Has re-adjusted hardware.
   2. Has evaluated maintenance procedures and recommend changes or additions, and instructed Owner’s personnel.
   3. Has identified items that have deteriorated or failed.

1.2 DEMONSTRATION:
A. Demonstrate mechanical hardware and electrical, electronic and pneumatic hardware systems, including adjustment and maintenance procedures.

1.3 PROTECTION/CLEANING:
A. Cover installed hardware, protect from paint, cleaning agents, weathering, carts/barrows, etc. Remove covering materials and clean hardware just prior to substantial completion.
B. Clean adjacent wall, frame and door surfaces soiled from installation / reinstallation process.

1.4 SCHEDULE OF FINISH HARDWARE
A. See door schedule in drawings for hardware set assignments.

END OF SECTION
SECTION 08 8000
METAL WINDOW PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. The Panels required are as manufactured by Mapes Architectural Panels, LLC, Lincoln, NE. Panels consist of metal skins laminated to stabilizer substrates with an insulating core material. Panels are designed to be glazed into a window system or curtain wall system.
B. Related Work
   1. Section 07600 - Metal Flashing
   2. Section 08500 - Windows

1.3 QUALITY ASSURANCE

A. Panel manufacturer shall have a minimum of 25 years experience.
B. Field measurements shall be taken prior to completion of manufacturing and cutting.
C. Maximum deviation from vertical and horizontal alignment of installed panels is 1/8" (3mm) in 20' (6m) non-commutative.

1.4 REFERENCE STANDARDS

A. American Society of Testing Materials (ASTM)
   2. D1781-76: Climbing Drum Peel Test for Adhesives.
   3. D3363-74: Method for Film Hardness by Pencil Test.

1.5 SUBMITTALS

A. Shop Drawings, Product Data and Samples.
B. Samples:
   a. Panel makeup - 2 samples - 10"x10"
   b. Two samples of each color and finish texture - 3"x5"
C. Submission Drawings: Indicate thickness, dimension and components of parts. Detail glazing methods, framing and tolerances to accommodate thermal movement.
D. Affidavit certifying materials meet all requirements as specified.
E. 2 copies of manufacturers standard literature for specified material.

1.6 DELIVERY, STORAGE AND HANDLING

A. Protect finish and edge in accordance with panel manufacturer's recommendations.
B. Store materials in accordance with panel manufacturer's recommendations.

PART 2 - PRODUCTS

2.1 PANELS - LAMINATED

A. Laminated metal faced Mapes-R panels as manufactured by Mapes Industries, Inc.
B. Acceptable alternatives: Panels having similar composite construction and finish providing manufacturer has a minimum of 25 years panel laminating experience and comparable published warranties.

2.2 FINISH
A. Finishes
B. Exterior: Standard Kynar
C. Interior: Standard Kynar
D. Color as selected by architect.

2.3 PANEL FABRICATION
A. Exterior Substrate: Cement Board
B. Core: Polystyrene
C. Interior Substrate: Cement Board
D. Tolerances - .8% of panels dimension length and width - (+/-) 1/16" thickness
E. Panel Thickness - 2"
F. R-Value - 9.33
G. U-Value - 0.11

2.4 ACCESSORIES
A. Recommended for use as an infill panel component in window and curtain wall systems. Related material to complete installation as recommended by the manufacturer.
B. Seals against moisture intrusion as recommended by the manufacturer. Polyurethane and silicone based sealant with a 20 year life are recommended.

PART 3 - EXECUTION

3.1 INSTALLATION
A. Panel surfaces shall be free from defects prior to installation.

3.2 EXECUTION
A. Erect panels plumb, level and true.
B. Glaze panels securely and in accordance with approved shop drawings and manufacturers instructions to allow for necessary thermal movement and structural support.
C. Do not install panels that are observed to be defective including warped, bowed, dented, scratched and delaminating components.
D. Weatherseal all joints as required using methods and materials as previously specified.
E. Separate dissimilar metals using gasketed fasteners and blocking to eliminate the possibility of electrolytic reaction.

3.3 ADJUSTING AND CLEANING
A. Remove masking film as soon as possible after installation. Masking intentionally left in place after panel installation will be the responsibility of the contractor.
B. Weep holes and drainage channels must be unobstructed and free from dirt and sealant.

END OF SECTION
SECTION 09 2116
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Performance criteria for gypsum board assemblies.
B. Acoustic insulation.
C. Gypsum sheathing.
D. Cementitious backing board.
E. Gypsum wallboard.
F. Joint treatment and accessories.
G. Textured finish system.
H. Water-resistive barrier over exterior wall sheathing.

1.2 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Building framing and sheathing.
B. Section 06 1000 - Rough Carpentry: Wood blocking product and execution requirements.
C. Section 07 2100 - Thermal Insulation: Acoustic insulation.
D. Section 07 2500 - Weather Barriers: Water-resistive barrier over sheathing.
E. Section 07 8400 - Firestopping: Top-of-wall assemblies at fire rated walls.
F. Section 07 9200 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.

1.3 REFERENCE STANDARDS

Q. ASTM E413 - Classification for Rating Sound Insulation; 2016.
S. GA-226 - Application of Gypsum Board to Form Curved Surfaces; Gypsum Association; 2016.

1.4 SUBMITTALS
A. See Section 01 3300 - Submittal Procedures, for submittal procedures.
B. Shop Drawings: Indicate special details associated with fireproofing and acoustic seals.
C. Product Data: Provide data on gypsum board, glass mat faced gypsum board, accessories, and joint finishing system.
D. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.
E. Test Reports: For stud framing products that do not comply with ASTM C645 or ASTM C754, provide independent laboratory reports showing maximum stud heights at required spacings and deflections.
F. Samples: Submit two samples of predecorated gypsum board, 12 by 12 inches in size, illustrating finish color and texture.

1.5 QUALITY ASSURANCE
A. Installer Qualifications: Company specializing in performing gypsum board installation and finishing, with minimum 5 years of documented experience.
B. Copies of Documents at Site: Maintain at the project site a copy of each referenced document that prescribes execution requirements.

PART 2 PRODUCTS

2.1 GYPSUM BOARD ASSEMBLIES
A. Provide completed assemblies complying with ASTM C840 and GA-216.
B. Interior Partitions, Indicated as Acoustic: Provide completed assemblies with the following characteristics:
   1. Acoustic Attenuation: STC of 45-49 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.
C. Shaft Walls at HVAC Shafts: Provide completed assemblies with the following characteristics:
   1. Air Pressure Within Shaft: Sustained loads of 5 lbf/sq ft with maximum mid-span deflection of L/240.
   2. Acoustic Attenuation: STC of 35-39 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.
D. Shaft Walls at Elevator Shafts: Provide completed assemblies with the following characteristics:
   1. 1. Air Pressure Within Shaft: Intermittent loads of 5 lbf/sq ft with maximum mid-span deflection of L/240.
   2. Acoustic Attenuation: STC of 35-39 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.
E. Fire Rated Assemblies: Provide completed assemblies complying with applicable code.
   1. UL Assembly Numbers: Provide construction equivalent to that listed for the particular assembly in the current UL (FRD).

2.2 BOARD MATERIALS
A. Manufacturers - Gypsum-Based Board:
B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
   1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
   2. Glass mat faced gypsum panels as defined in ASTM C1658/C1658M, suitable for paint finish, of the
same core type and thickness may be substituted for paper-faced board.

3. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
   a. Mold-resistant board is required whenever board is being installed before the building is enclosed and conditioned.

4. At Assemblies Indicated with Fire-Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.

5. Thickness:
   c. Multi-Layer Assemblies: Thicknesses as indicated on drawings.

6. Mold Resistant Paper Faced Products:
   a. American Gypsum Company; M-Bloc Type X.
   b. Continental Building Products; Mold Defense Type X.
   c. Georgia-Pacific Gypsum; ToughRock Fireguard X Mold-Guard.
   d. National Gypsum Company; Gold Bond XP Gypsum Board.

7. Glass Mat Faced Products:
   a. Application: Bathroom walls and ceilings.
   b. Thickness: 5/8 Type X.
   c. Continental Building Products; Weather Defense Platinum Interior Type X.
   d. Georgia-Pacific Gypsum; DensArmor Plus.
   e. National Gypsum Company; Gold Bond eXP Interior Extreme Gypsum Panel.
   f. USG Corporation; USG Sheetrock Brand Glass-Mat Panels Mold Tough.
   g. Substitutions: See Section 01 6000 - Product Requirements.

C. Abuse Resistant Wallboard:
   1. Application: as indicated on drawings; from finish floor to 48” above.
   2. Surface Abrasion: Level 2, minimum, when tested in accordance with ASTM C1629/C1629M.
   3. Indentation: Level 1, minimum, when tested in accordance with ASTM C1629/C1629M.
   4. Soft Body Impact: Level 1, minimum, when tested in accordance with ASTM C1629/C1629M.
   5. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
   6. Type: Fire resistance rated Type X, UL or WH listed.

   9. Products:
      a. American Gypsum Company; M-Bloc AR Type X.
      b. Continental Building Products; Protecta AR 100 Type X with Mold Defense.
      c. Georgia-Pacific Gypsum; ToughRock Fireguard X Mold Guard Abuse-Resistant.
      d. National Gypsum Company; Gold Bond Hi-Abuse XP Gypsum Board.
      e. Substitutions: See Section 01 6000 - Product Requirements.

D. Backing Board For Wet Areas: One of the following products:
   1. Application: Surfaces behind tile in wet areas including tub and shower surrounds and shower ceilings.
   2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
   3. ANSI Cement-Based Board: Non-gypsum-based; aggregated Portland cement panels with glass fiber mesh embedded in front and back surfaces complying with ANSI
   4. A118.9 or ASTM C1325.
      b. Products:
         2) National Gypsum Company; PermaBase Cement Board: www.nationalgypsum.com/#sle.
         4) Substitutions: See Section 01 6000 - Product Requirements.

E. Backing Board For Non-Wet Areas: Water-resistant gypsum backing board as defined in ASTM
C1396/C1396M; sizes to minimum joints in place; ends square cut.
1. Application: Vertical surfaces behind thinset tile, except in wet areas.
2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
3. At Assemblies Indicated with Fire-Rating: Use type required by indicated tested assembly; if no tested
   assembly is indicated, use Type X board, UL or WH listed.
4. Type: Regular and Type X, in locations indicated.
5. Type X Thickness: 5/8 inch.
6. Regular Board Thickness: 1/2 inch.
8. Products:
   a. American Gypsum Company; M-Bloc Type X.
   b. Georgia-Pacific Gypsum; ToughRock Mold-Guard Gypsum Board.
   c. National Gypsum Company; Gold Bond XP Gypsum Board.
   d. Substitutions: See Section 01 6000 - Product Requirements.

F. Ceiling Board: Special sag resistant gypsum ceiling board as defined in ASTM C1396/C1396M; sizes to
   minimize joints in place; ends square cut.
1. Application: Ceilings, unless otherwise indicated.
2. Thickness: 5/8 inch.
4. Products:
   a. Continental Building Products; Sagcheck.
   b. Georgia-Pacific Gypsum; ToughRock Span 24 Ceiling Board.
   c. Substitutions: See Section 01 6000 - Product Requirements.

G. Exterior Sheathing Board: Sizes to minimize joints in place; ends square cut.
1. Application: Exterior sheathing, unless otherwise indicated.
2. Glass Mat Faced Sheathing: Glass mat faced gypsum substrate as defined in ASTM C1177/C1177M.
3. Type X Thickness: 5/8 inch.
4. Edges: Square.
5. Glass Mat Faced Products:
   a. American Gypsum Company; M-Glass Exterior Sheathing Type X.
   c. Georgia-Pacific Gypsum; DensGlass Sheathing.
   d. Substitutions: See Section 01 6000 - Product Requirements.

H. Shaftwall and Coreboard: Type X; 1 inch thick by 24 inches wide, beveled long edges, ends square cut.
1. Paper Faced Type: Gypsum shaftliner board or gypsum coreboard as defined ASTM C1396/C1396M;
   water-resistant faces.
2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
3. Products:
   a. American Gypsum Company; M-Bloc Shaft Liner.
   b. Continental Building Products; Mold Defense Shaftliner Type X.
   c. Georgia-Pacific Gypsum; ToughRock Shaftliner.
   d. National Gypsum Company; Gold Bond Fire-Shield Shaftliner XP.
   e. Substitutions: See Section 01 6000 - Product Requirements.

2.3 ACCESSORIES

A. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-
   curing butyl sealant.
1. Products:
   a. Franklin International, Inc; Titebond GREENchoice Professional Acoustical Smoke and Sound
      Sealant: www.titebond.com/#sle.
   b. Liquid Nails, a brand of PPG Architectural Coatings; AS-825 Acoustical Sound Sealant:
      www.liquidnails.com/#sle.
c. Substitutions: See Section 01 6000 - Product Requirements.
B. Beads, Joint Accessories, and Other Trim: ASTM C1047, galvanized steel or rolled zinc, unless noted otherwise.
C. Rigid Corner Beads: Low profile, for 90 degree outside corners.
   a. Products:
      1) Phillips Manufacturing Co; Everlast Corner Bead: www.phillipsmfg.com/#sle.
      2) Trim-Tex, Inc: www.trim-tex.com/#sle.
      3) Substitutions: See Section 01 6000 - Product Requirements.
D. Bullnose Corner Beads with Paper Face: 3/4 inch radius.
   a. Products:
      2) Substitutions: See Section 01 6000 - Product Requirements.
E. Expansion Joints:
   a. Type: V-shaped metal with factory-installed protective tape.
   b. Products:
      2) Trim-Tex, Inc: www.trim-tex.com/#sle.
      3) Substitutions: See Section 01 6000 - Product Requirements.
F. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
   a. Tape: 2 inch wide, creased paper tape for joints and corners, except as otherwise indicated.
   c. Products:
      2) Substitutions: See Section 01 6000 - Product Requirements.
G. High Build Drywall Surfacer: Vinyl acrylic latex-based coating for spray application, designed to take the place of skim coating and separate paint primer in achieving Level 5 finish.
I. Nails for Attachment to Wood Members: ASTM C514.

PART 3 EXECUTION

3.1 EXAMINATION
A. Verify that project conditions are appropriate for work of this section to commence.

3.2 SHAFT WALL INSTALLATION
A. Shaft Wall Framing: Install in accordance with manufacturer's installation instructions.
   1. Fasten runners to structure with short leg to finished side, using appropriate powerdriven fasteners at not more than 24 inches on center.
   2. Install studs at spacing required to meet performance requirements.
B. Shaft Wall Liner: Cut panels to accurate dimension and install sequentially between special friction studs.
   1. On walls over sixteen feet high, screw-attach studs to runners top and bottom.
   2. Seal perimeter of shaft wall and penetrations with acoustical sealant.

3.3 FRAMING INSTALLATION
A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.
B. Suspended Ceilings and Soffits: Space framing and furring members as indicated.
   1. Level ceiling system to a tolerance of 1/1200.
   2. Laterally brace entire suspension system.
   3. Install bracing as required at exterior locations to resist wind uplift.
C. Studs: Space studs at 16 inches on center.
   1. Extend partition framing to structure where indicated and to ceiling in other locations.
   2. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.
   3. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.

D. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.

E. Blocking: Install wood blocking for support of:
   1. Framed openings.
   2. Wall mounted cabinets.
   3. Plumbing fixtures.
   4. Toilet partitions.
   5. Toilet accessories.
   6. Wall mounted door hardware.

3.4 ACOUSTIC ACCESSORIES INSTALLATION
A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.
B. Acoustic Sealant: Install in accordance with manufacturer's instructions.
   1. Place one bead continuously on substrate before installation of perimeter framing members.
   2. Place continuous bead at perimeter of each layer of gypsum board.
   3. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.

3.5 BOARD INSTALLATION
A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.
B. Single-Layer Non-Rated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.
C. Fire-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.
D. Exposed Gypsum Board in Interior Wet Areas: Seal joints, cut edges, and holes with water resistant sealant.
E. Exterior Sheathing: Comply with ASTM C1280. Install sheathing vertically, with edges butted tight and ends occurring over firm bearing.
   1. Seal joints, cut edges, and holes with water-resistant sealant.
F. Exterior Soffits: Install exterior soffit board perpendicular to framing, with staggered end joints over framing members or other solid backing.
   1. Seal joints, cut edges, and holes with water resistant sealant.
G. Cementitious Backing Board: Install over steel framing members and plywood substrate where indicated, in accordance with ANSI A108.11 and manufacturer's instructions.
H. Installation on Metal Framing: Use screws for attachment of gypsum board except face layer of non-rated double-layer assemblies, which may be installed by means of adhesive lamination.
I. Installation on Wood Framing: For rated assemblies, comply with requirements of listing authority. For non-rated assemblies, install as follows:
J. Curved Surfaces: Apply gypsum board to curved substrates in accordance with GA-226.

3.6 INSTALLATION OF TRIM AND 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.
   2. At exterior soffits, not more than 30 feet apart in both directions.
B. Corner Beads: Install at external corners, using longest practical lengths.
C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

3.7 JOINT TREATMENT


B. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
   1. Level 5: Walls and ceilings to receive semi-gloss or gloss paint finish and other areas specifically indicated.
   2. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
   3. Level 3: Walls to receive textured wall finish.
   4. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
   5. Level 1: Fire rated wall areas above finished ceilings, whether or not accessible in the completed construction.
   6. Level 0: Temporary partitions.
   7. Level 0: Surfaces indicated to be finished in later stage of project.

C. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
   1. Feather coats of joint compound so that camber is maximum 1/32 inch.
   2. Taping, filling, and sanding is not required at surfaces behind adhesive applied ceramic tile and fixed cabinetry.
   3. Taping, filling and sanding is not required at base layer of double layer applications.

D. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.

E. Fill and finish joints and corners of cementitious backing board as recommended by manufacturer.

3.8 TEXTURE FINISH

A. Apply finish texture coating by means of spraying apparatus in accordance with manufacturer’s instructions and to match approved sample.

3.9 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

END OF SECTION
SECTION 09 2520
CEMENTITIOUS BACKER BOARD

PART 1 GENERAL

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

1.1 SECTION INCLUDES
A. Fiber cement backer board panels.

1.2 RELATED REQUIREMENTS
A. Section 06 1000 - Rough Carpentry

1.3 REFERENCE STANDARDS
B. ANSI A108.11 - Installation of Cementitious Backer Units.
C. ANSI A118.4 - Specifications for Latex Portland Cement Mortar
D. ANSI A118.9 - Cementitious Baker Units.
E. ANSI A136.1 - Organic Adhesives for Installation of Ceramic Tile
F. ASTM C1288 - Discrete Non-Asbestos Fiber-Cement Interior Substrate Sheets.

1.4 SUBMITTALS
A. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

1.5 QUALITY ASSURANCE
A. Installer Qualifications: Minimum of 2 years experience with installation of similar products.

1.6 DELIVERY, STORAGE, AND HANDLING
A. Store products in manufacturer's unopened packaging until ready for installation.
B. Store boards flat on a smooth level surface. Protect edges and corners from chipping. Store sheets under cover and keep dry prior to installing.

1.7 PROJECT CONDITIONS
A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.8 WARRANTY
B. Product Warranty: limited product warranty against manufacturing defects:
   1. HardieBacker 1/2 inch (13 mm) nominal cement board for 20 years.
   2. HardieBacker 1/4 inch (6 mm) nominal cement board for 20 years.
C. Workmanship Warranty: application limited warranty for 2 years.

PART 2 PRODUCTS

2.1 MANUFACTURERS
A. Basis of Design: James Hardie Building Products, Inc., which is located at: 26300 La Alameda Suite 400; Mission Viejo, CA 92691; Toll Free Tel: 866-274-3464; Tel: 949-367-4980; Fax: 949-367-4981; Email: request info (info@jameshardie.com); Web: www.jameshardiecommercial.com

2.2 BACKERBOARD
A. Type: HardieBacker 1/2 inch (13 mm) nominal cement board as manufactured by James Hardie Building Products, Inc.
B. Material shall meet the following building code compliance:
   1. Non-asbestos fiber-cement board to comply with ASTM C1288 and ANSI A118.9.
   2. Board shall meet the building code compliance National Evaluation Report No. NER 405.
   3. US Department of Housing and Urban Development Materials Release 1268C.
   5. City of Los Angeles, Research Report No. 24862.

2.3 FASTENERS

A. Wood Framing fasteners
   1. Wood framing: 1-1/2 inches (32 mm) corrosion resistant (galvanized or stainless steel) roofing nails.
   2. Wood framing: 1-1/2 inches (32 mm) No. 8 by 0.375 inch (9.5 mm) HD self-drilling, corrosion resistant ribbed wafer head screws.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.
B. If framing preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 WALL FRAMING

A. Either vertical or horizontal, nominal 2 inches by 4 inches (51 mm by 102 mm) wood framing spaced a maximum of 24 inches (610 mm) on center with end joints staggered from adjacent courses in both vertical and horizontal applications.
B. To comply with ANSI A108.11, either vertical or horizontal, nominal 2 inches by 4 inches (51 mm by 102 mm) wood framing spaced a maximum of 16 inches (406 mm) on center with end joints staggered from adjacent courses in both vertical and horizontal applications.
C. Install a vapor barrier. Refer to Section 09260 for material and installation requirements.
D. Comply with building code regarding vapor barrier requirements.
E. Repair any punctures or tears in vapor barrier prior to the installation of the board.

3.3 FLOOR FRAMING

A. Design: Maximum deflection (dead and live load combined) for floor framing shall not exceed the following:
   1. Typical: L/360.
   2. Natural stone: L/270.

3.4 PREPARATION

A. Clean surfaces thoroughly prior to installation.
B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.5 INSTALLATION

A. Install in accordance with manufacturer's instructions. Install sheets with 1/8 inch (3 mm) gap between sheets.
B. Place fasteners 8 inches (152 mm) on center no closer than 3/8 inch (9.5 mm) from board edges and 2 inches (51 mm) from board corners.
C. Boards shall be placed with a minimum 1/4 inch (6 mm) clearance from the floor surfaces and other horizontal tile termination locations, including above tub edges. This gap shall be free of adhesive and grout and filled with a flexible sealant.
D. Boards shall be placed with a minimum 1/8 inch (3 mm) clearance from wall and cabinet bases, and other horizontal tile termination locations, including above tub edges. This gap shall be free of adhesive and grout and filled with a flexible sealant.
E. Joints shall be reinforced with 2 inches (51 mm) wide, high-strength, coated, alkali-resistant, glass fiber reinforcing tape embedded into the wet mastic or modified thinset mortar and allowed to dry thoroughly.
F. For large tiled areas, movement/control joints shall be provided in accordance with ANSI A108, Section AN-3.7 or as indicated on drawings.

G. Wall tiles complying with ANSI A137.1 are attached to the board with flexible Type I mastic adhesives complying with ANSI A136.1, or acrylic or latex-modified thinset mortars complying with ANSI A118.4, in accordance with ANSI A108.

END OF SECTION
SECTION 09 3000
TILE

PART 1 - GENERAL

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

1.2 SUMMARY
A. Section Includes:
   1. Ceramic tile with mortar, grout, expansion joints, sealants, transition strips, and accessories where indicated.
   2. Waterproof membrane for thin-set tile installations above first floor.
   3. Crack-suppression membrane for thin-set tile installations.
   4. Metal edge strips installed as part of tile installations.
   5. Waterproof membrane for shower floors.
B. Related Sections: Work of all sections, including Division 01 Sections, as required to properly execute the work and as necessary to maintain satisfactory progress of the work.
   1. Related Sections include:
      a. Section 03 3000: Cast-In-Place Concrete.
      b. Section 09 2116: Gypsum Board Assemblies.

1.3 DEFINITIONS
A. Module Size: Actual tile size (minor facial dimension as measured per ASTM C 499) plus joint width indicated.
B. Facial Dimension: Nominal tile size as defined in ANSI A137.1.

1.4 PERFORMANCE REQUIREMENTS
A. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028:
   1. Level Surfaces: Minimum 0.6.
B. DCOF 0.42

1.5 SUBMITTALS
A. Product Data: Provide manufacturers’ data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.
B. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, ceramic accessories, and setting details.
C. Samples: Mount tile and apply grout on two plywood panels, minimum 18 by 18 inches in size illustrating pattern, color variations, and grout joint size variations.
D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
E. Master Grade Certificate: Submit for each type of tile, signed by the tile manufacturer and tile installer.
F. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.
G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Tile: 3 percent of each size, color, and surface finish combination.
   3. Maintenance Materials listed in Part 2.7: minimum 2 percent of total quantity of each tile and color used

1.6 QUALITY ASSURANCE
A. This Section outlines the minimum standards and requirements for this Project. Refer to the Drawings and other Specifications for additional requirements. Bring all conflicts and discrepancies to the attention of the Architect, and do not start work until such conflicts and discrepancies are clarified and corrected.
B. Source Limitations for Tile: Obtain all tile of same type and color or finish from one source or producer.
   1. Obtain tile from same production run and of consistent quality in appearance and physical properties for each contiguous area.

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C. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.

D. Source Limitations for Other Products: Obtain each of the following products specified in this Section through one source from a single manufacturer for each product:
1. Waterproof membrane.
2. Crack-suppression membrane.
4. Metal edge strips.

1.7 DELIVERY, STORAGE, AND HANDLING
A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement in ANSI A137.1 for labeling sealed tile packages.
B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
D. Store liquid latexes in unopened containers and protected from freezing.

1.8 PROJECT CONDITIONS
A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL
A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1, "Specifications for Ceramic Tile" for types, compositions, and other characteristics indicated.
   1. Provide tile complying with Standard grade requirements, unless otherwise indicated.
   2. For facial dimensions of tile, comply with requirements relating to tile sizes specified in Part 1 "Definitions" Article.
C. Colors, Textures, and Patterns: Where manufacturer's standard products are indicated for tile, grout, and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide specific products or materials complying with the following requirements:
   1. As indicated on Drawings or if not indicated as selected by Architect from manufacturer's full range.
D. Factory Blending: For tile exhibiting color variations within ranges selected during Sample submittals, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

2.2 TILE
A. Floor Tile (F.CT.1), Base Tile (B.CT.1), Wall Tile (W.CT.1):
   1. Reference Architectural Drawings.

2.3 WATERPROOF MEMBRANE
A. General: Manufacturer's standard product, selected from the following, that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.
B. Chlorinated Polyethylene Sheet: Nonplasticized, chlorinated polyethylene faced on both sides with nonwoven polyester fabric; 0.030-inch nominal thickness.
   1. Products: Subject to compliance with requirements, provide the following provide one of the following:
      a. Noble Company (The); Nobleseal TS.
      b. Substitutions: see Section 01 25 00 – Substitution Procedures.
C. PVC Sheet: Two layers of PVC sheet heat-fused together and to facings of nonwoven polyester; 0.040-inch nominal thickness.
   1. Products: Subject to compliance with requirements, provide the following:
      a. Compotite Corporation; Composeal Gold.
      b. Substitutions: see Section 01 25 00 – Substitution Procedures.

D. Polyethylene Sheet: Polyethylene faced on both sides with fleece webbing; 0.008-inch nominal thickness.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Schluter Systems L.P.; KERDI.
      b. Substitutions: see Section 01 25 00 – Substitution Procedures.

E. Fabric-Reinforced, Modified-Bituminous Sheet: Self-adhering, SBS-modified-bituminous sheet with woven reinforcement facing; 0.040-inch nominal thickness.
   1. Products: Subject to compliance with requirements, provide the following:
      b. Substitutions: see section 01 25 00 – Substitution Procedures.

   1. Products: Subject to compliance with requirements, provide one of the following:
      c. MAPEI Corporation; Mapelastic AquaDefense with MAPEI Reinforcing Fabric.
      d. Mer-Kote Products, Inc.; Hydro-Guard 2000.
      e. Summitville Tiles, Inc.; S-9000.
      f. Substitutions: see section 01 25 00 – Substitution Procedures.

G. Fluid-Applied Membrane: Liquid-latex rubber or elastomeric polymer.
   1. Products: Subject to compliance with requirements, provide one of the following:
      b. Laticrete International, Inc.; Latapoxy 24hr HydroProofing.
      c. MAPEI Corporation; AquaDefense.
      d. Southern Grouts & Mortars, Inc.; Southcrete 1100 Crack Suppression and Waterproofing.
      e. TEC; a subsidiary of H. B. Fuller Company; HydraFlex - Waterproofing Crack Isolation Membrane.

H. Latex-Portland Cement: Flexible mortar consisting of cement-based mix and latex additive.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Boiardi Products; a QEP company; Elastiment 323 Cement Based Waterproofing, Anti-Fracture/Crack Suppression Membrane.
      b. C-Cure; UltraCure 971.
      c. MAPEI Corporation; Mapelastic 315.

2.4 CRACK ISOLATION MEMBRANE
   A. General: Manufacturer's standard product that complies with ANSI A118.12 for standard performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.
   B. Chlorinated Polyethylene Sheet: Nonplasticized, chlorinated polyethylene faced on both sides with nonwoven polyester fabric; 0.030-inch nominal thickness.
      1. Products: Subject to compliance with requirements, provide the following:
         a. Noble Company (The); Nobleseal CIS.
         b. Substitutions: see section 01 25 00 – Substitution Procedures.
         c. Fabric-Reinforced, Modified-Bituminous Sheet: Self-adhering, modified-bituminous sheet with fabric reinforcement facing; 0.040-inch nominal thickness.
      2. Products: Subject to compliance with requirements, provide one of the following:
a. MAPEI Corporation; Mapeguard 2.  
c. Substitutions: see section 01 25 00 – Substitution Procedures.  

C. Fabric-Reinforced, Fluid-Applied Membrane: System consisting of liquid-latex rubber or elastomeric polymer and fabric reinforcement.  
1. Products: Subject to compliance with requirements, provide one of the following:  
   c. MAPEI Corporation; Mapelastic AquaDefense with MAPEI Reinforcing Fabric.  
   d. Mer-Kote Products, Inc.; Hydro-Guard 2000.  
   e. Summitville Tiles, Inc.; S-9000.  

D. Latex-Portland Cement: Flexible mortar consisting of cement-based mix and latex additive.  
1. Products: Subject to compliance with requirements, provide one of the following:  
   a. C-Cure; UltraCure 971.  
   b. MAPEI Corporation; Mapelastic 315.  

2.5 SETTING MATERIALS  
A. Improved Latex-Portland Cement Mortar Bond Coat: ANSI A118.15.  
1. Applications: Use this type of bond coat where indicated and where no other type of bond coat is indicated.  
2. Products:  
   a. ARDEX Engineered Cements; S 28: www.ardexamericas.com/#sle.  
   b. Custom Building Products; Complete Contact-LFT Premium Rapid Setting Large Format Tile Mortar, with Multi-Surface Bonding Primer: www.custombuildingproducts.com/#sle.  
   d. TEC, an H.B. Fuller Construction Products Brand; TEC 3N1 Performance Mortar: www.tecspecialty.com/#sle.  

B. Mortar Bed Materials: Pre-packaged mix of Portland cement, sand, latex additive, and water.  
1. Products:  
   a. ARDEX Engineered Cements; A 38: www.ardexamericas.com/#sle.  
   c. Merkrete, by Parex USA, Inc; Merkrete Underlay C: www.merkrete.com/#sle.  
   d. Proflex Products, Inc; MSI - Mud Set Installation: www.proflex.us/#sle.  

2.6 GROUTS  
A. Epoxy Grout: ANSI A118.3 chemical resistant and water-cleanable epoxy grout.  
1. Applications: Where indicated.  
2. Color(s): As selected by Architect from manufacturer's full line.  
3. Products:  
   a. ARDEX Engineered Cements; ARDEX WA: www.ardexamericas.com/#sle.  
   b. Custom Building Products; CEG-IG 100% Solids Industrial Grade Epoxy Grout: www.custombuildingproducts.com/#sle.  
   d. Merkrete, by Parex USA, Inc; Merkrete Pro Epoxy: www.merkrete.com/#sle.  
   e. Stuart Dean Company, Inc; Marcoat GS: www.stuartdean.com/#sle.  
   f. TEC, an H.B. Fuller Construction Products Brand; TEC AccuColor EFX Epoxy
Special Effects Grout: www.tecspecialty.com/#sle.

## 2.7 MAINTENANCE MATERIALS

A. Tile Sealant: Gunnable, silicone, siliconized acrylic, or urethane sealant; moisture and mildew resistant type.
   1. Applications: Between tile and plumbing fixtures.
   2. Color(s): As selected by Architect from manufacturer's full line.
   3. Products:
      a. ARDEX Engineered Cements; ARDEX SX: www.ardexamericas.com/#sle.
      b. Custom Building Products; Commercial 100% Silicone Caulk: www.custombuildingproducts.com/#sle.
      d. Merkrete, by Parex USA, Inc; Merkrete Colored Caulking: www.merkrete.com/#sle.

B. Grout Sealer: Liquid-applied, moisture and stain protection for existing or new Portland cement grout.
   1. Composition: Water-based colorless silicone.
   2. Products:
      a. Merkrete, by Parex USA, Inc; Merkrete Grout Sealer: www.merkrete.com/#sle.

C. Grout Release: Temporary, water-soluble pre-grout coating.
   1. Products:

## 2.8 ACCESSORY MATERIALS

A. Waterproofing Membrane at Floors: Specifically designed for bonding to cementitious substrate under thick mortar bed or thin-set tile; complying with ANSI A118.10.
   1. Crack Resistance: No failure at 1/16 inch gap, minimum; comply with ANSI A118.12.
   2. Fluid or Trowel Applied Type:
      a. Material: Synthetic rubber or Acrylic.
      b. Thickness: 25 mils, minimum, dry film thickness.
      c. Products:
         1) ARDEX Engineered Cements; ARDEX 8+9: www.ardexamericas.com/#sle.
         3) TEC, an H.B. Fuller Construction Products Brand; TEC HydraFlex Waterproofing Crack Isolation Membrane: www.tecspecialty.com/#sle.
         4) LATICRETE International, Inc; LATICRETE HYDRO BAN: www.laticrete.com/#sle.
         5) Merkrete, by Parex USA, Inc; Merkrete Hydro Guard 2000: www.merkrete.com/#sle.

3. Bonded Sheet Membrane Type:
   b. Products:
      1) ARDEX Engineered Cements; ARDEX SK 175: www.ardexamericas.com/#sle.
      2) LATICRETE International, Inc; LATICRETE HYDRO BAN Sheet Membrane: www.laticrete.com/#sle.
      4) Substitutions: Not permitted.
B. Waterproofing Membrane at Showers and Tiled Tubs: Specifically designed for bonding to cementitious substrate under thick mortar bed or thin-set tile; complying with ANSI A118.10.

1. Fluid or Trowel Applied Type:
   b. Thickness: 40 mils, minimum, dry film thickness.
   c. Products:
      1) LATICRETE International, Inc; LATICRETE HYDRO BAN: www.laticrete.com/#sle.
      2) Merkrete, by Parex USA, Inc; Merkrete Hydro Guard 2000: www.merkrete.com/#sle.
      3) Substitutions: Not permitted.

2. Mortar Bonded Sheet Type:
   a. Material: Chlorinated polyethylene sheet membrane with polyester fabric laminated to both sides, 30 mils, thick, minimum.
   b. Products:
      1) LATICRETE International, Inc; LATICRETE HYDRO BAN Sheet Membrane: www.laticrete.com/#sle.
      2) Noble Company; NobleSeal TS: www.noblecompany.com/#sle.

C. Metal Lath: ASTM C847, Flat diamond mesh, of weight to suit application, galvanized finish.

D. Underlayment at Floors: Specifically designed for bonding to thin-set setting mortar; not primarily a waterproofing material and having the following characteristics:

2. Termite Resistance: 100 percent when tested in accordance with ICC-ES AC380.
3. Uncoupling Function: Allow for separation between membrane and the mortar adhering tile to the membrane when subjected to excessive substrate movement.
4. Suitable for installation over green concrete.
5. Suitable for installation over wood-based substrates.
6. Type: Fluid or Trowel Applied.
   a. Products:
      1) Proflex Products, Inc; Hydra-Seal: www.proflex.us/#sle.
      2) Substitutions: See Section 01 6000 - Product Requirements.

7. Type: Thin-Set Mortar Adhered Sheet.
   a. Products:
      1) ARDEX Engineered Cements; ARDEX UI 740 Flexbone: www.ardexamericas.com/#sle.
      2) Custom Building Products; EasyMat Tile & Stone Underlayment: www.custombuildingproducts.com/#sle.
      3) Custom Building Products; SpiderWeb II Uncoupling Mat: www.custombuildingproducts.com/#sle.
      4) Noble Company; NobleSeal SIS: www.noblecompany.com/#sle.
      5) Pliteq, Inc; GenieMat RST: www.pliteq.com/#sle.
      6) Substitutions: See Section 01 6000 - Product Requirements.

E. Backer Board: Cementitious type complying with ANSI A118.9; high density, glass fiber reinforced, 5/8 inch thick; 2 inch wide coated glass fiber tape for joints and corners.

1. Products:
   a. Custom Building Products; WonderBoard Lite Backerboard: www.custombuildingproducts.com/#sle.

2.9 MISCELLANEOUS MATERIALS
A. Trowelable Underlayments and Patching Compounds: Latex-modified, Portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. Temporary Protective Coating: Either product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products; and easily removable after grouting is completed without damaging grout or tile.
   1. Petroleum paraffin wax, fully refined and odorless, containing at least 0.5 percent oil with a melting point of 120 to 140 deg F per ASTM D 87.
   2. Grout release in form of manufacturer's standard proprietary liquid coating that is specially formulated and recommended for use as temporary protective coating for tile.

C. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

D. Grout Sealer: Manufacturer's standard product for sealing grout joints that does not change color or appearance of grout.

2.10 MIXING MORTARS AND GROUT
   A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers’ written instructions.
   B. Add materials, water, and additives in accurate proportions.
   C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION
   A. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.
   B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.
   C. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of setting materials to sub-floor surfaces.
   D. Verify that concrete sub-floor surfaces are ready for tile installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are not within the following limits:
      1. Moisture Emission Rate: Not greater than 3 lb per 1000 sq ft per 24 hours, test in accordance with ASTM F1869.
      2. Alkalinity (pH): Verify pH range of 5 to 9, test in accordance with ASTM F710.
   E. Verify that required floor-mounted utilities are in correct location.
   F. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
   G. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION
   A. Remove coatings, including curing compounds and other substances that contain soap, wax, oil, or silicone, that are incompatible with tile-setting materials.
   B. Protect surrounding work from damage.
   C. Vacuum clean surfaces and damp clean.
   D. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.
   E. Install backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of setting material to a feather edge.
   A. Provide concrete substrates for tile floors installed with thin-set mortar that comply with flatness tolerances specified in referenced ANSI A108 Series of tile installation standards.
      1. Fill cracks, holes, and depressions with trowelable leveling and patching compound according to tile-
3.3 INSTALLATION, GENERAL

A. ANSI Tile Installation Standards: Comply with parts of ANSI A108 Series "Specifications for Installation of Ceramic Tile" that apply to types of setting and grouting materials and to methods indicated in ceramic tile installation schedules.


C. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions, unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

D. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

E. Jointing Pattern: Lay tile in grid pattern, unless otherwise indicated. Align joints when adjoining tiles on floor, base, walls, and trim are same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths, unless otherwise indicated.

F. Expansion Joints: Locate expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
   1. Locate joints in tile surfaces directly above joints in concrete substrates.
   2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants".

G. Grout tile to comply with requirements of the following tile installation standards:
   1. For chemical-resistant epoxy grouts, comply with ANSI A108.6.

H. At wet walls, and where indicated, install cementious backer units and treat joints to comply with ANSI A108.11 and manufacturer's written instructions for type of application indicated.

3.4 INSTALLATION - FLOORS - THIN-SET METHODS

A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F113, dryset or latex-Portland cement bond coat, with standard grout, unless otherwise indicated.
   1. Use uncoupling membrane under all tile unless other underlayment is indicated.
   2. Where waterproofing membrane is indicated, install in accordance with TCNA (HB) Method F122, with latex-Portland cement grout.

B. Over wood substrates, install in accordance with TCNA (HB) Method F142, with standard grout, unless otherwise indicated.

3.5 WATERPROOFING AND CRACK-SUPPRESSION MEMBRANE INSTALLATION

A. Install waterproofing to comply with ANSI A108.13 and waterproofing manufacturer's written instructions to produce waterproof membrane of uniform thickness bonded securely to substrate.

B. Install crack-suppression membrane to comply with manufacturer's written instructions to produce membrane of uniform thickness bonded securely to substrate.

C. Do not install tile over waterproofing until waterproofing has cured and been tested to determine that it is watertight.

3.6 FLOOR TILE INSTALLATION

A. General: Install tile to comply with requirements in the Floor Tile Installation Schedule, including those referencing TCA installation methods and ANSI A108 Series of tile installation standards.
   1. For installations indicated below, follow procedures in ANSI A108 Series tile installation standards for

setting material manufacturer's written instructions. Use product specifically recommended by tile-setting material manufacturer.

2. Remove protrusions, bumps, and ridges by sanding or grinding.

F. Prepare substrate surfaces for adhesive installation in accordance with adhesive manufacturer's instructions.
providing 95 percent mortar coverage.
a. Tile floors in wet areas.
b. Tile floors composed of tiles 8 by 8 inches or larger.
c. Tile floors composed of rib-backed tiles.
B. Joint Widths: Install tile on floors with the following joint widths:
   1. Per manufacturer’s requirements and recommendation.
C. Metal Edge Strips: Install at locations indicated or where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile.
D. Grout Sealer: Apply grout sealer to cementitious grout joints according to grout-sealer manufacturer’s written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer that has gotten on tile faces by wiping with soft cloth.

3.7 WALL TILE INSTALLATION
A. Install types of tile designated for wall installations to comply with requirements in the Wall Tile Installation Schedule, including those referencing TCA installation methods and ANSI setting-bed standards.
B. Joint Widths: Install tile on walls with the following joint widths:
   1. Per manufacturer’s requirements and recommendation.

3.8 CLEANING AND PROTECTING
A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
   1. Remove epoxy grout residue from tile as soon as possible.
   2. Clean grout smears and haze from tile according to tile and grout manufacturer’s written instructions, but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
B. When recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.
C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
D. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

3.9 FLOOR TILE INSTALLATION SCHEDULE
A. Tile Installation: Interior floor installation on concrete; thin-set mortar; TCA F113 and ANSI A108.5.
   1. Tile Type: Ceramic tile.
   2. Thin-Set Mortar: Epoxy.

3.10 WALL AND BASE TILE INSTALLATION SCHEDULE
A. Tile Installation: Interior wall installation over gypsum board; thin-set mortar; TCA W243 and ANSI A108.5.
   1. Thin-Set Mortar: Epoxy.
   2. Grout: Chemical-resistant epoxy grout.
B. Tile Installation: Interior wall installation over cementitious backer units; thin-set mortar; TCA W244 and ANSI A108.5.
   1. Thin-Set Mortar: Epoxy.
   2. Grout: Chemical-resistant epoxy grout.

END OF SECTION
SECTION 09 9000
PAINTING

PART 1 GENERAL

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

1.2 SUMMARY
A. Section includes surface preparation and application of paints on exterior and interior substrates indicated.
B. Related Sections: Work of all sections, including Division 01 Sections as required to properly execute the work and as necessary to maintain satisfactory progress of the work.

1.3 DEFINITIONS
A. Conform to definitions of terms in ASTM D16 in interpreting requirements of this Section.

1.4 SUBMITTALS
A. Material lists. Give the supplier's name, product name, number and generic description of each proposed product and its use. Provide product data sheets and MSDS sheets for each product. Include VOC content.
B. Samples. Submit full range of colors, patterns, textures and finishes available for selection, including the following:
   2. Sheen Samples: Provide full range of varying sheens when sheens are controllable by intermixing.
C. One room and/or area, as selected by the Architect, shall be painted with materials specified or accepted and applied directly from container, unthinned. After acceptance by Architect, room and/or area shall be standard of quality of entire project.
D. Certification:
   1. Furnish a letter certifying that materials submitted are truly equivalent or better than those called out in the finish schedule.
   2. Furnish certification by the manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs).
E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Extra Paint and Finish Materials: 1 gallon of each color, type, and surface texture; from the same product run, store where directed.
   2. Label each container with color, type, texture, and room locations in addition to the manufacturer's label.

1.5 RESPONSIBILITY OF COORDINATION
A. Coordinate the work specified herein with the following work:
   1. Provide information to preceding trades for proper preparation of substrate.
   2. Inspect substrate before proceeding to verify proper preparation.
   3. Notify Architect of any item to receive paint which may not be covered by a scheduled finish type. Architect will furnish appropriate specification.

1.6 QUALITY ASSURANCE
A. This Section outlines only minimum standards and requirements. Refer to the Drawings and other sections of the specifications for additional requirements. Bring all conflicts and discrepancies to the attention of the Architect and do not start work until such conflicts and discrepancies are clarified and corrected.
B. Materials:
   1. Delivery and Storage: Products shall be delivered to jobsite in unopened containers bearing manufacturer's labels intact and legible at time of use. Storage shall be in designated areas away from excessive heat and open flames and in accordance with manufacturer's recommendations.
   2. Quality or Grade:
a. Paints and coatings shall be the manufacturer’s highest professional quality material of types specified and shall be applied directly from containers in which material is purchased, except where thinning is recommended by manufacturer and approved by Architect to suit intended use, i.e., painting acoustical tile or panels without destroying their acoustical properties.

b. Primers and other undercoat paints shall be those produced by same manufacturer as finish coats.

c. Thinners shall be those recommended by paint manufacturer's printed instructions.

3. Equipment:

a. Spray Equipment: Shall be the type recommended for the application and shall be maintained clean and in proper working order.

b. Brushes, Rollers, etc.:
   1) Shall be new of the various sizes and types recommended for each application.
   2) Shall be properly cleaned and stored in accordance with manufacturer’s instructions at the end of each days’ use.
   3) Shall be replaced as often as necessary to attain the best finish quality in the Work.

4. Application:

a. Applicator:
   1) Shall be person(s) or entity specializing in application of paints and coatings of types specified with minimum five (5) years experience.
   2) Shall provide Owner and Architect a notarized certification that paint used is as specified.

b. Application:
   1) Shall not proceed on surfaces which are not suitable to be painted, until such surfaces have been corrected. Notify Architect in writing of which surfaces need to be corrected and their locations. Surfaces shall be corrected by the responsible trades. Surfaces not suitable for painting shall include, but not be limited to:
      a) Damaged surfaces.
      b) Oily, greasy, dusty or excessively soiled surfaces.
      c) Non-dressed welds which will be exposed to view.
      d) Lack of touch-up where specified.
      e) Rusted or excessively deteriorated shop-prime painted surfaces.
   2) Number of coats of each of several finishes shall be in accordance with detailed specifications, which will produce first quality finish if properly applied. If number of coats specified fails to produce a finish acceptable to Architect, this Contractor shall apply additional coat or coats at his own expense until acceptable finish is achieved.

1.7 PRODUCT HANDLING

A. Use all means necessary to protect materials before, during, and after application and to protect the installed work and materials of all other trades.

B. Apply water-base paints only when temperature of surfaces to be painted and surrounding air temperatures are between 50 degrees F and 90 degrees F, unless otherwise permitted by paint manufacturer's printed instructions.

C. Apply solvent-thinned paints only when temperature of surfaces to be painted and surrounding air temperatures are between 45 degrees F and 95 F, unless otherwise permitted by paint manufacturer's printed instructions.

D. Do not paint in snow, rain, fog or mist, or when relative humidity exceeds 85 percent, or to damp or wet surfaces, unless otherwise permitted by paint manufacturer's printed instructions. Painting may be continued during inclement weather if areas and surfaces to be painted are enclosed and heated within temperature limits specified by paint manufacturer during application and drying periods.

1.8 WARRANTY

A. The undertaking of a painting subcontract will indicate that the subcontractor will warrant the work specified herein for two (2) years against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials and workmanship.

B. Defects shall include by not be limited to the following:
1. Discoloring noticeably by yellowing, streaking, blooming, changing color or darkening
2. Mildewing
3. Peeling, cracking, blistering, alligatoring or releasing from the substrate
4. Chalking or dusting excessively
5. Changing sheen in irregular fashion
6. Softening or becoming tacky
7. Bubbling

PART 2 PRODUCTS

2.1 MANUFACTURERS
A. Specifications are based on products specified below and on the Drawings or selected by the Architect or Owner from those listed below, or Architect or Owner approved equal. Other manufacturers must have a minimum of five (5) years experience manufacturing products meeting or exceeding the specifications to products specified for this Project and comply with Division 01 Section regarding Substitutions to be considered.
   a. Sherwin Williams (Basis of Design).
   b. ICI Paints

2.2 MATERIALS
A. Paint and Coatings: Ready mixed, except for field catalyzed coatings; having good flow and brushing properties and consistent drying or curing behavior, free of sags and streaks.
B. Stains: Interior Wood Stain (Semitransparent), water based type recommended to achieve specified color.
C. Accessory Materials: Linseed oil, turpentine, paint thinners and other materials recommended by paint and coatings manufacturer as necessary to achieve finishes specified.
D. Patching and Surface Preparation: Latex fillers as recommended by paint and coatings manufacturer.

2.3 COLORS
A. Colors shall be as selected by Architect. Different colors may be selected for each room, and more than one color may be selected in each room.
B. Provide colors indicated on Finish Schedule or selected by Architect.

PART 3 EXECUTION

3.1 EXAMINATION
A. Verify that site environmental conditions are appropriate and substrates are in proper condition to receive Work of this Section.
B. Verify that shop applied primers are compatible with specified finish coats.
C. Measure moisture content of surfaces using an electronic moisture meter. Do not begin application of coatings unless moisture content of surfaces is below the following maximum values:
   1. Gypsum soffits: 12 percent.
   2. Plaster: 12 percent.
   3. Masonry surfaces: 12 percent.
   5. Vertical concrete surfaces: 12 percent.
   6. Horizontal concrete surfaces: 8 percent.

3.2 ITEMS TO RECEIVE PAINT
A. Generally, all new items that are normally painted in any typical building, including but not limited to the following list:
   1. All ferrous metal
   2. All exterior galvanized metal
   3. All exterior wood
   4. All interior wood
   5. All prime coated hardware
6. All exposed conduit, outlet boxes and electrical cabinets, excluding those located in mechanical rooms.
7. All exposed pipe, plumbing, and ductwork, including those located in mechanical rooms.
8. All metal grilles, except aluminum, unless otherwise indicated.
9. All exposed gypsum board surfaces, including all mechanical rooms.
10. All exposed concrete masonry units (CMU), including all mechanical rooms.
11. Miscellaneous other items which normally require painting or are scheduled to be painted.
12. Consult plans, finish schedule, details and specifications for other trades as all items usually field painted or finish will be considered as part of the Contract.
13. All exposed structure scheduled or noted to receive paint.

B. All work where a coat of material has been applied must be inspected and approved by Architect before application of succeeding specified coat, otherwise no credit for coat applied will be given. Notify Architect when a particular coat has been completed for inspection and approval. Apply coats of material in strict accordance with manufacturer's specifications except where requirements of these specifications are in excess of manufacturer's requirements. Paint all sight exposed pipe and plumbing only after all mechanical work and tests have been completed.

3.3 PREPARATION
A. General: Surface must be clean to insure adhesion. Remove oil and grease with paint thinner. Wash off dirt with warm soapy water and rinse with clean water. Remove rust by wire brushing or sanding.
B. Wall surfaces must be dry before painting. Verify with moisture meter.
C. Unfinished Surfaces:
1. Wood: Sand smooth and apply one (1) coat of Primer Undercoat. After primer has dried overnight, putty nail holes and cracks, then spot-prime putty with primer. Again, allow the primer to dry over-night, sand lightly and topcoat.
2. Masonry and Concrete: Remove efflorescence or cement dust on masonry and concrete by etching with a 10 percent solution or muriatic (Hydrochloric) acid. Flush off surface after etching with clean water, and paint while still damp. On surface where muriatic acid cannot be used to neutralize the efflorescence, remove the efflorescence by sanding, scraping or wire brushing and apply a coat of Masonry Conditioner before painting. If efflorescence is not present, no primer is necessary on concrete and masonry surfaces. Fill voids and pores in concrete and haydite blocks with Latex Block Filler and allow to dry overnight before topcoating.
3. Iron and Steel: Prime with Metal Primer and allow to dry overnight before topcoating.
4. Galvanized Metal: Prime with galvanized metal primer and allow to dry overnight before topcoating.

3.4 APPLICATION
A. General: Surfaces to be finished must be clean, dry and free of dirt, oils, loose paint or any other contamination that would adversely affect adhesion, protective properties or appearance of the coating.
B. Paint Thickness: Provide the following minimum dry film thickness per coat unless noted otherwise:
1. Enamels on Metal: 1 mil
2. Latex Paints: 1 mil
3. Metal Primers: 1.5 mils
4. Undercoats: 1.5 mils
5. Oil Paints: 1.5 mils
6. Epoxy Coating: 2.0 mils
7. Thickness test: Use observation gauge that measures "V" shape scratch.
C. Allow exterior paints to dry 72 hours between coats and interior paint to dry 24 hours between coats. Allow all enamels and varnishes to dry 24 hours between coats. If enamel and varnishes are tacky after 24 hours, allow additional time until finish is dry.
D. Leveling: Apply with proper consistency and quality so paint flows out to a level surface free of brush and roller marks, bubbles, dust, runs, sags, and holidays. Spread evenly.
E. Appearance: Uniform color, texture and sheen.
F. Neatness: Paint shall not be smeared, spattered or run over adjoining colors or materials. Cut-on lines shall be straight.
G. First coat shall be white, unless otherwise specified.

3.5 CLEANING AND PROTECTION

A. Keep project premises free of painting-related debris. Collect material that may constitute a fire hazard, place in closed metal containers, and remove daily from site.

B. Protect work adjacent to painting operations from paint spatters and spills. Immediately remove paint that falls on finished surfaces not scheduled to receive paint, using materials and techniques that will not damage affected surfaces.

3.6 SCHEDULE

A. Paint items indicated on the Drawings. If not indicated, the following schedule of typical painted items shall apply, but does not specifically include every item that is to receive paint, but rather should establish type and quality of finish for all items normally included in a complete paint job.

B. Exterior Surfaces:
   1. Concrete Paving:
      d. a. Refer to Division 32 "Concrete Paving" for parking striping and accessible parking symbol.
   2. Steel - Unprimed:
      a. One (1) coat of universal primer.
      b. Two (2) coats of latex enamel, semi-gloss.
   3. Steel - Shop Primed:
      a. Touch-up with zinc chromate primer.
      b. Two (2) coats of latex enamel, semi-gloss.
   4. Steel - Galvanized:
      a. One (1) coat galvanize primer.
      b. Two (2) coats of enamel, semi-gloss.

C. Interior Surfaces:
   1. Wood: Stained / Clear-Sealed for plywood and cedar trim
      a. One (1) coat of latex primer.
      b. Two (2) coats of latex enamel, semi-gloss.
   2. Steel - Unprimed:
      a. One (1) coat of latex primer.
      b. Two (2) coats of latex enamel, semi-gloss.
   3. Steel - Primed:
      a. Touch-up with latex primer.
      b. Two (2) coats of latex enamel, semi-gloss.
   4. Steel - Galvanized:
      c. One (1) coat galvanize primer.
      d. Two (2) coats of latex enamel, semi-gloss.
   5. Gypsum Board:
      a. One (1) coat of latex primer sealer.
      b. Two (2) coats of latex enamel, semi-gloss.

END OF SECTION
SECTION 10 43 00
EXTERIOR SIGNAGE

PART 1 - GENERAL

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

1.2 SUMMARY
   A. Section Includes:
      1. Coordination of installation of Owner's corporate signage.
      2. Accessibility (Handicapped) parking signs.
      3. Brackets, clips, pipe and tube posts, fasteners, concrete footings, grout, anchors, and all accessories required for proper installation of signage where indicated.
   B. Related Sections: Work of all sections, including Division 01 Sections as required to properly execute the work and as necessary to maintain satisfactory progress of the work.

1.3 SUBMITTALS
   A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.
   B. Shop Drawings: Submit shop drawings indicating material characteristics, details of construction, connections, and relationship with adjacent construction.
   C. Samples: Submit two (2) representative samples of each material specified indicating visual characteristics and finish. Include range samples if variation of finish is anticipated.

1.4 DELIVERY, STORAGE, AND HANDLING
   A. Deliver products undamaged.
   B. Coordinate delivery with scheduled installation date to allow minimum storage time at site.
   C. Store products in clean, dry location. Protect from soiling, abuse and moisture. Follow manufacturer's instructions.

1.5 QUALITY ASSURANCE
   A. This Section outlines only minimum standards and requirements. Refer to the Drawings and other sections of the specifications for additional requirements. Bring all conflicts and discrepancies to the attention of the Architect and do not start work until such conflicts and discrepancies are clarified and corrected.
   B. Installer Qualifications: An authorized representative of signage manufacturer for installation and maintenance of units required for this Project.
   C. Source Limitations: Obtain each sign type through one source from a single manufacturer.
   D. Regulatory Requirements: Comply with code provisions as adopted by authorities having jurisdiction.

1.6 PROJECT CONDITIONS
   A. Field Measurements: Where sizes of signs are determined by dimensions of surfaces on which they are installed, verify dimensions by field measurement before fabrication and indicate measurements on Shop Drawings.

1.7 COORDINATION
   A. For signs supported by or anchored to permanent construction, advise installers of anchorage devices about specific requirements for placement of anchorage devices and similar items to be used for attaching signs.

PART 2 - PRODUCTS

2.1 MATERIALS
   A. Accessibility ("Handicapped Parking") Parking Signage:
      1. Signage Materials: 0.080 inch thick aluminum with 1-1/2 inch radius at corners typically. Sizes as indicated on Drawings or as required by authorities having jurisdiction.
      2. Post Materials: 2-3/8 inch diameter galvanized steel pipe by length required to set top of sign at 7 feet-0
inches above paving surface, unless indicated or directed otherwise. Provide galvanized steel post cap welded to top and bottom. Hot-dip galvanize after fabrication. If post is indicated or directed to be painted, paint in color selected by Architect from manufacturer's full range, under Section 09 9000 "Painting".

3. Graphics: 1-1/2 inch silk screen upper case letters in lettering and graphics as detailed, directed, or required by authorities having jurisdiction. Colors shall be as selected by Architect or to comply with local codes and ADA standards and requirements.

4. Accessories:
   a. Sign Mounting Hardware: Provide sign mounting hardware of galvanized steel of type and size recommended by manufacturer to suit intended use.
   b. Provide all materials required for signage and proper installation.

5. Provide concrete footings of 3,000 psi compressive strength at 28 days, unless noted or directed otherwise. Comply with requirements specified in Division 03 Section “Cast-In-Place Concrete”.

B. Exterior Signage: Refer to Drawings
   1. All copy to be Helvetica medium.
   2. All copy to be raised 1/32 inch minimum.
   3. Provide 1/2 inch rounded corners - typical all signage.
   4. Size of copy may be adjusted; however, letters may not be less than 5/8 inch high or numbers less than 1 inch.
   5. Exterior sign shall be cast aluminum. Copy to be painted black.
   6. Provide back cover plate at glass locations.

2.2 ACCESSORY MATERIALS

A. Fasteners: 1/8 inch thick, double-sided foam tape of type recommended to suit application and commercial grade silicone sealant.

B. Other Materials: Provide other materials, not specifically described, but required for a complete and proper installation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to which signage will be installed and areas are ready to receive signage.
B. Ensure, proper electrical power is installed and operational, as applicable.
C. Coordinate with responsible entity to correct unsatisfactory installation conditions.
D. Commencement of work by installer is considered an acceptance of substrate conditions.

3.2 INSTALLATION

A. Install signage and systems in accordance with manufacturer's instructions, approved submittals, and authorities having jurisdiction.
B. Install materials and systems in proper relation with adjacent construction and with uniform appearance. Coordinate with work of other sections.

3.3 CLEANING AND PROTECTION

A. Remove surplus materials and debris from site.
B. Restore damaged finishes.
C. Clean and protect work from damage.

END OF SECTION
SECTION 10 80 00
TOILET ACCESSORIES

PART 1 - GENERAL

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

1.2 SUMMARY
A. Section includes toilet accessories specified where indicated.
B. Related Sections: Work of all sections, including Division 01 Sections as required to properly execute the work and as necessary to maintain satisfactory progress of the work.

1.3 SUBMITTALS
A. Product Data:
   1. Manufacturer’s specifications and technical data.
   2. Manufacturer’s installation instructions.
   3. Manufacturer’s service and parts manual.
B. Manufacturer’s Warranty

1.4 QUALITY ASSURANCE
A. This Section outlines only minimum standards and requirements. Refer to the Drawings and other sections of the specifications for additional requirements. Bring all conflicts and discrepancies to the attention of the Architect and do not start work until such conflicts and discrepancies are clarified and corrected.

1.5 MINIMUM COMPLIANCE STANDARDS
A. Comply with ANSI A117.1, ADA Accessibility Guidelines for Buildings and Facilities (ADAAG), Texas Accessibilities Standards (TAS), and authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS
A. Specifications are based on named Basis-of-Design products by Bobrick Washroom Equipment, Inc., or Architect approved equal. Other manufacturers must have a minimum of five (5) years experience manufacturing products meeting or exceeding the specifications and comply with Division 01 Sections regarding substitutions to be considered.

2.2 QUALITY STANDARDS
A. Design, finish and keying of items shall be the same.
B. Furnish items from one (1) manufacturer only unless otherwise specified or directed by Architect.

2.3 MATERIALS
A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
   1. Grind welded joints smooth.
   2. Fabricate units made of metal sheet of seamless sheets, with flat surfaces.
B. Keys: Provide 5 keys for each accessory to Owner; master key lockable accessories.
C. Stainless Steel: ASTM A666, Type 304.
   1. Thickness: 0.031 inch minimal nominal thickness unless otherwise indicated.
D. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.
E. Stainless Steel Sheet: ASTM A1008/A1008M, Designation CS (cold-rolled, commercial steel).
   1. Thickness: 0.036 inch minimal nominal thickness unless otherwise indicated.
H. Mirror Glass: Tempered safety glass, ASTM C1048; and ASTM C1036 Type I, Class 1, Quality Q2, with silvering as required.
I. Adhesive: Two component epoxy type, waterproof.
J. Concealed Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.
K. Exposed Fasteners, Screws, and Bolts: Of same material as accessory unit and tamperproof, security type.

PART 3 - EXECUTION

3.1 EXAMINATION
A. Verify wall openings, blocking, and adjoining work is ready to receive Work of this Section.

3.2 MOUNTING LOCATIONS
A. Install items included in this Section in accordance with manufacturer’s instructions in locations and heights indicated on Drawings, or at heights complying with applicable ADA and other requirements, as applicable.
B. Contractor shall be responsible for supplying all openings, blocking, fasteners, and other components necessary for installation of all toilet accessories.
C. Use approved theft-resistant type fasteners.

3.3 TOILET ACCESSORY SCHEDULE
A. Reference Architectural Drawings.

END OF SECTION
SECTION 12 3600
COUNTERTOPS

PART 1 GENERAL

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

1.1 SECTION INCLUDES
   A. Countertops for architectural cabinetwork.

1.2 REFERENCE STANDARDS
   B. AWI/AWMAC/WI (AWS) -Architectural Woodwork Standards; 2009.
   D. NEMA LD 3 -High-Pressure Decorative Laminates; 2005.

1.3 SUBMITTALS
   A. Product Data: Manufacturer's data sheets on each product to be used, including:
      1. Preparation instructions and recommendations.
      2. Storage and handling requirements and recommendations.
      3. Specimen warranty.
   B. Shop Drawings: Complete details of materials and installation; combine with shop drawings of cabinets and
casework specified in other sections.
   C. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of
available colors and patterns.
   D. Verification Samples: For each finish product specified, minimum size 6 inches square, representing actual
product, color, and patterns.
   E. Installation Instructions: Manufacturer's installation instructions and recommendations.
   F. Maintenance Data: Manufacturer's instructions and recommendations for maintenance and repair of
countertop surfaces.

1.4 QUALITY ASSURANCE
   A. Fabricator Qualifications: Same fabricator as for cabinets on which tops are to be installed.
   B. Quality Certification: Provide AWI Quality Certification Program inspection report and quality certification of
completed work.
      1. Provide labels or certificates indicating that the work complies with requirements of AWS Grade or
Grades specified.
      2. Prior to delivery to the site provide shop drawings with certification labels.
      3. Provide labels on each product when required by certification program.
      4. Upon completion of installation provide certificate certifying that the installation and products meet the
specified requirements.
      5. Arrange and pay for inspections required for certification.
      6. Replace, repair, or rework all work for which certification is refused.
   C. Installer Qualifications: Fabricator.
1.5 DELIVERY, STORAGE, AND HANDLING
   A. Store products in manufacturer's unopened packaging until ready for installation.
   B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.6 FIELD CONDITIONS
   A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 PRODUCTS

2.1 COUNTERTOP ASSEMBLIES
   A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WW Architectural Woodwork Standards.
   B. Natural Quartz and Resin Composite Countertops: Sheet or slab of natural quartz and plastic resin over continuous substrate.
      1. Flat Sheet Thickness: 1-1/4 inch, minimum.
      2. Natural Quartz and Resin Composite Sheets, Slabs and Castings: Complying with ISSFA-2 and NEMA LD 3; orthophthalic polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
         b. Factory fabricate components to the greatest extent practical in sizes and shapes indicated; comply with the MIA Dimension Stone Design Manual.
         c. Finish on Exposed Surfaces: Polished.
         d. Color and Pattern: As indicated on drawings.
         e. Manufacturers:
            7) Refer to Architectural Drawings.
   3. Other Components Thickness: 3/4 inch, minimum.
   4. Back and End Splashes: Same sheet material, square top; minimum 4 inches high.

2.2 ACCESSORY MATERIALS
   A. Plywood for Supporting Substrate: PS 1 Exterior Grade, A-C veneer grade, minimum 5-ply; minimum 3/4 inch thick; join lengths using metal splines.
   B. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.
   C. Joint Sealant: Mildew-resistant silicone sealant, clear.

2.3 FABRICATION
   A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
   4. Fabricate to overhang fronts and ends of cabinets 1 inch except where top butts against cabinet or wall.
   5. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.
   B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
      1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
      2. Height: 4 inches, unless otherwise indicated.
   C. Solid Surfacing: Fabricate tops up to 144 inches long in one piece; join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.

PART 4 PART 3 EXECUTION
PART 5

3.1 EXAMINATION

B. Do not begin installation until substrates have been properly prepared.
C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
D. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.
B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.
B. Attach plastic laminate countertops using screws with minimum penetration into substrate board of 5/8 inch.
C. Seal joint between back/end splashes and vertical surfaces.

3.4 TOLERANCES

A. Variation From Horizontal: 1/8 inch in 10 feet, maximum.
B. Offset From Wall, Countertops: 1/8 inch maximum; 1/16 inch minimum.
C. Field Joints: 1/8 inch wide, maximum.

3.5 CLEANING

A. Clean countertops surfaces thoroughly.

3.6 PROTECTION

A. Protect installed products until completion of project.
B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION
SECTION 22 0553
IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Nameplates.
   B. Tags.

1.02 RELATED REQUIREMENTS
   A. Drawings and general provisions of the Contract, including Uniform General Conditions and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

1.03 SUBMITTALS
   A. See Uniform General Conditions for administrative requirements, for submittal procedures.
   B. Product Data: Provide manufacturers catalog literature for each product required.

PART 2 PRODUCTS

2.01 NAMEPLATES
   A. Description: Laminated three-layer plastic with engraved letters.

2.02 TAGS
   A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.

PART 3 EXECUTION

3.01 INSTALLATION
   A. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
   B. Install ductwork with plastic nameplates. Identify with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.

END OF SECTION 22 0553
SECTION 22 0719
PLUMBING PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Piping insulation.
B. Jackets and accessories.

1.02 RELATED REQUIREMENTS
A. Drawings and general provisions of the Contract, including Uniform General Conditions and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

1.03 REFERENCE STANDARDS

1.04 SUBMITTALS
A. See Uniform General Conditions for administrative requirements, for submittal procedures.
B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.05 DELIVERY, STORAGE, AND HANDLING
A. Accept materials on site, labeled with manufacturer’s identification, product density, and thickness.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS
A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER
A. Manufacturers:
B. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.
   1. K Value: ASTM C177, 0.24 at 75 degrees F.
2. Maximum Service Temperature: 850 degrees F.
3. Maximum Moisture Absorption: 0.2 percent by volume.

C. Vapor Barrier Jacket: White Kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches.

D. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

E. Vapor Barrier Lap Adhesive: Compatible with insulation.

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

G. Fibrous Glass Fabric:

H. Outdoor Vapor Barrier Mastic: Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

I. Insulating Cement: ASTM C449.

2.03 JACKETS

    1. Thickness: 0.016 inch sheet.
    2. Finish: Smooth.
    4. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
    5. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Exposed Piping: Locate insulation and cover seams in least visible locations.

C. For hot piping conveying fluids 140 degrees F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.

D. For hot piping conveying fluids over 140 degrees F, insulate flanges and unions at equipment.

E. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 07 8400.

F. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

3.02 SCHEDULES

A. Plumbing Systems:
    1. Domestic Hot Water Supply:
        a. Glass Fiber Insulation:
            1) Pipe Size Range: 2" and smaller inch.
            2) Thickness: 1 inch.
    2. Domestic Hot Water Recirculation:
        a. Glass Fiber Insulation:
            1) Pipe Size Range: All sizes.
            2) Thickness: 1 inch.
    3. Tempered Domestic Water Supply:
    4. Tempered Domestic Water Recirculation:
    5. Domestic Cold Water:
        a. Glass Fiber Insulation:
            1) Pipe Size Range: All sizes.
2) Thickness: 1 inch.

END OF SECTION 22 0719
SECTION 22 1005
PLUMBING PIPING

PART 1  GENERAL
1.01  SECTION INCLUDES
   A. Pipe, pipe fittings, specialties, and connections for piping systems.
      1. Sanitary sewer.
      2. Domestic water.
      3. Flanges, unions, and couplings.
      4. Pipe hangers and supports.
      5. Valves.
      7. Relief valves.

1.02  RELATED REQUIREMENTS
   A. Drawings and general provisions of the Contract, including Uniform General Conditions and Supplementary
      Conditions and Division 1 Specification Sections, apply to this section.
   B. Section 22 0719 - Plumbing Piping Insulation.

1.03  REFERENCE STANDARDS
   B. ASME BPVC-IV - Boiler and Pressure Vessel Code, Section IV - Rules for Construction of Heating Boilers;
      2015.
   C. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and
      120; 2015.
   D. ASTM D2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series);
      2015.
      2013.
      Systems; 2012.
      and Fittings; 2014.
   H. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe
      and Fittings; 1996 (Reapproved 2010).
   I. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings;
      2015.
      Distribution Systems; 2011.
      Cross-linked Polyethylene (PEX) Tubing; 2015.
   M. AWWA C651 - Disinfecting Water Mains; 2005.
   N. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and
      Installation; 2009.
   O. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010.
R. PPI TR-4 - PPI Listing of Hydrostatic Design Basis (HDB), Hydrostatic Design Stress (HDS), Strength Design Basis (SDB), Pressure Design Basis (PDB), and Minimum Required Strength (MRS) Ratings For Thermoplastic Piping Materials or Pipe; 2013.

1.04 SUBMITTALS
A. See Uniform General Conditions for administrative requirements, for submittal procedures.
B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

1.05 DELIVERY, STORAGE, AND HANDLING
A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
B. Provide temporary protective coating on cast iron and steel valves.
C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.06 FIELD CONDITIONS
A. Do not install underground piping when bedding is wet or frozen.

PART 2 PRODUCTS
2.01 GENERAL REQUIREMENTS
A. Potable Water Supply Systems: Provide piping, pipe fittings, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.02 SANITARY SEWER PIPING, BURIED BEYOND 5 FEET OF BUILDING
A. PVC Pipe: ASTM D2665 or ASTM D3034.
   1. Fittings: PVC.

2.03 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET OF BUILDING
A. PVC Pipe: ASTM D2665 or ASTM D3034.
   1. Fittings: PVC.

2.04 SANITARY SEWER PIPING, ABOVE GRADE
A. PVC Pipe: ASTM D1785 Schedule 40, or ASTM D2241 SDR 26 with not less than 150 psi pressure rating.
   1. Fittings: ASTM D2466, PVC.

2.05 DOMESTIC WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING
A. Cross-Linked Polyethylene (PEX) Pipe: ASTM F876 or ASTM F877.
   1. Manufacturers:
   2. PPI TR-4 Pressure Design Basis:
      a. 160 psig at maximum 73 degrees F.

2.06 DOMESTIC WATER PIPING, ABOVE GRADE
A. Cross-Linked Polyethylene (PEX) Pipe: ASTM F876 or ASTM F877.
1. Manufacturers:
2. PPI TR-4 Pressure Design Basis:
   a. 160 psig at maximum 73 degrees F.

2.07 PIPE HANGERS AND SUPPORTS
A. Provide hangers and supports that comply with MSS SP-58.
   1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
   2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
   3. Trapeze Hangers: Welded steel channel frames attached to structure.
B. Plumbing Piping - Drain, Waste, and Vent:
   1. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Malleable iron, adjustable swivel, split ring.
   2. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
   3. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
C. Plumbing Piping - Water:
   1. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Malleable iron, adjustable swivel, split ring.

2.08 BALL VALVES
A. Manufacturers:
B. Construction, 4 Inches and Smaller: MSS SP-110, Class 150, 400 psi CWP, bronze or ductile iron body, 304 stainless steel or chrome plated brass ball, regular port, teflon seats and stuffing box ring, blow-out proof stem, lever handle with balancing stops, threaded or grooved ends with union.

2.09 RELIEF VALVES
2.10 RELIEF VALVES
A. Temperature and Pressure Relief:
   1. 2 certified, bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, temperature relief maximum 210 degrees F, capacity 1 certified and labelled.

PART 3 EXECUTION
3.01 EXAMINATION
A. Verify that excavations are to required grade, dry, and not over-excavated.
3.02 PREPARATION
A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
B. Remove scale and dirt, on inside and outside, before assembly.
C. Prepare piping connections to equipment with flanges or unions.
3.03 INSTALLATION
A. Install in accordance with manufacturer’s instructions.
B. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.
C. Provide access where valves and fittings are not exposed.
D. PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.
E. Pipe Hangers and Supports:
   1. Support horizontal piping as indicated.
   2. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
   3. Place hangers within 12 inches of each horizontal elbow.

3.04 APPLICATION
   A. Install gate valves for shut-off and to isolate equipment, part of systems, or vertical risers.

3.05 TOLERANCES
   A. Drainage Piping: Establish invert elevations within 1/2 inch vertically of location indicated and slope to drain at minimum of 1/4 inch per foot slope.
   B. Water Piping: Slope at minimum of 1/32 inch per foot and arrange to drain at low points.

3.06 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM
   A. Prior to starting work, verify system is complete, flushed and clean.
   B. Ensure acidity (pH) of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).
   C. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain 50 to 80 mg/L residual.
   D. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.
   E. Maintain disinfectant in system for 24 hours.
   F. If final disinfectant residual tests less than 25 mg/L, repeat treatment.
   G. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.
   H. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

3.07 SCHEDULES
   A. Pipe Hanger Spacing:
      1. Plastic Piping:
         a. All Sizes:
            1) Maximum Hanger Spacing: 6 ft.
            2) Hanger Rod Diameter: 3/8 inch.

END OF SECTION 22 1005
SECTION 22 1006
PLUMBING PIPING SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Drains.
   B. Cleanouts.
   C. Hydrants.

1.02 RELATED REQUIREMENTS
   A. Drawings and general provisions of the Contract, including Uniform General Conditions and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

1.03 REFERENCE STANDARDS
   A. ASSE 1019 - Performance Requirements for Wall Hydrant with Backflow Protection and Freeze Resistance; 2011.

1.04 SUBMITTALS
   A. See Uniform General Conditions for administrative requirements, for submittal procedures.
   B. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS
   A. Specialties in Potable Water Supply Systems: Provide products that comply with NSF 61 and NSF 372 for maximum lead content.

2.02 DRAINS
   A. Manufacturers:

2.03 CLEANOUTS
   A. Manufacturers:
   B. Cleanouts at Exterior Surfaced Areas (CO-1):
   C. Cleanouts at Exterior Unsurfaced Areas (CO-2):
      1. Line type with lacquered cast iron body and round epoxy coated gasketed cover.

2.04 HYDRANTS
   A. Wall Hydrants:
      1. ASSE 1019; freeze resistant, self-draining type with chrome plated wall plate hose thread spout, handwheel, and integral vacuum breaker.

PART 3 EXECUTION

3.01 INSTALLATION
   A. Install in accordance with manufacturer's instructions.
B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.

C. Encase exterior cleanouts in concrete flush with grade.

D. Install air chambers on hot and cold water supply piping to each fixture or group of fixtures (each washroom). Fabricate same size as supply pipe or 3/4 inch minimum, and minimum 18 inches long.

END OF SECTION 22 1006
SECTION 22 3000
PLUMBING EQUIPMENT

PART 1 GENERAL
1.01 SECTION INCLUDES
A. Diaphragm-type compression tanks.
B. Water heaters.
C. Compression tanks.
D. Pumps.
   1. Circulators.

1.02 RELATED REQUIREMENTS
A. Drawings and general provisions of the Contract, including Uniform General Conditions and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

1.03 REFERENCE STANDARDS
A. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1 - Rules for Construction of Pressure Vessels; 2015.

1.04 REFERENCE STANDARDS
A. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1 - Rules for Construction of Pressure Vessels; 2015.

1.05 SUBMITTALS
A. See Uniform General Conditions for administrative requirements, for submittal procedures.
B. Product Data:
   1. Provide dimension drawings of water heaters indicating components and connections to other equipment and piping.
   2. Indicate pump type, capacity, power requirements.
   3. Provide certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.
   4. Provide electrical characteristics and connection requirements.

PART 2 PRODUCTS
2.01 WATER HEATER MANUFACTURERS

2.02 RESIDENTIAL ELECTRIC WATER HEATERS
A. Type: Automatic, electric, vertical storage.
B. Performance: Refer to Drawing
C. Electrical Characteristics:
   1. 240 volts, single phase.
D. Tank: Glass lined welded steel, thermally insulated with one inch thick glass fiber; encased in corrosion-resistant steel jacket; baked-on enamel finish.
E. Controls: Automatic water thermostat with externally adjustable temperature range from 120 to 170 degrees F, flanged or screw-in nichrome elements, enclosed controls and electrical junction box and operating light. Wire double element units so elements do not operate simultaneously.
F. Accessories: Provide:
2. Dip Tube: Brass.
3. Drain Valve.
4. Anode: Magnesium

2.03 DIAPHRAGM-TYPE COMPRESSION TANKS

A. Manufacturers:

B. Construction: Welded steel, tested and stamped in accordance with ASME BPVC-VIII-1; supplied with National Board Form U-1, rated for working pressure of 125 psig, with flexible EPDM diaphragm sealed into tank, and steel legs or saddles.

C. Accessories: Pressure gauge and air-charging fitting, tank drain; precharge to 12 psig.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions of certification, if any.

B. Coordinate with plumbing piping and related fuel piping work to achieve operating system.

C. Domestic Water Storage Tanks:
   1. Provide steel pipe support, independent of building structural framing members.
   2. Clean and flush prior to delivery to site. Seal until pipe connections are made.

END OF SECTION 22 3000
SECTION 22 4000
PLUMBING FIXTURES

PART 1 GENERAL
1.01 RELATED REQUIREMENTS
   A. Drawings and general provisions of the Contract, including Uniform General Conditions and Supplementary
      Conditions and Division 1 Specification Sections, apply to this section.

1.02 REFERENCE STANDARDS
   A. ASME A112.18.1 - Plumbing Supply Fittings; 2012.
   B. ASME A112.19.2 - Ceramic Plumbing Fixtures; 2013.

1.03 SUBMITTALS
   A. See Uniform General Conditions for administrative requirements, for submittal procedures.
   B. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and
      finishes.
   C. Maintenance Data: Include fixture trim exploded view and replacement parts lists.

PART 2 PRODUCTS
2.01 GENERAL REQUIREMENTS
   A. Potable Water Systems: Provide plumbing fittings and faucets that comply with NSF 61 and NSF 372 for
      maximum lead content; label pipe and fittings.

2.02 FLUSH VALVE WATER CLOSETS
      1. Flush Valve: Concealed (back spud).
      2. Flush Operation: Manual, push button or plate.
      3. Handle Height: 44 inches or less.
   B. Flush Valves: ASME A112.18.1, diaphragm type, complete with vacuum breaker stops and accessories.
      1. Concealed Type: Rough brass, exposed parts chrome plated, wall escutcheon, wheel handle stop.

2.03 LAVATORIES (REFER TO FIXTURE SCHEDULE ON DRAWINGS)
2.04 SINKS - REFER TO SCHEDULE ON DRAWINGS
2.05 SHOWERS - REFER TO SCHEDULE ON DRAWINGS

PART 3 EXECUTION
3.01 EXAMINATION
   A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.

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

3.03 INSTALLATION
   A. Install each fixture with trap, easily removable for servicing and cleaning.
   B. Provide chrome plated rigid or flexible supplies to fixtures with loose key stops, reducers, and escutcheons.
   C. Install components level and plumb.
   D. Solidly attach water closets to floor with lag screws. Lead flashing is not intended hold fixture in place.
3.04 INTERFACE WITH WORK OF OTHER SECTIONS
   A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

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

3.06 CLEANING
   A. Clean plumbing fixtures and equipment.

3.07 PROTECTION
   A. Protect installed products from damage due to subsequent construction operations.
   B. Repair or replace damaged products before Date of Substantial Completion.

3.08 SCHEDULES - REFER TO DRAWINGS

   END OF SECTION 22 4000
PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Nameplates.
   B. Tags.
   C. Adhesive-backed duct markers.
   D. Pipe markers.
   E. Ceiling tacks.

1.02 RELATED REQUIREMENTS
   A. Drawings and general provisions of the Contract, including Uniform General Conditions and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

1.03 REFERENCE STANDARDS

1.04 SUBMITTALS
   A. See Uniform General Conditions for administrative requirements, for submittal procedures.
   B. Product Data: Provide manufacturers catalog literature for each product required.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS
   A. Automatic Controls: Tags. Key to control schematic.
   B. Dampers: Ceiling tacks, where located above lay-in ceiling.
   C. Ductwork: Nameplates.
   D. Piping: Tags.
   E. Small-sized Equipment: Tags.
   F. Thermostats: Nameplates.
   G. Valves: Tags and ceiling tacks where located above lay-in ceiling.

2.02 NAMEPLATES
   A. Manufacturers:

2.03 TAGS
   A. Manufacturers:
   B. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.
2.04 ADHESIVE-BACKED DUCT MARKERS
   A. Material: High gloss acrylic adhesive-backed vinyl film 0.0032 inch; printed with UV and chemical resistant inks.
   B. Style: Individual Label.
   C. Color: Yellow/Black.

2.05 PIPE MARKERS

2.06 CEILING TACKS
   A. Description: Steel with 3/4 inch diameter color coded head.

PART 3 EXECUTION

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

3.02 INSTALLATION
   A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
   B. Install plastic pipe markers in accordance with manufacturer's instructions.
   C. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.
   D. Use tags on piping 3/4 inch diameter and smaller.
      1. Identify service, flow direction, and pressure.
   E. Install ductwork with plastic nameplates. Identify with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.

END OF SECTION 23 0553
SECTION 23 0593
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1  GENERAL

1.01  RELATED REQUIREMENTS
   A. Drawings and general provisions of the Contract, including Uniform General Conditions and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

1.02  REFERENCE STANDARDS

1.03  SUBMITTALS
   A. See Uniform General Conditions for administrative requirements, for submittal procedures.
   B. Installer Qualifications: Submit name of adjusting and balancing agency and TAB supervisor for approval within 30 days after award of Contract.
   C. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.
      1. Submit to Architect.
      2. Include at least the following in the plan:
         a. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
         b. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
         c. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
         d. Final test report forms to be used.
         e. Procedures for formal deficiency reports, including scope, frequency and distribution.
   D. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
      1. Revise TAB plan to reflect actual procedures and submit as part of final report.
      2. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect and for inclusion in operating and maintenance manuals.
      3. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
      4. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
      5. Units of Measure: Report data in both I-P (inch-pound) and SI (metric) units.

PART 2  PRODUCTS - NOT USED

PART 3  EXECUTION

3.01  GENERAL REQUIREMENTS
   A. Perform total system balance in accordance with one of the following:
      1. AABC (NSTSB), AABC National Standards for Total System Balance.
   B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.
   C. TAB Agency Qualifications:
      1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
      2. Having minimum of three years documented experience.
3. Certified by one of the following:

D. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

3.02 EXAMINATION

A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
   1. Systems are started and operating in a safe and normal condition.
   2. Temperature control systems are installed complete and operable.
   3. Proper thermal overload protection is in place for electrical equipment.
   4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
   5. Duct systems are clean of debris.
   6. Fans are rotating correctly.
   7. Fire and volume dampers are in place and open.
   8. Air coil fins are cleaned and combed.
   9. Access doors are closed and duct end caps are in place.
  10. Air outlets are installed and connected.
  11. Duct system leakage is minimized.
  12. Service and balance valves are open.

3.03 PREPARATION

A. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Architect to facilitate spot checks during testing.

B. Provide additional balancing devices as required.

3.04 ADJUSTMENT TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.

B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

3.05 RECORDING AND ADJUSTING

A. Ensure recorded data represents actual measured or observed conditions.

B. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

C. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

D. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

3.06 SCOPE

A. Test, adjust, and balance the following:
   1. Air Coils.
   2. Air Handling Units.

3.07 MINIMUM DATA TO BE REPORTED

A. Electric Motors:
   1. Manufacturer.
   2. Model/Frame.
   3. HP/BHP.
   4. Phase, voltage, amperage; nameplate, actual, no load.
5. RPM.
7. Starter size, rating, heater elements.

B. Air Cooled Condensers:
1. Identification/number.
2. Location.
3. Manufacturer.
4. Model number.
5. Serial number.
6. Entering DB air temperature, design and actual.
7. Leaving DB air temperature, design and actual.
8. Number of compressors.

C. Cooling Coils:
1. Identification/number.
2. Location.
4. Manufacturer.
5. Entering air DB temperature, design and actual.
6. Entering air WB temperature, design and actual.
7. Leaving air DB temperature, design and actual.
8. Leaving air WB temperature, design and actual.
10. Water pressure drop, design and actual.
11. Entering water temperature, design and actual.
12. Leaving water temperature, design and actual.
13. Saturated suction temperature, design and actual.
14. Air pressure drop, design and actual.

D. Duct Traverses:
1. System zone/branch.
2. Duct size.
3. Area.
4. Design velocity.
5. Design air flow.
6. Test velocity.
7. Test air flow.
8. Duct static pressure.
9. Air temperature.
10. Air correction factor.

E. Air Distribution Tests:
1. Air terminal number.
2. Room number/location.
3. Terminal type.
4. Terminal size.
5. Area factor.
6. Design velocity.
7. Design air flow.
8. Test (final) velocity.
9. Test (final) air flow.
10. Percent of design air flow.

END OF SECTION 23 0593
SECTION 23 0713
DUCT INSULATION

PART 1 GENERAL

1.01 RELATED REQUIREMENTS
A. Drawings and general provisions of the Contract, including Uniform General Conditions and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

1.02 REFERENCE STANDARDS

1.03 SUBMITTALS
A. See Uniform General Conditions for administrative requirements, for submittal procedures.
B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.04 DELIVERY, STORAGE, AND HANDLING
A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.
B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS
A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER, FLEXIBLE
A. Manufacturer:
B. Insulation: ASTM C553; flexible, noncombustible blanket.
  1. ‘K’ value: 0.36 at 75 degrees F, when tested in accordance with ASTM C518.
C. Vapor Barrier Jacket:
  1. Kraft paper with glass fiber yarn and bonded to aluminized film.
D. Vapor Barrier Tape:
  1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

PART 3 EXECUTION

3.01 EXAMINATION
A. Verify that ducts have been tested before applying insulation materials.
B. Verify that surfaces are clean, foreign material removed, and dry.

3.02 INSTALLATION
   A. Install in accordance with manufacturer's instructions.

3.03 SCHEDULES
   A. Supply Ducts:

END OF SECTION 23 0713
SECTION 23 0716
HVAC EQUIPMENT INSULATION

PART 1  GENERAL

1.01  RELATED REQUIREMENTS
   A. Drawings and general provisions of the Contract, including Uniform General Conditions and Supplementary
      Conditions and Division 1 Specification Sections, apply to this section.

1.02  SUBMITTALS
   A. See Uniform General Conditions for administrative requirements, for submittal procedures.
   B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for
      equipment scheduled.

1.03  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 mechanical damage, by
      storing in original wrapping.

PART 2  PRODUCTS

2.01  REGULATORY REQUIREMENTS
   A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when
      tested in accordance with ASTM E84 or UL 723.

2.02  FLEXIBLE ELASTOMERIC CELLULAR INSULATION
   A. Manufacturer:
   B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M
      Grade 1, in sheet form.
      1. Minimum Service Temperature: Minus 40 degrees F.
      2. Maximum Service Temperature: 220 degrees F.

PART 3  EXECUTION

3.01  INSTALLATION
   A. Install in accordance with manufacturer's instructions.
   B. Cover glass fiber insulation with metal mesh and finish with heavy coat of insulating cement.

END OF SECTION 23 0716
SECTION 23 0719
HVAC PIPING INSULATION

PART 1 GENERAL

1.01 RELATED REQUIREMENTS
   A. Drawings and general provisions of the Contract, including Uniform General Conditions and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

1.02 REFERENCE STANDARDS

1.03 SUBMITTALS
   A. See Uniform General Conditions for administrative requirements, for submittal procedures.
   B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.04 DELIVERY, STORAGE, AND HANDLING
   A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS
   A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 FLEXIBLE ELASTOMERIC CELLULAR INSULATION
   A. Manufacturer:
   B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1; use molded tubular material wherever possible.
      1. Minimum Service Temperature: Minus 40 degrees F.
      2. Maximum Service Temperature: 180 degrees F.

2.03 JACKETS
      1. Thickness: 0.016 inch sheet.
      2. Finish: Smooth.
      4. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.

PART 3 EXECUTION

3.01 INSTALLATION
   A. Install in accordance with manufacturer's instructions.
3.02 SCHEDULE

A. Cooling Systems:
   1. Condensate Drains from Cooling Coils:
   2. Refrigerant Suction:

   END OF SECTION 23 0719
SECTION 23 2300
REFRIGERANT PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Piping.
B. Refrigerant.
C. Moisture and liquid indicators.
D. Valves.
E. Strainers.
F. Filter-driers.
G. Expansion valves.
H. Flexible connections.

1.02 RELATED REQUIREMENTS
A. Drawings and general provisions of the Contract, including Uniform General Conditions and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

1.03 REFERENCE STANDARDS
A. AHRI 710 - Performance Rating of Liquid-Line Driers; 2009.
E. ASME B31.5 - Refrigeration Piping and Heat Transfer Components; 2013.
F. ASME B31.9 - Building Services Piping; 2014.
H. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2011-AMD 1.

1.04 SYSTEM DESCRIPTION
A. Where more than one piping system material is specified ensure system components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.
B. Provide pipe hangers and supports in accordance with ASME B31.5 unless indicated otherwise.
C. Liquid Indicators:
D. Valves:
   1. Use service valves on suction and discharge of compressors.
   2. Use gauge taps at compressor inlet and outlet.
E. Filter-Driers:
   1. Use a filter-drier immediately ahead of liquid-line controls, such as thermostatic expansion valves, solenoid valves, and moisture indicators.

1.05 SUBMITTALS
A. See Uniform General Conditions for administrative requirements, for submittal procedures.
B. Product Data: Provide general assembly of specialties, including manufacturers' catalogue information.
   Provide manufacturers' catalog data including load capacity.

1.06 DELIVERY, STORAGE, AND HANDLING
   A. Deliver and store piping and specialties in shipping containers with labeling in place.
   B. Protect piping and specialties from entry of contaminating material by leaving end caps and plugs in place until installation.
   C. Dehydrate and charge components such as piping and receivers, seal prior to shipment, until connected into system.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS
   A. Comply with ASME B31.9 for installation of piping system.
   B. Products Requiring Electrical Connection: Listed and classified by UL, as suitable for the purpose indicated.

2.02 PIPING
   A. Copper Tube: ASTM B280, H58 hard drawn or O60 soft annealed.
      2. Joints: Braze, AWS A5.8M/A5.8 BCuP silver/phosphorus/copper alloy.
   B. Pipe Supports and Anchors:
      1. Provide hangers and supports that comply with MSS SP-58.
         a. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
      2. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
      3. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
      4. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
      5. Vertical Support: Steel riser clamp.
      6. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
      7. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.
      8. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.03 REFRIGERANT
   A. Refrigerant: Use only refrigerants that have ozone depletion potential (ODP) of zero and global warming potential (GWP) of less than 50.

2.04 MOISTURE AND LIQUID INDICATORS
   A. Manufacturers:
   B. Indicators: Single port type, UL listed, with copper or brass body, flared or solder ends, sight glass, color coded paper moisture indicator with removable element cartridge and plastic cap; for maximum temperature of 200 degrees F and maximum working pressure of 500 psi.

2.05 VALVES
   A. Manufacturers:
B. Service Valves:
   1. Forged brass body with copper stubs, brass caps, removable valve core, integral ball check valve, flared or solder ends, for maximum pressure of 500 psi.

2.06 STRAINERS

2.07 FILTER-DRIERS

A. Performance:
   1. Flow Capacity - Liquid Line: As indicated in schedule, minimum, rated in accordance with AHRI 710.
   2. Pressure Drop: 2 psi, maximum, when operating at full connected evaporator capacity.

B. Cores: Molded or loose-fill molecular sieve desiccant compatible with refrigerant, activated alumina, activated charcoal, and filtration to 40 microns, with secondary filtration to 20 microns; of construction that will not pass into refrigerant lines.

C. Construction: UL listed.
   1. Connections: As specified for applicable pipe type.

2.08 EXPANSION VALVES

A. Manufacturers:

B. Angle or Straight Through Type: AHRI 750; design suitable for refrigerant, brass body, internal or external equalizer, bleed hole, adjustable superheat setting, replaceable inlet strainer, with non-replaceable capillary tube and remote sensing bulb and remote bulb well.

C. Selection: Evaluate refrigerant pressure drop through system to determine available pressure drop across valve. Select valve for maximum load at design operating pressure and minimum 10 degrees F superheat. Select to avoid being undersized at full load and excessively oversized at part load.

2.09 ELECTRONIC EXPANSION VALVES

A. Manufacturers:

B. Valve:
   1. Brass body with flared or solder connection, needle valve with floating needle and machined seat, stepper motor drive.

C. Evaporation Control System:
   1. Electronic microprocessor based unit in enclosed case, proportional integral control with adaptive superheat, maximum operating pressure function, preselection allowance for electrical defrost and hot gas bypass.

D. Refrigeration System Control: Electronic microprocessor based unit in enclosed case, with proportional integral control of valve, on/off thermostat, air temperature alarm (high and low), solenoid valve control, liquid injection adaptive superheat control, maximum operating pressure function, night setback thermostat, timer for defrost control.

2.10 FLEXIBLE CONNECTORS

A. Manufacturers:
B. Corrugated stainless steel hose with single layer of stainless steel exterior braiding, minimum 9 inches long with copper tube ends; for maximum working pressure of 500 psi.

PART 3 EXECUTION
3.01 PREPARATION
A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
B. Remove scale and dirt on inside and outside before assembly.
C. Prepare piping connections to equipment with flanges or unions.

3.02 INSTALLATION
A. Install refrigeration specialties in accordance with manufacturer's instructions.
B. Route piping in orderly manner, with plumbing parallel to building structure, and maintain gradient.
C. Install piping to conserve building space and avoid interference with use of space.
D. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
E. Pipe Hangers and Supports:
   1. Install in accordance with ASME B31.5.
F. Arrange piping to return oil to compressor. Provide traps and loops in piping, and provide double risers as required. Slope horizontal piping 0.40 percent in direction of flow.
G. Provide clearance for installation of insulation and access to valves and fittings.
H. Provide access to concealed valves and fittings. Coordinate size and location of access doors with Section 08 3100.
I. Follow ASHRAE Std 15 procedures for charging and purging of systems and for disposal of refrigerant.

3.03 FIELD QUALITY CONTROL
A. Test refrigeration system in accordance with ASME B31.5.
B. Pressure test system with dry nitrogen to 200 psi. Perform final tests at 27 inches vacuum and 200 psi using halide torch. Test to no leakage.

3.04 SCHEDULES
A. Hanger Spacing for Copper Tubing.
   1. 1/2 inch, 5/8 inch, and 7/8 inch OD: Maximum span, 5 feet; minimum rod size, 1/4 inch.
   2. 1-1/8 inch OD: Maximum span, 6 feet; minimum rod size, 1/4 inch.
   3. 1-3/8 inch OD: Maximum span, 7 feet; minimum rod size, 3/8 inch.
   4. 1-5/8 inch OD: Maximum span, 8 feet; minimum rod size, 3/8 inch.

END OF SECTION 23 2300
SECTION 23 3100
HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Metal ductwork.

1.02 RELATED REQUIREMENTS
A. Drawings and general provisions of the Contract, including Uniform General Conditions and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

1.03 REFERENCE STANDARDS
A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.
D. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005.

1.04 SUBMITTALS
A. See Uniform General Conditions for administrative requirements, for submittal procedures.
B. Product Data: Provide data for duct materials.

PART 2 PRODUCTS

2.01 DUCT ASSEMBLIES
A. Regulatory Requirements: Construct ductwork to comply with NFPA 90A standards.
B. Ducts: Galvanized steel, unless otherwise indicated.
C. Low Pressure Supply (System with Cooling Coils): 1/2 inch w.g. pressure class, galvanized steel.
D. Return and Relief: 1/2 inch w.g. pressure class, galvanized steel.
E. General Exhaust: 1/2 inch w.g. pressure class, galvanized steel.

2.02 MATERIALS
A. Galvanized Steel for Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 coating.
B. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
   1. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.
   2. VOC Content: Not more than 250 g/L, excluding water.
   3. Surface Burning Characteristics: Flame spread index of zero and smoke developed index of zero, when tested in accordance with ASTM E84.

2.03 DUCTWORK FABRICATION
A. Fabricate and support in accordance with SMACNA (DCS) and as indicated.
B. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.
C. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
D. Fabricate continuously welded round and oval duct fittings in accordance with SMACNA (DCS).

2.04 MANUFACTURED DUCTWORK AND FITTINGS
A. Flexible Ducts: Two ply vinyl film supported by helically wound spring steel wire.
   1. Insulation: Fiberglass insulation with polyethylene vapor barrier film.
2. Pressure Rating: 10 inches WG positive and 1.0 inches WG negative.
4. Temperature Range: Minus 10 degrees F to 160 degrees F.
5. Manufacturers:
   a. Flexmaster.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install, support, and seal ducts in accordance with SMACNA (DCS).
B. Duct sizes indicated are inside clear dimensions. For lined ducts, maintain sizes inside lining.
C. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

END OF SECTION 23 3100
SECTION 23 3300
AIR DUCT ACCESSORIES

PART 1  GENERAL
1.01 RELATED REQUIREMENTS
   A. Drawings and general provisions of the Contract, including Uniform General Conditions and Supplementary Conditions and Division 1 Specification Sections, apply to this section.
   B. Section 23 3100 - HVAC Ducts and Casings.

1.02 REFERENCE STANDARDS
   B. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005.

1.03 SUBMITTALS
   A. See Uniform General Conditions for administrative requirements, for submittal procedures.
   B. Product Data: Provide for shop fabricated assemblies including volume control dampers. Include electrical characteristics and connection requirements.

1.04 DELIVERY, STORAGE, AND HANDLING
   A. Protect dampers from damage to operating linkages and blades.

PART 2  PRODUCTS
2.01 AIR TURNING DEVICES/EXTRACTORS
   A. Manufacturers:

2.02 DUCT ACCESS DOORS
   A. Manufacturers:
   B. Fabrication: Rigid and close-fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ducts, install minimum 1 inch thick insulation with sheet metal cover.

2.03 FLEXIBLE DUCT CONNECTIONS
   A. Fabricate in accordance with SMACNA (DCS) and as indicated.
   B. Flexible Duct Connections: Fabric crimped into metal edging strip.

2.04 VOLUME CONTROL DAMPERS
   A. Manufacturers:
   B. Fabricate in accordance with SMACNA (DCS) and as indicated.
   C. Single Blade Dampers:
      1. Fabricate for duct sizes up to 6 by 30 inch.
      2. Blade: 24 gage, 0.0239 inch, minimum.
   D. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 by 72 inch. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.
      1. Blade: 18 gage, 0.0478 inch, minimum.
E. End Bearings: Except in round ducts 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon, thermoplastic elastomer, or sintered bronze bearings.

F. Quadrants:
   1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
   2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.

PART 3 EXECUTION

3.01 PREPARATION
   A. Verify that electric power is available and of the correct characteristics.

3.02 INSTALLATION
   A. Install accessories in accordance with manufacturer’s instructions, NFPA 90A, and follow SMACNA (DCS). Refer to Section 23 3100 for duct construction and pressure class.

END OF SECTION 23 3300
SECTION 23 3423
HVAC POWER VENTILATORS

PART 1 GENERAL

1.01 RELATED REQUIREMENTS
A. Drawings and general provisions of the Contract, including Uniform General Conditions and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

1.02 REFERENCE STANDARDS
C. AMCA 204 - Balance Quality and Vibration Levels for Fans; 2005.
F. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; 2014.

1.03 SUBMITTALS
A. See Uniform General Conditions for administrative requirements, for submittal procedures.
B. Product Data: Provide data on fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels at rated capacity, and electrical characteristics and connection requirements.
C. Manufacturer's Instructions: Indicate installation instructions.
D. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

PART 2 PRODUCTS

2.01 POWER VENTILATORS - GENERAL
A. Static and Dynamically Balanced: AMCA 204 - Balance Quality and Vibration Levels for Fans.
B. Performance Ratings: Determined in accordance with AMCA 210 and bearing the AMCA Certified Rating Seal.
C. Sound Ratings: AMCA 301, tested to AMCA 300 and bearing AMCA Certified Sound Rating Seal.
D. Fabrication: Comply with AMCA 99.
E. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

2.02 CABINET EXHAUST FANS
A. Centrifugal Fan Unit: V-belt or direct driven with galvanized steel housing lined with acoustic insulation, resilient mounted motor, gravity backdraft damper in discharge.
B. Grille: Molded white plastic.
C. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

PART 3 EXECUTION

3.01 INSTALLATION
A. Install in accordance with manufacturer's instructions.

END OF SECTION 23 3423
SECTION 23 3700
AIR OUTLETS AND INLETS

PART 1 GENERAL

1.01 RELATED REQUIREMENTS
   A. Drawings and general provisions of the Contract, including Uniform General Conditions and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

1.02 SUBMITTALS
   A. See Uniform General Conditions for administrative requirements, for submittal procedures.
   B. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

PART 2 PRODUCTS

2.01 MANUFACTURERS
   B. Price Industries; ______: www.price-hvac.com/#sle.
   C. Titus, a brand of Air Distribution Technologies; ______: www.titus-hvac.com/#sle.

2.02 WALL SUPPLY REGISTERS/GRILLES
   A. Type: Streamlined and individually adjustable blades, 3/4 inch minimum depth, 3/4 inch maximum spacing with spring or other device to set blades, vertical face, single deflection.
   B. Frame: 1-1/4 inch margin with countersunk screw mounting and gasket.
   C. Fabrication: Steel with 20 gage, 0.0359 inch minimum frames and 22 gage, 0.0299 inch minimum blades, steel and aluminum with 20 gage, 0.0359 inch minimum frame, or aluminum extrusions, with factory baked enamel finish.
   D. Color: To be selected by Architect from manufacturer's standard range.
   E. Damper: Integral, gang-operated opposed blade type with removable key operator, operable from face.

PART 3 EXECUTION

3.01 INSTALLATION
   A. Install in accordance with manufacturer’s instructions.
   B. Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.

END OF SECTION 23 3700
SECTION 23 4000
HVAC AIR CLEANING DEVICES

PART 1 GENERAL
1.01 SECTION INCLUDES
   A. Disposable panel filters.

1.02 RELATED REQUIREMENTS
   A. Drawings and general provisions of the Contract, including Uniform General Conditions and Supplementary
      Conditions and Division 1 Specification Sections, apply to this section.

1.03 REFERENCE STANDARDS

1.04 SUBMITTALS
   A. See Uniform General Conditions for administrative requirements, for submittal procedures.
   B. Product Data: Provide data on filter media, filter performance data, filter assembly and filter frames,
      dimensions, motor locations and electrical characteristics and connection requirements.

PART 2 PRODUCTS
2.01 FILTER MANUFACTURERS

2.02 DISPOSABLE PANEL FILTERS
   A. Media: UL 900 Class 2, fiber blanket, factory sprayed with flameproof, non-drip, non-volatile adhesive.
   B. Casing: Cardboard frame.

END OF SECTION 23 4000
SECTION 23 8126.13
SMALL-CAPACITY SPLIT-SYSTEM AIR CONDITIONERS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Air-source heat pumps.
B. Forced air furnaces.
C. Air cooled condensing units.
D. Indoor air handler (fan & coil) units for duct connection.
E. Controls.

1.02 RELATED REQUIREMENTS
A. Drawings and general provisions of the Contract, including Uniform General Conditions and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

1.03 REFERENCE STANDARDS
B. AHRI 520 - Performance Rating of Positive Displacement Condensing Units; 2004.
E. NEMA MG 1 - Motors and Generators; 2014.

1.04 SUBMITTALS
A. See Uniform General Conditions for administrative requirements, for submittal procedures.
B. Product Data: Provide rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.
C. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.
D. Warranty: Submit manufacturers warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

1.05 WARRANTY
A. Provide five year manufacturers warranty for heat exchangers.

PART 2 PRODUCTS

2.01 SYSTEM DESIGN
A. Split-System Heating and Cooling Units: Self-contained, packaged, matched factory-engineered and assembled, pre-wired indoor and outdoor units; UL listed.
   1. Heating and Cooling: Air-source electric heat pump located in outdoor unit with evaporator; auxiliary electric heat.
   2. Provide refrigerant lines internal to units and between indoor and outdoor units, factory cleaned, dried, pressurized and sealed, with insulated suction line.
B. Performance Requirements: See Drawings for additional requirements.

C. Electrical Characteristics:
   1. 240 volts, single phase, 60 Hz.
   2. Disconnect Switch: Factory mount disconnect switch on equipment under provisions of Section 26 0583.

2.02 INDOOR UNITS FOR DUCTED SYSTEMS
A. Indoor Units: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, heating and cooling element(s), controls, and accessories; wired for single power connection with control transformer.
   2. Cabinet: Steel with baked enamel finish, easily removed and secured access doors with safety interlock switches, glass fiber insulation with reflective liner.

B. Supply Fan: Centrifugal type rubber mounted with direct or belt drive with adjustable variable pitch motor pulley.
   1. Motor: NEMA MG 1; 1750 rpm single speed, permanently lubricated, hinge mounted.
   2. Motor Electrical Characteristics:

C. Air Filters: 1 inch thick urethane, washable type arranged for easy replacement.

D. Evaporator Coils: Copper tube aluminum fin assembly, galvanized or polymer drain pan sloped in all directions to drain, drain connection, refrigerant piping connections, restricted distributor or thermostatic expansion valve.
   1. Construction and Ratings: In accordance with AHRI 210/240 and UL 207.

2.03 OUTDOOR UNITS
A. Outdoor Units: Self-contained, packaged, pre-wired unit consisting of cabinet, with compressor and condenser.
   1. Construction and Ratings: In accordance with AHRI 210/240 with testing in accordance with ASHRAE Std 23.1 and UL 207.

B. Air Cooled Condenser: Aluminum fin and copper tube coil, AHRI 520 with direct drive axial propeller fan resiliently mounted, galvanized fan guard.

C. Accessories: Filter drier, high pressure switch (manual reset), low pressure switch (automatic reset), service valves and gauge ports, thermometer well (in liquid line).
   1. Provide thermostatic expansion valves.

D. Operating Controls:
   1. Control by room thermostat to maintain room temperature setting.

PART 3 EXECUTION
3.01 EXAMINATION
A. Verify that substrates are ready for installation of units and openings are as indicated on shop drawings.
B. Verify that proper power supply is available and in correct location.
C. Verify that proper fuel supply is available for connection.

3.02 INSTALLATION
A. Install in accordance with manufacturer's instructions and requirements of local authorities having jurisdiction.
B. Install in accordance with NFPA 90A and NFPA 90B.
C. Install refrigeration systems in accordance with ASHRAE Std 15.

END OF SECTION 23 8126.13
SECTION 26 0519
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Single conductor building wire.
B. Wiring connectors.
C. Electrical tape.
D. Wire pulling lubricant.
E. Cable ties.

1.02 RELATED REQUIREMENTS
A. Drawings and general provisions of the Contract, including Uniform General Conditions and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

1.03 REFERENCE STANDARDS
F. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
G. NECA 121 - Standard for Installing Nonmetallic-Sheathed Cable (Type NM-B) and Underground Feeder and Branch-Circuit Cable (Type UF); 2007.
I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
M. UL 486C - Splicing Wire Connectors; Current Edition, Including All Revisions.
N. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape; Current Edition, Including All Revisions.
O. UL 719 - Nonmetallic-Sheathed Cables; Current Edition, Including All Revisions.

1.04 SUBMITTALS
A. See Uniform General Conditions for administrative requirements, for submittal procedures.
B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conductors and cables, including detailed information on materials, construction, ratings, listings, and available sizes, configurations, and stranding.
PART 2 PRODUCTS

2.01 CONDUCTOR AND CABLE APPLICATIONS

A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.
B. Underground feeder and branch-circuit cable is not permitted.
C. Service entrance cable is not permitted.
D. Armored cable is not permitted.
E. Metal-clad cable is not permitted.

2.02 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

A. Provide products that comply with requirements of NFPA 70.
B. Provide products listed, classified, and labeled as suitable for the purpose intended.
C. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.
D. Comply with NEMA WC 70.
E. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.
F. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.

G. Conductor Material:
   1. Provide copper conductors only. Aluminum conductors are not acceptable for this project. Conductor sizes indicated are based on copper.
   2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
   3. Tinned Copper Conductors: Comply with ASTM B33.

H. Minimum Conductor Size:
   1. Branch Circuits: 12 AWG.
      a. Exceptions:
         1) 20 A, 120 V circuits longer than 75 feet: 10 AWG, for voltage drop.

I. Conductor Color Coding:
   1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction.
   2. Color Coding Method: Integrally colored insulation.
   3. Color Code:

2.03 SINGLE CONDUCTOR BUILDING WIRE

A. Manufacturers:
   1. Copper Building Wire:

B. Description: Single conductor insulated wire.

C. Conductor Stranding:
   1. Feeders and Branch Circuits:
      b. Size 8 AWG and Larger: Stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation:
1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.

2.04 NONMETALLIC-SHEATHED CABLE
   A. Description: NFPA 70, Type NM multiple-conductor cable listed and labeled as complying with UL 719, Type NM-B.
   B. Conductor Stranding:
      2. Size 8 AWG and Larger: Stranded.
   C. Insulation Voltage Rating: 600 V.

2.05 WIRING CONNECTORS
   A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.

2.06 WIRING ACCESSORIES
   A. Electrical Tape:
      1. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F and suitable for continuous temperature environment up to 221 degrees F.
   B. Wire Pulling Lubricant: Listed; suitable for use with the conductors or cables to be installed and suitable for use at the installation temperature.
   C. Cable Ties: Material and tensile strength rating suitable for application.

PART 3 EXECUTION

3.01 EXAMINATION
   A. Verify that interior of building has been protected from weather.
   B. Verify that work likely to damage wire and cable has been completed.
   C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.
   D. Verify that field measurements are as indicated.
   E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION
   A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.03 INSTALLATION
   A. Circuiting Requirements:
      1. Unless dimensioned, circuit routing indicated is diagrammatic.
      2. When circuit destination is indicated without specific routing, determine exact routing required.
      3. Arrange circuiting to minimize splices.
      4. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
   B. Install products in accordance with manufacturer's instructions.
   C. Perform work in accordance with NECA 1 (general workmanship).
   D. Install nonmetallic-sheathed cable (Type NM-B) in accordance with NECA 121.
   E. Installation in Raceway:
      1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
      2. Pull all conductors and cables together into raceway at same time.
3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.

F. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.

G. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.

H. Terminate cables using suitable fittings.

I. Install conductors with a minimum of 12 inches of slack at each outlet.

J. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.

K. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.

L. Make wiring connections using specified wiring connectors.
   1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
   2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
   3. Do not remove conductor strands to facilitate insertion into connector.
   4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.

M. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.

N. Insulate ends of spare conductors using vinyl insulating electrical tape.

O. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

P. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

END OF SECTION 26 0519
SECTION 26 0526
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Grounding and bonding requirements.
   B. Conductors for grounding and bonding.
   C. Connectors for grounding and bonding.
   D. Ground bars.
   E. Ground rod electrodes.

1.02 RELATED REQUIREMENTS
   A. Drawings and general provisions of the Contract, including Uniform General Conditions and Supplementary Conditions and Division 1 Specification Sections, apply to this section.
   B. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Additional requirements for conductors for grounding and bonding, including conductor color coding.
   C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS
   A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
   C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
   D. UL 467 - Grounding and Bonding Equipment; Current Edition, Including All Revisions.

1.04 SUBMITTALS
   A. See Uniform General Conditions for administrative requirements, for submittal procedures.
   B. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.

1.05 QUALITY ASSURANCE
   A. Conform to requirements of NFPA 70.

1.06 DELIVERY, STORAGE, AND HANDLING
   A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 GROUNDING AND BONDING REQUIREMENTS
   A. Do not use products for applications other than as permitted by NFPA 70 and product listing.
   B. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.
   C. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
   D. Grounding Electrode System:
      1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.
         a. Provide continuous grounding electrode conductors without splice or joint.
b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.

2. Metal Underground Water Pipe(s):
   a. Provide connection to underground metal domestic and fire protection (where present) water service pipe(s) that are in direct contact with earth for at least 10 feet at an accessible location not more than 5 feet from the point of entrance to the building.
   b. Provide bonding jumper(s) around insulating joints/pipes as required to make pipe electrically continuous.
   c. Provide bonding jumper around water meter of sufficient length to permit removal of meter without disconnecting jumper.

3. Metal In-Ground Support Structure:
   a. Provide connection to metal in-ground support structure that is in direct contact with earth in accordance with NFPA 70.

4. Concrete-Encased Electrode:
   a. Provide connection to concrete-encased electrode consisting of not less than 20 feet of either steel reinforcing bars or bare copper conductor not smaller than 4 AWG embedded within concrete foundation or footing that is in direct contact with earth in accordance with NFPA 70.

5. Ground Rod Electrode(s):
   a. Provide three electrodes in an equilateral triangle configuration unless otherwise indicated or required.
   b. Space electrodes not less than 10 feet from each other and any other ground electrode.

6. Ground Bar: Provide ground bar, separate from service equipment enclosure, for common connection point of grounding electrode system bonding jumpers as permitted in NFPA 70. Connect grounding electrode conductor provided for service-supplied system grounding to this ground bar.
   a. Ground Bar Size: 1/4 by 2 by 12 inches unless otherwise indicated or required.

E. Service-Supplied System Grounding:
   1. For each service disconnect, provide grounding electrode conductor to connect neutral (grounded) service conductor to grounding electrode system. Unless otherwise indicated, make connection at neutral (grounded) bus in service disconnect enclosure.
   2. For each service disconnect, provide main bonding jumper to connect neutral (grounded) bus to equipment ground bus where not factory-installed. Do not make any other connections between neutral (grounded) conductors and ground on load side of service disconnect.

F. Grounding for Separate Building or Structure Supplied by Feeder(s) or Branch Circuits:
   1. Provide grounding electrode system for each separate building or structure.
   2. Provide equipment grounding conductor routed with supply conductors.
   3. For each disconnecting means, provide grounding electrode conductor to connect equipment ground bus to grounding electrode system.
   4. Do not make any connections and remove any factory-installed jumpers between neutral (grounded) conductors and ground.

G. Communications Systems Grounding and Bonding:
   1. Provide intersystem bonding termination at service equipment or metering equipment enclosure and at disconnecting means for any additional buildings or structures in accordance with NFPA 70.

2.02 GROUNDING AND BONDING COMPONENTS

A. General Requirements:
   1. Provide products listed, classified, and labeled as suitable for the purpose intended.
   2. Provide products listed and labeled as complying with UL 467 where applicable.

B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 26 0526:
   1. Use insulated copper conductors unless otherwise indicated.
      a. Exceptions:
1) Use bare copper conductors where installed underground in direct contact with earth.
2) Use bare copper conductors where directly encased in concrete (not in raceway).

C. Connectors for Grounding and Bonding:
1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.

D. Ground Bars:
1. Description: Copper rectangular ground bars with mounting brackets and insulators.
2. Size: As indicated.
3. Holes for Connections: As indicated or as required for connections to be made.

E. Ground Rod Electrodes:
1. Comply with NEMA GR 1.
3. Size: 3/4 inch diameter by 10 feet length, unless otherwise indicated.

PART 3 EXECUTION

3.01 EXAMINATION
A. Verify that work likely to damage grounding and bonding system components has been completed.
B. Verify that field measurements are as indicated.
C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION
A. Install products in accordance with manufacturer's instructions.
B. Perform work in accordance with NECA 1 (general workmanship).
C. Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45 degree angle or bury horizontally in trench at least 30 inches (750 mm) deep in accordance with NFPA 70 or provide ground plates.
D. Make grounding and bonding connections using specified connectors.
1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
E. Identify grounding and bonding system components in accordance with Section 26 0553.

END OF SECTION 26 0526
SECTION 26 0529
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL
1.01 SECTION INCLUDES
A. Support and attachment requirements and components for equipment, conduit, cable, boxes, and other electrical work.

1.02 RELATED REQUIREMENTS
A. Drawings and general provisions of the Contract, including Uniform General Conditions and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

1.03 REFERENCE STANDARDS
D. MFMA-4 - Metal Framing Standards Publication; 2004.
E. NEC 1 - Standard for Good Workmanship in Electrical Construction; 2010.
F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS
A. See Uniform General Conditions for administrative requirements, for submittal procedures.
B. Product Data: Provide manufacturer's standard catalog pages and data sheets for channel (strut) framing systems, non-penetrating rooftop supports, and post-installed concrete and masonry anchors.

1.05 DELIVERY, STORAGE, AND HANDLING
A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS
2.01 SUPPORT AND ATTACHMENT COMPONENTS
A. General Requirements:
1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical work.
2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported with a minimum safety factor of 50%. Include consideration for vibration, equipment operation, and shock loads where applicable.
4. Do not use products for applications other than as permitted by NFPA 70 and product listing.
5. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
   a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
   b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.
   c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
   d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.
B. Conduit and Cable Supports: Straps, clamps, etc. suitable for the conduit or cable to be supported.
   1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
   2. Conduit Clamps: Bolted type unless otherwise indicated.
C. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.

D. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.

E. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.

F. Anchors and Fasteners:
   1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

D. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

E. Unless specifically indicated or approved by Architect, do not provide support from roof deck.

F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

G. Equipment Support and Attachment:
   1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
   2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
   3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
   4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

H. Secure fasteners according to manufacturer's recommended torque settings.

I. Remove temporary supports.

END OF SECTION 26 0529
SECTION 26 0533.13
CONDUIT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Galvanized steel rigid metal conduit (RMC).
B. Electrical metallic tubing (EMT).
C. Rigid polyvinyl chloride (PVC) conduit.
D. Reinforced thermosetting resin conduit (RTRC).
E. Conduit fittings.

1.02 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including Uniform General Conditions and Supplementary Conditions and Division 1 Specification Sections, apply to this section.
B. Section 26 0526 - Grounding and Bonding for Electrical Systems.
C. Section 26 0529 - Hangers and Supports for Electrical Systems.
D. Section 26 2100 - Low-Voltage Electrical Service Entrance: Additional requirements for electrical service conduits.

1.03 REFERENCE STANDARDS

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2005.
B. ANSI C80.3 - American National Standard for Steel Electrical Metallic Tubing (EMT); 2005.
C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
D. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); 2013.
E. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC); 2003.
F. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2012.
G. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit; 2013.
H. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; 2015.
I. NEMA TC 14 (SERIES) - Reinforced Thermosetting Resin Conduit and Fittings Series; 2015.
J. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
K. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.
L. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.
M. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.
N. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Uniform General Conditions for administrative requirements, for submittal procedures.
B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.
1.06 DELIVERY, STORAGE, AND HANDLING
   A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer’s instructions.

PART 2 PRODUCTS

2.01 CONDUIT APPLICATIONS
   A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70 and product listing.
   B. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications. Where more than one listed application applies, comply with the most restrictive requirements. Where conduit type for a particular application is not specified, use galvanized steel rigid metal conduit.
   C. Underground:
      1. Under Slab on Grade: Use rigid PVC conduit.
      2. Exterior, Direct-Buried: Use galvanized steel rigid metal conduit, intermediate metallic conduit (IMC), PVC-coated galvanized steel rigid metal conduit, rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC).
      3. Where steel conduit is installed in direct contact with earth where soil has a resistivity of less than 2000 ohm-centimeters or is characterized as severely corrosive based on soils report or local experience, use corrosion protection tape to provide supplementary corrosion protection or use PVC-coated galvanized steel rigid metal conduit.

2.02 CONDUIT REQUIREMENTS
   A. Electrical Service Conduits: Also comply with Section 26 2100.
   B. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.
   C. Provide products listed, classified, and labeled as suitable for the purpose intended.
   D. Minimum Conduit Size, Unless Otherwise Indicated:
      1. Branch Circuits: 3/4 inch (21 mm) trade size.
      2. Branch Circuit Homeruns: 3/4 inch (21 mm) trade size.
      3. Flexible Connections to Luminaires: 1/2 inch (16 mm) trade size.
      5. Underground, Exterior: 1 inch (27 mm) trade size.
   E. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)
   A. Manufacturers:
      3. Substitutions: See Section 01 6000 - Product Requirements.
   B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.
   C. Fittings:
      1. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
      2. Material: Use steel or malleable iron.

2.04 ELECTRICAL METALLIC TUBING (EMT)
   A. Description: NFPA 70, Type EMT steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.
B. Fittings:
   1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Material: Use steel or malleable iron.
      a. Do not use indenter type connectors and couplings.
      b. Do not use set-screw type connectors and couplings.
   4. Damp or Wet Locations (where permitted): Use fittings listed for use in wet locations.

2.05 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

A. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.

B. Fittings:
   1. Manufacturer: Same as manufacturer of conduit to be connected.
   2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

2.06 REINFORCED THERMOSETTING RESIN CONDUIT (RTRC)

A. Description: NFPA 70, Type RTRC reinforced thermosetting resin conduit complying with NEMA TC 14 (SERIES).

B. Supports: Per manufacturer's recommendations.

C. Fittings: Same type and manufacturer as conduit to be connected.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.

D. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.

E. Conduit Support:
   1. Secure and support conduits in accordance with NFPA 70 and Section 26 0529 using suitable supports and methods approved by the authority having jurisdiction.
   2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

F. Connections and Terminations:
   1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
   2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
   3. Use suitable adapters where required to transition from one type of conduit to another.
   4. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
   5. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.
   6. Secure joints and connections to provide maximum mechanical strength and electrical continuity.

G. Penetrations:
   1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
   2. Make penetrations perpendicular to surfaces unless otherwise indicated.
3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.

4. Conceal bends for conduit risers emerging above ground.

5. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.

6. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.

7. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty. Include proposed locations of penetrations and methods for sealing with submittals.

8. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

H. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:

1. Where conduits cross structural joints intended for expansion, contraction, or deflection.

2. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.

3. Where calculated in accordance with NFPA 70 for reinforced thermosetting resin conduit (RTRC) conduit installed above ground to compensate for thermal expansion and contraction.

4. Where conduits are subject to earth movement by settlement or frost.

I. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at an accessible point near the penetration to prevent condensation. This includes, but is not limited to:

1. Where conduits pass from outdoors into conditioned interior spaces.

2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.

J. Provide grounding and bonding in accordance with Section 26 0526.

3.02 FIELD QUALITY CONTROL

A. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

B. Correct deficiencies and replace damaged or defective conduits.

3.03 CLEANING

A. Clean interior of conduits to remove moisture and foreign matter.

3.04 PROTECTION

A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

END OF SECTION 26 0533.13
SECTION 26 0533.16
BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Outlet and device boxes up to 100 cubic inches, including those used as junction and pull boxes.
   B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches.

1.02 RELATED REQUIREMENTS
   A. Drawings and general provisions of the Contract, including Uniform General Conditions and Supplementary
      Conditions and Division 1 Specification Sections, apply to this section.
   B. Section 26 0529 - Hangers and Supports for Electrical Systems.
   C. Section 26 2726 - Wiring Devices:
      1. Wall plates.

1.03 REFERENCE STANDARDS
   A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
   B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2010.
   C. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and
      Cable; 2012.
   D. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; 2013.
   E. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports; 2013.
   F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including
      All Applicable Amendments and Supplements.
   G. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including
      All Revisions.
   H. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All
      Revisions.
   J. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.
   K. UL 514C - Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers; Current Edition, Including All
      Revisions.

1.04 SUBMITTALS
   A. See Uniform General Conditions for administrative requirements, for submittal procedures.
   B. Product Data: Provide manufacturer's standard catalog pages and data sheets for cabinets and enclosures,
      boxes for hazardous (classified) locations, floor boxes, and underground boxes/enclosures.

1.05 DELIVERY, STORAGE, AND HANDLING
   A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 BOXES
   A. General Requirements:
      1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and
         product listing.
2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
3. Provide products listed, classified, and labeled as suitable for the purpose intended.
4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
5. Provide grounding terminals within boxes where equipment grounding conductors terminate.

B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:
1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
3. Use nonmetallic boxes where exposed rigid PVC conduit is used.
4. Use suitable concrete type boxes where flush-mounted in concrete.
5. Use suitable masonry type boxes where flush-mounted in masonry walls.
6. Use raised covers suitable for the type of wall construction and device configuration where required.
7. Use shallow boxes where required by the type of wall construction.
8. Do not use "through-wall" boxes designed for access from both sides of wall.
9. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
10. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
11. Nonmetallic Boxes: Comply with NEMA OS 2, and list and label as complying with UL 514C.
12. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
14. Wall Plates: Comply with Section 26 2726.

C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:
1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
2. NEMA 250 Environment Type, Unless Otherwise Indicated:
3. Junction and Pull Boxes Larger Than 100 cubic inches:
   a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.

PART 3 EXECUTION
3.01 INSTALLATION
A. Install products in accordance with manufacturer's instructions.
B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.
C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
D. Box Supports:
   1. Secure and support boxes in accordance with NFPA 70 and Section 26 0529 using suitable supports and methods approved by the authority having jurisdiction.
   2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.
E. Install boxes plumb and level.
F. Flush-Mounted Boxes:
   1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch or does not project beyond finished surface.
2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch at the edge of the box.

G. Install boxes as required to preserve insulation integrity.

H. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

I. Install firestopping to preserve fire resistance rating of partitions and other elements. 

J. Close unused box openings.

K. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.

L. Provide grounding and bonding in accordance with Section 26 0526.

END OF SECTION 26 0533.16
SECTION 26 0553
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL
1.01 SECTION INCLUDES
A. Electrical identification requirements.
B. Identification nameplates and labels.
C. Underground warning tape.
D. Warning signs and labels.

1.02 RELATED REQUIREMENTS
A. Drawings and general provisions of the Contract, including Uniform General Conditions and Supplementary Conditions and Division 1 Specification Sections, apply to this section.
B. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.

1.03 REFERENCE STANDARDS
C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS
A. See Uniform General Conditions for administrative requirements, for submittal procedures.
B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.

PART 2 PRODUCTS
2.01 IDENTIFICATION REQUIREMENTS
A. Identification for Equipment:
   1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
      a. Load Centers:
         1) Identify ampere rating.
         2) Identify voltage and phase.
         3) Identify power source and circuit number. Include location when not within sight of equipment.
         4) Identify main overcurrent protective device. Use identification label for panelboards with a door. For power distribution panelboards without a door, use identification nameplate.
         5) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.
         6) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
   2. Service Equipment:
      a. Use identification nameplate to identify each service disconnecting means.
      b. Use identification label at each piece of service equipment to identify the available fault current and the date calculations were performed.
   3. Available Fault Current Documentation: Use identification label to identify the available fault current and date calculations were performed at locations requiring documentation by NFPA 70, including but not limited to the following.
      a. Service equipment.
b. Industrial control panels.
c. Motor control centers.
d. Elevator control panels.
e. Industrial machinery.

B. Identification for Conductors and Cables:
   1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 0519.
   2. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.

2.02 IDENTIFICATION NAMEPLATES AND LABELS

A. Identification Nameplates:
   1. Materials:
      a. Indoor Clean, Dry Locations: Use plastic nameplates.
      b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.
   2. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch; engraved text.
   3. Stainless Steel Nameplates: Minimum thickness of 1/32 inch; engraved or laser-etched text.
   4. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch; engraved or laser-etched text.
   5. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.

B. Identification Labels:
   1. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
   2. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.

2.03 UNDERGROUND WARNING TAPE

A. Materials: Use non-detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.
B. Non-detectable Type Tape: 6 inches wide, with minimum thickness of 4 mil.
C. Legend: Type of service, continuously repeated over full length of tape.
D. Color:

2.04 WARNING SIGNS AND LABELS

A. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.
B. Warning Signs:
   1. Materials:
   2. Minimum Size: 7 by 10 inches unless otherwise indicated.
C. Warning Labels:
   1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
   3. Minimum Size: 2 by 4 inches unless otherwise indicated.

PART 3 EXECUTION

3.01 PREPARATION

A. Clean surfaces to receive adhesive products according to manufacturer's instructions.
3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
   3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
   4. Elevated Equipment: Legible from the floor or working platform.
   5. Branch Devices: Adjacent to device.
   6. Interior Components: Legible from the point of access.
   7. Conductors and Cables: Legible from the point of access.

C. Install identification products centered, level, and parallel with lines of item being identified.

D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.

E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.

F. Install underground warning tape above buried lines with one tape per trench at 3 inches below finished grade.

G. Mark all handwritten text, where permitted, to be neat and legible.

END OF SECTION 26 0553
SECTION 26 2100
LOW-VOLTAGE ELECTRICAL SERVICE ENTRANCE

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Electrical service requirements.

1.02 RELATED REQUIREMENTS
A. Drawings and general provisions of the Contract, including Uniform General Conditions and Supplementary Conditions and Division 1 Specification Sections, apply to this section.
B. Section 26 0526 - Grounding and Bonding for Electrical Systems.
C. Section 26 0529 - Hangers and Supports for Electrical Systems.
D. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS
B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS
A. See Uniform General Conditions for administrative requirements, for submittal procedures.
B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product. Include ratings, configurations, standard wiring diagrams, outline and support point dimensions, finishes, weights, service condition requirements, and installed features.

1.05 QUALITY ASSURANCE
A. Comply with the following:
   2. NFPA 70 (National Electrical Code).
   3. The requirements of the Utility Company.

1.06 DELIVERY, STORAGE, AND HANDLING
A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.
B. Store products indoors in a clean, dry space having a uniform temperature to prevent condensation (including outdoor rated products which are not weatherproof until completely and properly installed). Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
C. Handle products carefully to avoid damage to internal components, enclosure, and finish.

PART 2 PRODUCTS

2.01 ELECTRICAL SERVICE REQUIREMENTS
A. Provide new electrical service consisting of all required conduits, conductors, equipment, metering provisions, supports, accessories, etc. as necessary for connection between Utility Company point of supply and service entrance equipment.
B. Electrical Service Characteristics: As indicated on drawings.
C. Utility Company: As indicated on drawings.
D. Division of Responsibility: As indicated on drawings.
E. Products Furnished by Contractor: Comply with Utility Company requirements.
PART 3 EXECUTION

3.01 EXAMINATION
   A. Verify that field measurements are as indicated.
   B. Verify that ratings and configurations of service entrance equipment are consistent with the indicated requirements.
   C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

3.03 INSTALLATION
   A. Install products in accordance with manufacturer’s instructions and Utility Company requirements.
   B. Perform work in accordance with NECA 1 (general workmanship).
   C. Arrange equipment to provide minimum clearances and required maintenance access.
   D. Provide required support and attachment components in accordance with Section 26 0529.
   E. Provide grounding and bonding for service entrance equipment in accordance with Section 26 0526.
   F. Identify service entrance equipment, including main service disconnect(s) in accordance with Section 26 0553.

END OF SECTION 26 2100
SECTION 26 2200
LOW-VOLTAGE TRANSFORMERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General purpose transformers.

1.02 REFERENCE STANDARDS


B. IEEE C57.94 - IEEE Recommended Practice for Installation, Application, Operation, and Maintenance of Dry-Type Distribution and Power Transformers; 2015.


D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

E. NECA 409 - Standard for Installing and Maintaining Dry-Type Transformers; 2015.

F. NEMA ST 20 - Dry-Type Transformers for General Applications; 2014.

G. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.

H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.


J. UL 1561 - Standard for Dry-Type General Purpose and Power Transformers; Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. See Uniform General Conditions for administrative requirements, for submittal procedures.

B. Product Data: Include voltage, kVA, impedance, tap configurations, insulation system class and rated temperature rise, efficiency, sound level, enclosure ratings, outline and support point dimensions, weight, required clearances, service condition requirements, and installed features.

C. Source Quality Control Test Reports: Include reports for tests designated in NEMA ST 20 as design and routine tests.

D. Source Limitations: Obtain each transformer type through one source from a single manufacturer.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

F. Comply with IEEE C57.12.91, "Test Code for Dry-Type Distribution and Power Transformers."

G. Qualification Data: For testing agency.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to transformer internal components, enclosure, and finish.

1.05 FIELD CONDITIONS

A. Ambient Temperature: Do not exceed 86 degrees F average or 104 degrees F maximum measured during any 24 hour period during and after installation of transformers.
PART 2 PRODUCTS

2.01 MANUFACTURERS

B. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.
C. ACME Electric Corporation; Power Distribution Products Division.
D. Challenger Electrical Equipment Corp.; a division of Eaton Corp.

2.02 TRANSFORMERS - GENERAL REQUIREMENTS

A. Description: Factory-assembled, dry type transformers for 60 Hz operation designed and manufactured in accordance with NEMA ST 20 and listed, classified, and labeled as suitable for the purpose intended.
B. Unless noted otherwise, transformer ratings indicated are for continuous loading according to IEEE C57.96 under the following service conditions:
   1. Altitude: Less than 3,300 feet.
   2. Ambient Temperature:
      a. Greater than 10 kVA: Not exceeding 104 degrees F.
      b. Less than 10 kVA: Not exceeding 77 degrees F.
   3. Ambient Temperature: Not exceeding 86 degrees F average or 104 degrees F maximum measured during any 24 hour period.
C. Core: High grade, non-aging silicon steel with high magnetic permeability and low hysteresis and eddy current losses. Keep magnetic flux densities substantially below saturation point, even at 10 percent primary overvoltage. Tightly clamp core laminations to prevent plate movement and maintain consistent pressure throughout core length.
D. Coils: Continuous windings without splices except for taps.
   1. Internal Coil Connections: Brazed or pressure type.
   2. Coil Material: Copper.
E. Impregnate core and coil assembly with non-hydroscopic thermo-setting varnish to effectively seal out moisture and other contaminants.
F. Basic Impulse Level: 10 kV.
G. Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap.
H. Isolate core and coil from enclosure using vibration-absorbing mounts.
I. Nameplate: Include transformer connection data, ratings, wiring diagrams, and overload capacity based on rated winding temperature rise.

2.03 GENERAL PURPOSE TRANSFORMERS

A. Description: Self-cooled, two winding transformers listed and labeled as complying with UL 506 or UL 1561; ratings as indicated on the drawings.
B. Insulation System and Allowable Average Winding Temperature Rise:
   1. Less than 15 kVA: Class 180 degrees C insulation system with 115 degrees C average winding temperature rise.
   2. 15 kVA and Larger: Class 220 degrees C insulation system with 150 degrees C average winding temperature rise.
C. Coil Conductors: Continuous aluminum windings with terminations brazed or welded.
D. Winding Taps:
   1. Less than 3 kVA: None.
   2. 3 kVA through 15 kVA: Two 5 percent full capacity primary taps below rated voltage.
   3. 15 kVA through 300 kVA: Two 2.5 percent full capacity primary taps above and four 2.5 percent full capacity primary taps below rated voltage.
4. 500 kVA and Larger: Two 2.5 percent full capacity primary taps above and two 2.5 percent full capacity primary taps below rated voltage.

E. Energy Efficiency: Comply with 10 CFR 431, Subpart K.

F. Sound Levels: Standard sound levels complying with NEMA ST 20.

G. Mounting Provisions:
   1. Less than 15 kVA: Suitable for wall mounting.
   2. 15 kVA through 75 kVA: Suitable for wall, floor, or trapeze mounting.
   3. Larger than 75 kVA: Suitable for floor mounting.

   1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
      a. Outdoor locations: Type 3R.
   2. Construction: Steel.
      a. Less than 15 kVA: Totally enclosed, non-ventilated.
      b. 15 kVA and Larger: Ventilated.
   3. Finish: Manufacturer's standard grey, suitable for outdoor installations.
   4. Provide lifting eyes or brackets.

2.04 IDENTIFICATION DEVICES

   A. Nameplates: Engraved, laminated-plastic or metal nameplate for each distribution transformer, mounted with corrosion-resistant screws. Nameplates and label products are specified in Division 26 Section "Identification for Electrical Systems."

2.05 SOURCE QUALITY CONTROL

   A. Sound Level Tests: Perform factory test designated in NEMA ST 20 as "design" test on each production unit.

   B. A. Test and inspect transformers according to IEEE C57.12.91.

PART 3 EXECUTION

3.01 EXAMINATION

   A. Verify that field measurements are as indicated.

   B. Verify that suitable support frames and anchors are installed where required and that mounting surfaces are ready to receive transformers.

   C. Perform pre-installation tests and inspections on transformers per manufacturer's instructions and as specified in NECA 409. Correct deficiencies prior to installation.

   D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

   A. Perform work in accordance with NECA 1 (general workmanship).

   B. Install products in accordance with manufacturer's instructions.

   C. Install transformers in accordance with NECA 409 and IEEE C57.94.

   D. Use flexible conduit, under the provisions of Section 26 0533.13, 2 feet minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure.

   E. Arrange equipment to provide minimum clearances as specified on transformer nameplate and in accordance with manufacturer's instructions and NFPA 70.

   F. Install transformers plumb and level.

   G. Transformer Support:
      1. Provide required support and attachment in accordance with Section 26 0529, where not furnished by transformer manufacturer.
2. Use integral transformer flanges, accessory brackets furnished by manufacturer, or field-fabricated supports to support wall-mounted transformers.

3. Unless otherwise indicated, mount floor-mounted transformers on properly sized 3 inch high concrete pad constructed in accordance with Section 03 3000.

4. Use trapeze hangers assembled from threaded rods and metal channel (strut) to support suspended transformers. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

H. Provide grounding and bonding in accordance with Section 26 0526.

I. Remove shipping braces and adjust bolts that attach the core and coil mounting bracket to the enclosure according to manufacturer's recommendations in order to reduce audible noise transmission.

J. Where not factory-installed, install lugs sized as required for termination of conductors as indicated.

3.03 FIELD QUALITY CONTROL

A. Tests and Inspections:
   1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

B. Remove and replace units that do not pass tests or inspections and retest as specified above.

C. Test Labeling: On completion of satisfactory testing of each unit, attach a dated and signed “Satisfactory Test” label to tested component.

3.04 ADJUSTING

A. Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 10 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.

B. Output Settings Report: Prepare a written report recording output voltages and tap settings.

3.05 CLEANING

A. Clean dirt and debris from transformer components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.
SECTION 26 2416
PANELBOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Lighting and appliance panelboards.
   B. Overcurrent protective devices for panelboards.

1.02 RELATED REQUIREMENTS
   A. Section 26 0526 - Grounding and Bonding for Electrical Systems.
   B. Drawings and general provisions of the Contract, including Uniform General Conditions and Supplementary Conditions and Division 1 Specification Sections, apply to this section.
   C. Section 26 0526 - Grounding and Bonding for Electrical Systems.
   D. Section 26 0529 - Hangers and Supports for Electrical Systems.

1.03 REFERENCE STANDARDS
   A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
   B. NECA 407 - Standard for Installing and Maintaining Panelboards; 2009.
   C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.
   D. NEMA PB 1 - Panelboards; 2011.
   E. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less; 2013.
   F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
   I. UL 67 - Panelboards; Current Edition, Including All Revisions.

1.04 SUBMITTALS
   A. See Uniform General Conditions for administrative requirements, for submittal procedures.
   B. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.

1.05 QUALITY ASSURANCE
   A. Conform to requirements of NFPA 70.

1.06 DELIVERY, STORAGE, AND HANDLING
   A. Receive, inspect, handle, and store panelboards in accordance with manufacturer's instructions and NECA 407.
   B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
   C. Handle carefully in accordance with manufacturer's written instructions to avoid damage to panelboard internal components, enclosure, and finish.
PART 2  PRODUCTS

2.01  MANUFACTURERS
    C. Schneider Electric; Square D Products:  www.schneider-electric.us.

2.02  PANELBOARDS - GENERAL REQUIREMENTS
    A. Provide products listed, classified, and labeled as suitable for the purpose intended.
    B. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
        1. Altitude: Less than 6,600 feet.
        2. Ambient Temperature:
           a. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.
    C. Short Circuit Current Rating:
        1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
    D. Panelboards Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.
    E. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.
    F. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.
    G. Bussing: Sized in accordance with UL 67 temperature rise requirements.
        1. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
        2. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit grounding conductor.
    H. Conductor Terminations: Suitable for use with the conductors to be installed.
    I. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
        1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
           2. Boxes: Galvanized steel unless otherwise indicated.
              a. Provide wiring gutters sized to accommodate the conductors to be installed.
           3. Fronts:
              a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
              b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.
        4. Lockable Doors: All locks keyed alike unless otherwise indicated.
    J. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

2.03  LIGHTING AND APPLIANCE PANELBOARDS
    A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.
    B. Conductor Terminations:
        1. Main and Neutral Lug Material: Copper, suitable for terminating copper conductors only.
        2. Main and Neutral Lug Type: Mechanical.
    C. Bussing:
2. Phase and Neutral Bus Material: Copper.

D. Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated.

E. Enclosures:
   1. Provide surface-mounted or flush-mounted enclosures as indicated.
   2. Fronts: Provide lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
   3. Provide clear plastic circuit directory holder mounted on inside of door.

2.04 OVERCURRENT PROTECTIVE DEVICES

A. Molded Case Circuit Breakers:
   1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
   2. Interrupting Capacity:
      a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
      b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
   3. Conductor Terminations:
      a. Provide compression lugs.
      b. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
   4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
   5. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.
B. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.
C. Verify that mounting surfaces are ready to receive panelboards.
D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).
B. Install products in accordance with manufacturer's instructions.
C. Install panelboards in accordance with NECA 407 and NEMA PB 1.1.
D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
E. Provide required support and attachment in accordance with Section 26 0529.
F. Install panelboards plumb.
G. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.
H. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches above the floor or working platform.
I. Provide minimum of six spare 1 inch trade size conduits out of each flush-mounted panelboard stubbed into accessible space above ceiling and below floor.

J. Provide grounding and bonding in accordance with Section 26 0526.

K. Install all field-installed branch devices, components, and accessories.

L. Provide filler plates to cover unused spaces in panelboards.

3.03 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

B. Adjust alignment of panelboard fronts.

3.04 CLEANING

A. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION 26 2416
SECTION 26 2726
WIRING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Wall switches.
   B. Wall dimmers.
   C. Receptacles.
   D. Wall plates.
   E. Floor box service fittings.

1.02 RELATED REQUIREMENTS
   A. Drawings and general provisions of the Contract, including Uniform General Conditions and Supplementary
      Conditions and Division 1 Specification Sections, apply to this section.
   B. Section 26 0533.16 - Boxes for Electrical Systems.

1.03 REFERENCE STANDARDS
   B. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush-mounted (General Specification); Federal
      Specification; Revision F, 1999.
   C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
   D. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2010.
   E. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (R 2010).
   F. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2012.
   G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including
      All Applicable Amendments and Supplements.
   I. UL 498 - Attachment Plugs and Receptacles; Current Edition, Including All Revisions.
   L. UL 1472 - Solid-State Dimming Controls; Current Edition, Including All Revisions.

1.04 SUBMITTALS
   A. See Uniform General Conditions for administrative requirements, for submittal procedures.
   B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

1.05 DELIVERY, STORAGE, AND PROTECTION
   A. Store in a clean, dry space in original manufacturer's packaging until ready for installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS
   D. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us
E. Source Limitations: Where possible, provide products for each type of wiring device produced by a single manufacturer and obtained from a single supplier.

2.02 WIRING DEVICE APPLICATIONS
A. Provide wiring devices suitable for intended use and with ratings adequate for load served.
B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.
C. Provide weather resistant GFCI receptacles with specified weatherproof covers for receptacles installed outdoors or in damp or wet locations.
D. Provide GFCI protection for receptacles installed within 6 feet of sinks.

2.03 WIRING DEVICE FINISHES
A. Provide wiring device finishes as described below unless otherwise indicated.
B. Wiring Devices, Unless Otherwise Indicated: White with stainless steel wall plate.
C. Wiring Devices Installed in Finished Spaces: White with white stainless steel wall plate.
D. Wiring Devices Installed in Unfinished Spaces: White with stainless steel wall plate.

2.04 WALL SWITCHES
A. Manufacturers:
3. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us
B. Wall Switches - General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and where applicable, FS W-S-896; types as indicated on the drawings.
1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.
C. Standard Wall Switches: Industrial specification grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

2.05 WALL DIMMERS
A. Manufacturers:
3. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us
B. Wall Dimmers - General Requirements: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 1472; types and ratings suitable for load controlled as indicated on the drawings.

2.06 RECEPTACLES
A. Manufacturers:
4. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us
B. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.
1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
2. NEMA configurations specified are according to NEMA WD 6.

C. Convenience Receptacles:
1. Standard Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
2. Weather Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.
3. Tamper Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; single or duplex as indicated on the drawings.
4. Tamper Resistant and Weather Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.

D. GFCI Receptacles:
1. GFCI Receptacles - General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.
3. Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.

2.07 WALL PLATES
A. Manufacturers:
4. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us
B. Wall Plates: Comply with UL 514D.
1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
3. Screws: Metal with slotted heads finished to match wall plate finish.
C. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.

PART 3 EXECUTION
3.01 EXAMINATION
A. Verify that field measurements are as indicated.
B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.
C. Verify that wall openings are neatly cut and will be completely covered by wall plates.
D. Verify that final surface finishes are complete, including painting.
E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.
F. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION
A. Provide extension rings to bring outlet boxes flush with finished surface.
B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.
3.03 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of wiring devices provided under this section.
   1. Mounting Heights: Unless otherwise indicated, as follows:
      a. Wall Switches: 48 inches above finished floor.
      b. Wall Dimmers: 48 inches above finished floor.
      c. Receptacles: 18 inches above finished floor or 6 inches above counter.

C. Install wiring devices in accordance with manufacturer's instructions.

D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

E. Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.

F. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.

G. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

H. Install wiring devices plumb and level with mounting yoke held rigidly in place.

I. Install wall switches with OFF position down.

J. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.

K. Do not share neutral conductor on branch circuits utilizing wall dimmers.

L. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.

M. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

N. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.

3.04 FIELD QUALITY CONTROL

A. Inspect each wiring device for damage and defects.

B. Operate each wall switch, wall dimmer, and fan speed controller with circuit energized to verify proper operation.

C. Test each receptacle to verify operation and proper polarity.

D. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.

E. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.05 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

END OF SECTION 26 2726
SECTION 31 10 00
SITE CLEARING

PART 1 - GENERAL

1.1 SUMMARY
   A. Section Includes:
      1. Protecting existing vegetation to remain.
      2. Removing existing vegetation.
      3. Clearing and grubbing.
      4. Stripping and stockpiling topsoil.
      5. Removing above- and below-grade site improvements.
      6. Disconnecting, capping, or sealing site utilities.
      7. Temporary erosion and sedimentation control.

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

1.3 PREINSTALLATION MEETINGS
   A. Refer to general conditions.

1.4 MATERIAL OWNERSHIP
   A. Except for materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.5 FIELD CONDITIONS
   A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
      1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
      2. Provide alternate routes around closed or obstructed trafficways if required by Owner or authorities having jurisdiction.
   B. Salvageable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises.
   C. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.
   D. Do not commence site clearing operations until temporary erosion- and sedimentation-control and plant-protection measures are in place.

PART 2 - PRODUCTS

2.1 MATERIALS
   A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 312000 "Earth Moving."
      1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.
PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Verify that trees, shrubs, and other vegetation to remain or to be relocated have been flagged and that protection zones have been identified and enclosed.

C. Protect existing site improvements to remain from damage during construction.
   1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.

B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

C. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.

D. Remove erosion and sedimentation controls, and restore and stabilize areas disturbed during removal.

3.3 TREE AND PLANT PROTECTION

A. Protect trees and plants remaining on-site.

B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations.

3.4 EXISTING UTILITIES

A. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.
   1. Arrange with utility companies to shut off indicated utilities.

B. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others, unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
   1. Notify Texas Parks and Wildlife Department not less than five days in advance of proposed utility interruptions.
   2. Do not proceed with utility interruptions without Texas Parks and Wildlife Department written permission.

C. Removal of underground utilities is included in earthwork sections; in applicable fire suppression, plumbing, HVAC, electrical, communications, electronic safety and security, and utilities sections; and in Section 024116 "Structure Demolition" and Section 024119 "Selective Demolition."

3.5 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.
   1. Depth of 24 inches below finished subgrade elevation in area bounded by lines two feet behind back of curbs.
   2. Depth of 24 inches below finished surface of required cross sections for other areas.
   3. Use only hand methods or air spade for grubbing within protection zones.
B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
   1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground.

3.6 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.
B. Strip topsoil to depth of 6 inches in a manner to prevent intermingling with underlying subsoil or other waste materials.
C. Stockpile topsoil away from edge of excavations without intermixing with subsoil or other materials. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.
D. Stockpile topsoil to a depth not exceeding 8 feet.

3.7 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.

3.8 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.
B. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials, and transport them to recycling facilities. Do not interfere with other Project work.

END OF SECTION
SECTION 31 20 00
EARTH MOVING

PART 1 - GENERAL

1.1 SUMMARY
A. Section Includes:
   1. Excavating and filling for rough grading the Site.
   2. Preparing subgrades for pavements.
   3. Subbase course for pavements.
   4. Excavating and backfilling trenches for utilities and pits for buried utility structures.

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

1.3 DEFINITIONS
A. Backfill: Soil material used to fill an excavation.
   1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
   2. Final Backfill: Backfill placed over initial backfill to fill a trench.
B. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.
C. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
D. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
   1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect or Engineer. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
   2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect or Engineer. Unauthorized excavation, as well as remedial work directed by Architect or Engineer, shall be without additional compensation.
E. Fill: Soil materials used to raise existing grades.
F. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
G. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.
H. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.
I. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

1.4 PREINSTALLATION MEETINGS
A. Refer to general conditions.
1.5 INFORMATIONAL SUBMITTALS
   A. Material test reports.

1.6 ACTION SUBMITTALS
   A. See borrow pit site to confirm clean site and absence of cultural resources.

1.7 FIELD CONDITIONS
   A. Utility Locator Service: Notify utility locator service for area where Project is located before beginning earth-moving operations.
   B. Do not commence earth-moving operations until plant-protection measures are in place.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS
   A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
   B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D 2487, or a combination of these groups; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
   C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487, or a combination of these groups. Unsatisfactory soils also include:
      1. Satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.
      2. Soils that cannot be compacted to required density due to gradation, plasticity, or moisture content.
   D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940/D 2940M; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
   E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940/D 2940M 0; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.
   F. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940/D 2940M; except with 100 percent passing a 1-inch (25-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.

PART 3 - EXECUTION

3.1 PREPARATION
   A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth-moving operations.
   B. Protect and maintain erosion and sedimentation controls during earth-moving operations.
   C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 EXCAVATION, GENERAL
   A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

3.3 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

2. Pile Foundations: Stop excavations 6 to 12 inches above bottom of pile cap before piles are placed. After piles have been driven, remove loose and displaced material. Excavate to final grade, leaving solid base to receive concrete pile caps.

3. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended as bearing surfaces.

B. Excavations at Edges of Tree- and Plant-Protection Zones:

1. Excavate by hand or with an air spade to indicated lines, cross sections, elevations, and subgrades. If excavating by hand, use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.

3.4 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.5 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit unless otherwise indicated.

1. Clearance: 12 inches each side of pipe or conduit.

C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.

1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

D. Trenches in Tree- and Plant-Protection Zones:

1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.

2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.

3.6 SUBGRADE INSPECTION

A. Proof-roll subgrade with a pneumatic-tired dump truck to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
B. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect or Engineer, without additional compensation.

3.7 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Architect or Engineer.

1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Architect or Engineer.

3.8 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees, as feasible.

3.9 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings.

D. Trenches under Roadways: Provide cement-stabilized sand bedding and haunching for piping or conduit below surface of roadways. After installing and testing, completely encase piping or conduit in cement-stabilized sand before backfilling or placing roadway subbase course.

E. Initial Backfill: Place and compact initial backfill of cement-stabilized sand, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the pipe or conduit.

1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

F. Final Backfill: Place and compact final backfill of satisfactory soil to final subgrade elevation.

3.10 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use satisfactory soil material.

2. Under walks and pavements, use satisfactory soil material.

3. Under steps and ramps, use engineered fill.

4. Under building slabs, use engineered fill.

5. Under footings and foundations, use engineered fill.
3.11 **SOIL MOISTURE CONTROL**

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
   1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
   2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.12 **COMPACTION OF SOIL BACKFILLS AND FILLS**

A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698:
   1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent of maximum dry density.
   2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 95 percent of maximum dry density.
   3. Under turf or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 85 percent of maximum dry density.
   4. For utility trenches, compact each layer of initial and final backfill soil material at 85 percent of maximum dry density.

3.13 **GRADING**

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to elevations required to achieve indicated finish elevations, within the following subgrade tolerances:
   1. Turf or Unpaved Areas: Plus or minus 1 inch.
   2. Walks: Plus or minus 1/2 inch.
   3. Pavements: Plus or minus 1/2 inch.

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.14 **SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS**

A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase course and base course under pavements and walks as follows:
   1. Shape subbase course and base course to required crown elevations and cross-slope grades.
   2. Place subbase course and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
3. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.15 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform inspections.

B. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.

C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

D. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.16 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.17 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION
SECTION 31 3116
TERMITE CONTROL

PART 1 GENERAL

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

1.2 SUMMARY
A. Section Includes:
   1. Soil treatment with termiticide.

1.3 ACTION SUBMITTALS
A. Product Data: For each type of termite control product.
   1. Include the EPA-Registered Label for termiticide products.

1.4 INFORMATIONAL SUBMITTALS
A. Qualification Data: For qualified Installer.
B. Product Certificates: For termite control products, from manufacturer.
C. Soil Treatment Application Report: After application of termiticide is completed, submit report for Owner's records and include the following:
   1. Date and time of application.
   2. Moisture content of soil before application.
   3. Termiticide brand name and manufacturer.
   4. Quantity of undiluted termiticide used.
   5. Dilutions, methods, volumes used, and rates of application.
   6. Areas of application.
   7. Water source for application.
D. Wood Treatment Application Report: After application of termiticide is completed, submit report for Owner's records and include the following:
   1. Date and time of application.
   2. Termiticide brand name and manufacturer.
   3. Quantity of undiluted termiticide used.
   4. Dilutions, methods, volumes used, and rates of application.
   5. Areas of application.
E. Warranties: Sample of special warranties.

1.5 QUALITY ASSURANCE
A. Installer Qualifications: A specialist who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment and products in jurisdiction where Project is located.
B. Regulatory Requirements: Formulate and apply termiticides and termiticide devices according to the EPA-Registered Label.
C. Source Limitations: Obtain termite control products from single manufacturer:
   1. Dominion 2L Termiticide/Insecticide

1.6 PROJECT CONDITIONS
A. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with requirements of the EPA-Registered Label and requirements of authorities having jurisdiction.
B. Coordinate soil treatment application with excavating, filling, grading, and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs before construction.
C. Apply wood treatment after framing, sheathing, and exterior weather protection is completed but before electrical and mechanical systems are installed.

1.7 WARRANTY
A. Soil Treatment Special Warranty: Manufacturer’s standard form, signed by Applicator and Contractor, certifying that termite control work, consisting of applied soil termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, retreat soil and repair or replace damage caused by termite infestation.

1.8 MAINTENANCE SERVICE
A. Continuing Service: Beginning at Substantial Completion, provide 12 months continuing service including monitoring, inspection, and re-treatment for occurrences of termite activity. Provide a standard continuing service agreement. State services, obligations, conditions, terms for agreement period, and terms for future renewal options.

PART 2 PRODUCTS
2.1 SOIL TREATMENT
A. Termiticide: Provide an EPA-Registered termiticide, complying with requirements of authorities having jurisdiction, in an aqueous solution formulated to prevent termite infestation. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to product’s EPA-Registered Label.

1. Products: Subject to compliance with requirements, provide Dominion 2L Termiticide/Insecticide or approved equal.

PART 3 EXECUTION
3.1 EXAMINATION
A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of soil per termiticide label requirements, interfaces with earthwork, slab and foundation work, landscaping, utility installation, and other conditions affecting performance of termite control. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION
A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer’s written instructions for preparation before beginning application of termite control treatment. Remove all extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil within and around foundations.

B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended in writing by termiticide manufacturer.

1. Fit filling hose connected to water source at the site with a backflow preventer, complying with requirements of authorities having jurisdiction.

3.3 APPLICATION, GENERAL
A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.

3.4 APPLYING SOIL TREATMENT
A. Application: Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical
termicidal barrier or treated zone is established around and under building construction. Distribute treatment evenly.

1. **Slabs-on-Grade:** Under ground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.

2. **Foundations:** Adjacent soil, including soil along the entire inside perimeter of foundation walls; along both sides of interior partition walls; around plumbing pipes and electric conduit penetrating the slab; around interior column footers, piers, and chimney bases; and along the entire outside perimeter, from grade to bottom of footing. Avoid soil washout around footings.

3. **Masonry:** Treat voids.

4. **Penetrations:** At expansion joints, control joints, and areas where slabs will be penetrated.

**B.** Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.

**C.** Protect termicide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.

**D.** Post warning signs in areas of application.

**E.** Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

**END OF SECTION**
SECTION 32 12 16

ASPHALT PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Hot-mix asphalt patching.
   2. Hot-mix asphalt paving.

B. Related Requirements:
   1. Section 312000 "Earth Moving" for subgrade preparation, fill material, unbound-aggregate subbase and base courses, and aggregate pavement shoulders.
   2. Section 321373 "Concrete Paving Joint Sealants" for joint sealants and fillers at pavement terminations.

1.2 RELATED DOCUMENTS

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

1.3 PREINSTALLATION MEETINGS

A. Refer to general conditions.

1.4 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each paving material.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of TXDOT and TPWD for asphalt paving work.

PART 2 - PRODUCTS

2.1 AGGREGATES

A. Coarse Aggregate: ASTM C 33, sound; angular crushed stone, crushed gravel, or cured, crushed blast-furnace slag free from dirt, organic or other injurious matter occurring either free or as coating on aggregate.
   1. Reference TXDOT Items 247 and 302
   2. Use Type A or Type B Aggregate for Flex Base
   3. Use Type B Grade 5 for One Course Surface Treatment
   4. Use Type B Grade 4 for HMAC Top Coat

B. Fine Aggregate: ASTM C 33, sharp-edged natural sand or sand prepared from stone, gravel, cured blast-furnace slag, or combinations thereof. Use sand composed of sound, durable stone particles free from loams or other injurious foreign matter.

2.2 ASPHALT MATERIALS

A. Asphalt Binder: PG 64-22

B. Surface Treatment: TXDOT Item 316 – CRS-1P (cool weather) / AC-15P (warm weather) at 0.375 gal/sqy

C. Tack Coat: TXDOT Item 316 – RC 250 at 0.22 gal/sqy – NO CUTBACK
2.3 AUXILIARY MATERIALS
A. Recycled Materials for Hot-Mix Asphalt Mixes: Reclaimed asphalt pavement; reclaimed, unbound-aggregate base material; and recycled tires, asphalt shingles, or glass from sources and gradations that have performed satisfactorily in previous installations, equal to performance of required hot-mix asphalt paving produced from all new materials.
B. Herbicide: Commercial chemical for weed control, registered by the EPA, and not classified as "restricted use" for locations and conditions of application. Provide in granular, liquid, or wettable powder form.

2.4 MIXES
A. Hot-Mix Asphalt: Dense-graded, hot-laid, hot-mix asphalt plant mixes complying with the following requirements:
   1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.
   2. Base Course: Use coarse aggregate complying with 2.1.A and fine aggregate complying with 2.1.B, or alternately, reclaimed asphalt pavement or reclaimed Portland cement concrete complying with 2.1.A and 2.1.B.
   3. Surface Course: Percent density between 94.5 and 97.5; HVEEM Stability Percent not less than 35.

PART 3 - EXECUTION
3.1 PATCHING
A. Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into perimeter of adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.
B. Portland Cement Concrete Pavement: Break cracked slabs and roll as required to reseat concrete pieces firmly.
   1. Remove disintegrated or badly cracked pavement. Excavate rectangular or trapezoidal patches, extending into perimeter of adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Recompact existing unbound-aggregate base course to form new subgrade.
C. Tack Coat: Before placing patch material, apply tack coat uniformly to vertical asphalt surfaces abutting the patch. Apply at a rate of 0.22 gal./sq. yd.
   1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
   2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.
D. Placing Patch Material: Fill excavated pavement areas with hot-mix asphalt base mix for full thickness of patch and, while still hot, compact flush with adjacent surface.

3.2 SURFACE PREPARATION
A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.
B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
C. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.22 gal./sq. yd.
   1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

### 3.3 PLACING HOT-MIX ASPHALT

A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand in areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
   1. Spread mix at a minimum temperature of 250 deg F.
   2. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.

B. Place paving in consecutive strips.

C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

### 3.4 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.
   1. Complete compaction before mix temperature cools to 185 deg F.

B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
   1. Average Density: 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent or greater than 96 percent.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.

F. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

G. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

### 3.5 INSTALLATION TOLERANCES

A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:
   1. Base Course: Plus or minus 1/2 inch.
   2. Surface Course: Plus 1/4 inch, no minus.

B. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:
   1. Base Course: 1/4 inch.
2. Surface Course: 1/8 inch.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Replace and compact hot-mix asphalt where core tests were taken.

C. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

END OF SECTION
SECTION 32 13 13
CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes Concrete Paving.
   1. Driveways – NOT USED
   2. Roadways – NOT USED
   3. Parking lots – NOT USED
   4. Curbs and gutters.
   5. Walks and equipment pads.

B. No Concrete Paving proposed for driving surfaces
   1. Plans provided with these specifications dictate asphalt pavement for driving surfaces of parking lot and park road
   2. If plans are subsequently modified for parking lot and/or park road to be constructed of reinforced concrete pavement, Contractor shall submit proposed specifications for review and approval for Concrete Paving to be used for parking and roadway surfaces

1.2 RELATED DOCUMENTS

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

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
B. Samples: For each type of product, ingredient, or admixture requiring color selection.
C. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
D. Test reports from independent testing agency qualified to perform testing on concrete paving mixtures.

1.4 QUALITY ASSURANCE

A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94 requirements for production facilities and equipment.
   1. Manufacturer certified according to NRMCA’s “Certification of Ready Mixed Concrete Production Facilities” (Quality Control Manual - Section 3, “Plant Certification Checklist”).

1.5 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified independent testing agency to perform preconstruction testing on concrete paving mixtures.
PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL
A. ACI Publications: Comply with ACI 301 unless otherwise indicated.

2.2 STEEL REINFORCEMENT
A. Steel Welded-Wire Reinforcement: ASTM A 82, in which longitudinal and transverse wires have been electrically welded at points of intersection. Welds shall have sufficient strength not to be broken during handling or placing. Conform welding and fabrication of fabric sheets to ASTM A 185.
B. Reinforcing Bars: ASTM A 615, Grade 60; deformed.
C. Joint Dowel Bars: ASTM A 615, Grade 60 plain-steel bars. Cut bars true to length with ends square and free of burrs.
D. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded-wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified.

2.3 CONCRETE MATERIALS
A. Cementitious Materials: Use the following cementitious materials, of same type, brand, and source throughout Project:
   1. Portland Cement: ASTM C 150, gray portland cement Type I or Type III.
B. Coarse Aggregates: ASTM C 33, using gradation within the following limits when graded in accordance with ASTM C 136.

<table>
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<th>Sieve Designation (Square Openings)</th>
<th>Percentage by Weight</th>
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<tr>
<td>Retained on 1-3/4” sieve</td>
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<td>Retained on 1-1/2” sieve</td>
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<td>Retained on 3/4” sieve</td>
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<td>Retained on 3/8” sieve</td>
<td>70 to 90</td>
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<tr>
<td>Retained on No. 4 sieve</td>
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</table>
C. Fine Aggregates: ASTM C 33, using gradation within the following limits when graded in accordance with ASTM C 136.

<table>
<thead>
<tr>
<th>Sieve Designation (Square Openings)</th>
<th>Percentage by Weight</th>
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</thead>
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<td>Retained on 3/8” sieve</td>
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<td>Retained on No. 8 sieve</td>
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<td>65 to 90</td>
</tr>
</tbody>
</table>
Retained on No. 100 sieve | 90 to 100
---|---
Retained on No. 200 sieve | 97 to 100

E. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.
F. Potable water, free of oils, acids, alkalizes, organic matter or other deleterious substances, meeting requirements of ASTM C 94.
G. Water Reducer: Water reducing admixture conforming to requirements of ASTM C 494 may be used when required to improve workability of concrete.

2.4 CURING MATERIALS
A. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry.
B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
C. Water: Potable.
D. Liquid Membrane Forming Curing Compound: ASTM C 309, shall restrict water loss to not more than 0.55 kg/m² in 72 hours using test method ASTM C 156.

2.5 RELATED MATERIALS
A. Joint Fillers: ASTM D 1751, asphalt-saturated cellulosic fiber or comparable ASTM D 1751 compliant preformed strips.
B. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.

2.6 CONCRETE MIXTURES
A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.
B. Manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:
   1. Air Content: 4-1/2 percent plus or minus 1-1/2 percent.
C. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.
D. Concrete Mixtures: Normal-weight concrete.
   2. Maximum W/C Ratio at Point of Placement: 0.45.
   3. Slump Limit: 5 inches maximum, tested according to ASTM C 143.

2.7 CONCRETE MIXING
A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94. Furnish batch certificates for each batch discharged and used in the Work.
PART 3 - EXECUTION

3.1 EXAMINATION
   A. Proof-roll prepared subbase surface below concrete paving to identify soft pockets and areas of excess yielding.

3.2 PREPARATION
   A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.3 EDGE FORMS AND SCREED CONSTRUCTION
   A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.
   B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 STEEL REINFORCEMENT INSTALLATION
   A. Comply with CRSI's “Manual of Standard Practice” for fabricating, placing, and supporting reinforcement.

3.5 JOINTS
   A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.
   B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.
   C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.
   D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness:
   E. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 3/8-inch radius. Repeat tooling of edges after applying surface finishes.

3.6 CONCRETE PLACEMENT
   A. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.
   B. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.
   C. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
   D. Screed paving surface with a straightedge and strike off.
   E. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleedwater appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

3.7 FLOAT FINISHING
   A. General: Do not add water to concrete surfaces during finishing operations.
   B. Float Finish: Begin the second floating operation when bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand
floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

1. Burlap Finish: Drag a seamless strip of damp burlap across float-finished concrete, perpendicular to line of traffic, to provide a uniform, gritty texture.


3. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.

C. Slip-Resistive Aggregate Finish: Before final floating, spread slip-resistive aggregate finish on paving surface according to manufacturer’s written instructions.

   1. Cure concrete with curing compound recommended by slip-resistive aggregate manufacturer. Apply curing compound immediately after final finishing.

   2. After curing, lightly work surface with a steel-wire brush or abrasive stone and water to expose nonslip aggregate.

3.8 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Comply with ACI 306.1 for cold-weather protection.

C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer’s written instructions after placing, screeding, and bull floating or darbying concrete but before float finishing.

D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these.

3.9 PAVING TOLERANCES

A. Comply with tolerances in ACI 117 and as follows:

   1. Elevation: 1/2 inch.


   3. Surface: Gap below 10-feet-long; unleveled straightedge not to exceed 1/8 inch.

   4. Joint Spacing: 3 inches.

   5. Contraction Joint Depth: Plus 1/4 inch, no minus.


3.10 REPAIR AND PROTECTION

A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.

B. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.
C. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION
SECTION 32 13 73
CONCRETE PAVING JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY
A. Section Includes:
   1. Cold-applied joint sealants.
   2. Joint-sealant backer materials.
   3. Primers.

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

1.3 PREINSTALLATION MEETINGS
A. Refer to general conditions.

1.4 ACTION SUBMITTALS
A. Product Data: For each type of product.
B. Paving-Joint-Sealant Schedule: Include the following information:
   1. Joint-sealant application, joint location, and designation.
   2. Joint-sealant manufacturer and product name.

1.5 INFORMATIONAL SUBMITTALS
A. Product certificates.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL
A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

2.2 COLD-APPLIED JOINT SEALANTS
A. Single-Component, Nonsag, Silicone Joint Sealant: ASTM D 5893/D 5893M, Type NS.
B. Single-Component, Self-Leveling, Silicone Joint Sealant: ASTM D 5893/D 5893M, Type SL.

2.3 JOINT-SEALANT BACKER MATERIALS
A. Round Backer Rods for Cold-Applied Joint Seals: ASTM D 5249, Type 3, of diameter and density required to control joint-sealant depth and prevent bottom-side adhesion of sealant.
B. Backer Strips for Cold- and Hot-Applied Joint Sealants: ASTM D 5249; Type 2; of thickness and width required to control joint-sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.
2.4 PRIMERS
   A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated.

PART 3 - EXECUTION

3.1 INSTALLATION OF JOINT SEALANTS
   A. Comply with joint-sealant manufacturer’s written installation instructions for products and applications indicated unless more stringent requirements apply.
   B. Cleaning of Joints: Clean out joints immediately to comply with joint-sealant manufacturer’s written instructions.
   C. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer.
   D. Joint-Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions.
   E. Install joint-sealant backings to support joint sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
      1. Do not leave gaps between ends of joint-sealant backings.
      2. Do not stretch, twist, puncture, or tear joint-sealant backings.
      3. Remove absorbent joint-sealant backings that have become wet before sealant application and replace them with dry materials.
   F. Install joint sealants immediately following backing installation, using proven techniques that comply with the following:
      1. Place joint sealants so they fully contact 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.
   G. Tooling of Nonsag Joint Sealants: Immediately after joint-sealant application and before skinning or curing begins, tool sealants according to the following requirements to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint:
      1. Remove excess joint sealant from surfaces adjacent to joints.
      2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.
   H. Provide joint configuration to comply with joint-sealant manufacturer’s written instructions unless otherwise indicated.
   I. Clean off excess joint sealant as the Work progresses, by methods and with cleaning materials approved in writing by joint-sealant manufacturers.

END OF SECTION
SECTION 32 17 13
PARKING BUMPERS

PART 1 - GENERAL

1.01 SUBMITTALS
A. Product Data: Catalog cuts, specifications, and installation instructions for precast bumpers.
B. Quality Control Submittals:
   1. Test Reports: Random freeze thaw tests shall be conducted by the manufacturer. Test specimens shall retain 60 percent of its initial modulus of elasticity after 300 cycles. Furnish test results to the Director upon request.

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

PART 2 - PRODUCTS

2.01 MATERIALS
A. Precast Concrete: Normal weight, 5000 psi, air entrained concrete. Air content shall be 6 percent by volume within an allowable tolerance of plus or minus 1.5 percent.
B. Bar Reinforcement: ASTM A 615, Grade 40, deformed.
C. Setting Pins: 3/4 x 18 inches galvanized steel.

2.02 FABRICATION
A. Parking bumpers shall be cast at the manufacturer’s plant, not at the job site. Castings shall have plane smooth surfaces, true to line and face, free from defects and sharp arises. Overall dimensions for castings shall not vary more than 1/16 inch from those indicated.

PART 3 - EXECUTION

3.01 INSTALLATION
A. Center each unit between parking bay lines.
B. Anchor each parking bumper with two setting pins driven through precast or drilled holes into the subgrade or pavement below.

END OF SECTION
SECTION 32 17 23
PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 SUMMARY
A. Section includes painted markings applied to concrete pavement.

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

1.3 PREINSTALLATION MEETINGS
A. Refer to general conditions.

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

PART 2 - PRODUCTS

2.1 PAVEMENT-MARKING PAINT
A. Pavement-Marking Paint: MPI #32, alkyd traffic-marking paint.
B. Glass Beads: AASHTO M 247, Type 1.

PART 3 - EXECUTION

3.1 PAVEMENT MARKING
A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect and Engineer.
B. Allow paving to age for a minimum of 30 days before starting pavement marking.
C. Sweep and clean surface to eliminate loose material and dust.
D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.
   1. Apply graphic symbols and lettering with paint-resistant, die-cut stencils. Apply paint so that it cannot run beneath the stencil.
   2. Broadcast glass beads uniformly into wet markings at a rate of 6 lb/gal.

END OF SECTION
SECTION 32 3113
CHAIN LINK FENCE

PART 1 GENERAL

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

1.2 SUMMARY
A. This Section includes the following:
   1. Polyvinyl Chloride (PVC) coated steel chain link fence and gates.

1.3 APPLICABLE PUBLICATIONS
A. American Society for Testing and Materials Standards (ASTM):
   1. F668 - Standard Specification for Polyvinyl Chloride (PVC) and Other Organic Polymer- Coated Steel Chain-Link Fence Fabric
   2. F 1043 - Standard Specification for Strength and Protective Coatings on Steel Industrial Chain Link Fence Framework
   3. F 1083 - Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures
   5. A 653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
   8. A 875 - Standard Specification for Steel Sheet, Zinc-5 % Aluminum Alloy-Coated by the Hot-Dip Process
   9. A 400 - Standard Practice for Steel Bars, Selection Guide, Composition, and Mechanical Properties
   10. F 626 - Standard Specification for Fence Fittings
   11. A 153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
   17. F 567 - Standard Practice for Installation of Chain-Link Fence

1.4 SUBMITTALS
A. Product data in the form of manufacturer’s technical data, specifications, and installation instructions for fence and gate posts, fabric, gates, and accessories.
B. Shop drawings showing location of fence, gates, each post, and details of post installation, extension arms, gate swing, hardware, and accessories.
C. Samples for initial selection of PVC color in form of manufacturer’s color charts or 6-inch lengths of actual fabric wire showing colors available.
D. Samples for verification of PVC color in form of 6-inch lengths of actual fabric wire to be used in color selected.
   1. Include similar samples of PVC applied on posts, rails, and accessories in color selected.

1.5 QUALITY ASSURANCE
A. Single-Source Responsibility: Obtain chain link fences and gates as complete units, including necessary erection accessories, fittings, and fastenings from a single source of manufacturer.
PART 2 PRODUCT

2.1 MANUFACTURERS
A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. PVC Coated Galvanized Steel Fencing and Fabric:
      a. Master Halco, Inc.
      b. American Chain Link Fence Company
      c. Anchor Fence, Inc.
      d. BWF Fence Systems
      e. Colorguard Fence Products, Inc.
      f. Cyclone Fence Dvi./USX Corp.
      g. Semmerling Fence & Supply, Inc.

2.2 FABRIC
A. Selvage: Fabric 72 inches high and over with 3/8” mesh shall be knuckled at one selvage and twisted at the other. All mesh 60 inches high and under shall be knuckled at both selvages.
B. Steel Fabric: Comply with Chain Link Fence Manufacturers Institute (CLFMI) Product Manual. Furnish one-piece fabric widths for fencing up to 12 feet high. Wire size includes zinc or aluminum coating.
   1. Size: 2-inch mesh, 9 gage (0.148-inch diameter) wire.
   2. Polyvinyl Chloride (PVC) Finish Comply with ASTM F668, with core wire diameter (gage) measured prior to application of PVC coating with not less than 0.40 oz. zinc per sq. ft. Or uncoated surface on 6 gage wire and not less than 0.30 oz. Zinc per sq. ft. of uncoated surface on 9 and 11 gage wire. Color selected by Architect from manufacturers standard colors available.
      a. Class 2, minimum 0.006-inch, maximum 0.025-inch-thick PVC coating thermally bonded and adhered to a cured primer applied over zinc-coated steel core wire.
         1) Class 2a, 0.015- to 0.0025-inch thick PVC coating extruded and adhered to zinc-coated steel wire.

2.3 FRAMING
A. Strength requirements for posts and rails conforming to ASTM F 1043.
B. Pipe shall be straight, true to section, material, and sizes specified, and shall conform to the following weights per foot:

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<tr>
<th>NPS in inches</th>
<th>Outside Diameter (OD) in inches</th>
<th>Type I Steel</th>
<th>Type II Steel</th>
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<td>1-1/4</td>
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<td>3.65</td>
<td>3.12</td>
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</tr>
<tr>
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<td>5.79</td>
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</table>

C. Steel Framework, General: Posts, rails, braces, gate frames.
   1. Type I pipe: Hot-dipped galvanized steel pipe conforming to ASTM F 1083, plain ends, standard weight (schedule 40) with not less than 1.8 oz. zinc per sq. ft. of surface area coated.
   2. Type II Pipe: Manufactured from steel conforming to ASTM A 1011 or A 653, grade D, cold formed, electric welded with minimum yield strength of 50,000 psi and triple coated with minimum 0.9 oz. zinc per sq. ft. after welding, a chromate conversion coating and a clear polymer overcoat. Corrosion protection
on inside surfaces shall protect the metal from corrosion when subjected to the salt spray test of ASTM B 117 for 300 hours with the end point of 5 percent Red Rust.

3. **C Section:** Rolled form steel shapes conforming to ASTM F 669, group II produced from steel conforming to A 653, grade D, or ASTM A 1011, grade 45, cold formed, hot-dip galvanized with minimum 2.0 oz. zinc per sq. ft. of surface area conforming to ASTM A 123 or ASTM A 653; or 5 percent aluminum-mischmetal coated with minimum 1.0 oz. coating per sq. ft. of surface area each side conforming to ASTM A 875.

4. **H Section:** Hot-rolled steel H shape with minimum yield strength of 45,000 psi conforming to ASTM F 669, group m and hot-dip galvanized with minimum 2.0 oz. zinc per sq. ft. of surface area conforming to ASTM A 123.

5. **Square Tubing:** Fabricated from steel conforming to ASTM A 400, grade B and hot-dip galvanized with minimum 2.0 oz. zinc per sq. ft. of surface area conforming to ASTM A 123.

6. **Polyvinyl Chloride (PVC) Finish:** Provide framework fittings, and accessories with manufacturer’s standard polyvinyl chloride (PVC) plastic resin finish thermally bonded and adhered to a cured primer applied over zinc-coated steel not less than 10 mils (0.010-inch) thick. Color to match chain link fabric.

D. **End, corner, and pull posts** for following fabric heights:

1. **Over 6 feet:** 2.875-inch OD Type I or II steel pipe, 2.50-inch - square steel tubing weighting 5.10 lbs. per lin. ft., or 3.5-inch by 3.5-inch roll-formed sections weighting 4.85 lbs. per lin. ft.

E. **Line or intermediate posts** for following fabric heights:

1. **Over 6 feet:** 2.375-inch OD Type I or II steel pipe, 2.25-inch by 1.70-inch C section weighting 2.70 lbs. per lin. Ft., or 2.25-inch by 1.70-inch galvanized steel H section weighting 3.26 lb. per lin. ft.

F. **Gate Posts:** Furnish posts for supporting single gate leaf for nominal gate widths as follows:

1. **Over 6 feet to 13 feet:** 4.00-inch OD Type I or II steel pipe.

G. **Top Rail:** Manufacturer’s longest lengths, with expansion-type couplings, approximately 6 inches long, for each joint. Provide means for attaching top rail securely to each gate corner, pull and end posts.

1. **Galvanized Steel:** 1-1/4-inch NPS (1.66-inch OD) Type I or II steel pipe or 1:625-inch by 1.25-inch roll-formed C sections weighing 1.35 lb. per ft.

### 2.4 FITTINGS AND ACCESSORIES

A. **Material:** Comply with ASTM F 626. Mill-finished aluminum or galvanized iron or steel to suit manufacturer’s standards.

1. **Zinc Coating** unless specified otherwise, galvanize steel fence fittings and accessories in accordance with ASTM A 153, with zinc weights per Table I.

B. **Bottom and Tie Wires:** 12-gage (0.106-inch diameter) galvanized steel with a minimum of 0.80 oz. per square foot of zinc coating of surface area in accordance with ASTM A 641, Class 3 or 9- gage (0.106-inch-diameter) aluminum wire alloy 1100-H14 or equal to match fabric core material.

C. **Center Rail:** Same material as top rail. Provide manufacturer’s standard galvanized steel or cast iron or cast aluminum cap for each end.

D. **Post and Line Caps:** Provide weather tight closure cap for each post. Provide line post caps with loop to receive tension wire or top rail.

E. **Tension or Stretcher Bars:** Hot-dip galvanized steel with minimum length 2 inches less than full height of fabric, minimum cross-section of 3/16 inch by 3/4 inch and minimum 1.2 oz. zinc coating per sq. ft. of surface area. Provide one bar for each gate and end post, and two for each corner of pull post, except where fabric is integrally woven into post.

F. **Tension and Brace Bands:** Minimum ¾-inch-wide hot-dip galvanized steel with minimum 1.2 oz. zinc coating per sq. ft. of surface area.

1. **Tension Bands:** Minimum 14 gage (0.074 inch) thick.
2. **Tension and Brace Bands:** Minimum 12 gage (0.105 inch) thick.
G. Concrete: Provide concrete consisting of Portland cement, ASTM C 150, aggregates ASTM C 33, and clean water. Mix materials to obtain concrete with a minimum 28-day compressive strength of 2500 psi. Use at least 4 sacks of cement per cu. yd. 1-inch maximum size aggregate, maximum 3-inch slump, and 2 to 4 percent entrained air.

2.5 GATES

A. Fabrication: Fabricate perimeter frames of gates from metal and finish to match fence framework. Assemble gate frames by welding. Provided horizontal and vertical members to ensure proper gate operation and attachment to fabric, hardware, and accessories. Space frame members maximum of 8 feet apart unless otherwise indicated.

1. Provide same fabric as for fence unless otherwise indicated. Install fabric with tension bars and bands at vertical edges and at top and bottom edges.
2. Install diagonal cross-bracing consisting of 3/8-inch diameter adjustable-length truss rods on gates to ensure frame rigidity without sag or twist.

B. Swing Gates: Comply with ASTM F 900.

1. Steel:
   a. Over 6 feet high and 8 feet wide: Fabricate perimeter frames of minimum 1.90-inch OD Type I or II steel pipe or 2.00-inch square galvanized steel tubing weighing 2.60 lb. per sq. ft.
2. Gate Hardware: Provide hardware and accessories for each gate, galvanized per 153, and in accordance with the following:
   a. Hinges: Size and material to suit gate size, non-lift-off type, offset to permit 180-deg. gate opening. Provide 1-112 pair of hinges for each leaf over 6-foot nominal height.
   b. Latch forked type or plunger-bar type to permit operation from either side of gate with padlock eye as integral part of latch.

C. Sliding Gates: Comply with ASTM F 1184.

1. Type II Cantilever: Provide manufacturer's standard top rail incorporating track for top roller and guide posts to keep gate on rollers. External rollers shall have accessible grease fittings and internal rollers shall have sealed lubricant ball bearings. Brace frame to prevent sagging and apply fabric to entire gate. Provide lockable positive latch and other hardware and accessories as required.

PART 3 EXECUTION

3.1 INSTALLATION

A. General: Install fence in compliance with ASTM F 567. Do not begin installation and erection before final grading is completed, unless otherwise permitted.

B. Setting Posts: Center and align posts in holes 3 inches above bottom of excavation. Space maximum 10 feet o.c., unless otherwise indicated.

1. Protect portion of posts above ground from concrete splatter. Place concrete around posts and vibrate or tamp for consolidation. Check each post for vertical and top alignment, and hold in position during placement and finishing operations.
   a. Unless otherwise indicated, extend concrete footings 2 inches above grade and trowel to a crown to shed water.

C. Top Middle Rails: Run rail continuously through line post caps, and at the vertical mid-point, bending to radius for curved runs and at other posts terminating into rail end attached to posts or post caps fabricated to receive rail. Provide expansion couplings as recommended by fencing manufacturer.

D. Brace Assemblies: Install braces so posts are plumb when diagonal rod is under proper tension.

E. Bottom Tension Wire: Install tension wire within 6 inches of bottom of fabric before stretching fabric and tie to each post with no less than same gage and type of wire. Pull wire taut, without sags. Fasten fabric to tension wire with 11-gage hog rings of same material and finish as fabric wire, spaced maximum 24 inches o.c.
F. Fabric: Leave approximately 2 inches between finish grade and bottom selvage unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Install fabric on security side of fence, and anchor to framework so that fabric remains in tension after pulling force is released.

G. Tension or Stretcher Bars: Thread through or clamp to fabric 4 inches o.c., and secure to end, corner, pull and gate posts with tension bands spaced no over 15 inches o.c.

H. Tie Wires: Use U-shaped wire of proper length to secure fabric firmly to posts and rails with ends twisted at least 2 full turns. Bend ends of wire to minimize hazard to persons or clothing.
   1. Maximum Spacing Tie fabric to line posts 12 inches o.c. and to rails and braces 24 inches.

I. Fasteners: Install nuts for tension bands and hardware bolts on side of fence opposite fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

J. Gates: Install gates plumb, level and secure for full opening without interference. Install ground- set items in concrete for anchorage. Adjust hardware to smooth operation and lubricate where necessary.

K. Barbed Wire: Pull wire taut and install securely to extension arms and secure to end post or terminal arms in accordance with manufacturer’s instructions.

END OF SECTION
SECTION 33 11 13
FACILITY WATER DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 SUMMARY
   A. This Section includes water-distribution piping and related components outside the building for water service and fire-service mains.

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

1.3 ACTION SUBMITTALS
   A. Product Data: For each type of product indicated.
   B. Shop Drawings: Detail precast concrete vault assemblies and indicate dimensions, method of field assembly, and components.

1.4 INFORMATIONAL SUBMITTALS
   A. Field quality-control test reports.

1.5 CLOSEOUT SUBMITTALS
   A. Operation and maintenance data.

1.6 QUALITY ASSURANCE
   A. Regulatory Requirements:
      1. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.
      2. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.
      3. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.
   B. Piping materials shall bear label, stamp, or other markings of specified testing agency.
   C. Comply with ASTM F 645 for selection, design, and installation of thermoplastic water piping.
   D. Comply with FMG's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.
   E. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.
   F. NSF Compliance:
      1. Comply with NSF 14 for plastic potable-water-service piping.
      2. Comply with NSF 61 Annex G for materials for water-service piping and specialties for domestic water.

1.7 PROJECT CONDITIONS
   A. Interruption of Existing Water-Distribution Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water-distribution service according to requirements indicated:
1. Notify Construction Manager and Owner no fewer than two days in advance of proposed interruption of service.
2. Do not proceed with interruption of water-distribution service without Construction Manager's written permission.

1.8 COORDINATION
   A. Coordinate connection to water main with utility company.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS
   A. PVC, AWWA Pipe: AWWA C900, Class 150, with bell end with gasket, and with spigot end.
      1. Comply with UL 1285 for fire-service mains if indicated.
      2. PVC Fabricated Fittings: AWWA C900, Class 150, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.
      3. PVC Molded Fittings: AWWA C907, Class 150, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.
      4. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
      5. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
         a. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

2.2 JOINING MATERIALS
   A. Plastic Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

2.3 PIPING SPECIALTIES
   A. Transition Fittings: Manufactured fitting or coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.
   B. Tubular-Sleeve Pipe Couplings:
      1. Description: Metal, bolted, sleeve-type, reducing or transition coupling, with center sleeve, gaskets, end rings, and bolt fasteners and with ends of same sizes as piping to be joined.

2.4 BALL VALVES
   A. PVC Ball Valves:
      1. PVC Type 1
      2. Grade 1 Molding
      3. Teflon ball seals
      4. True union design
      5. Minimum 200psi rating
2.5 BALL VALVE ACCESSORIES AND SPECIALTIES
A. Valve Boxes: Oldcastle CMB36 B09 meter box enclosure with concrete or cast-iron lid.

2.6 CORPORATION VALVES
A. Service-Saddle Assemblies: Comply with AWWA C800. Include saddle and valve compatible with tapping machine.
   1. Service Saddle: Copper alloy with seal and AWWA C800, threaded outlet for corporation valve.
   2. Corporation Valve: Bronze body and ground-key plug, with AWWA C800, threaded inlet and outlet matching service piping material.
   3. Manifold: Copper fitting with two to four inlets as required, with ends matching corporation valves and outlet matching service piping material.
B. Curb Valves: Comply with AWWA C800. Include bronze body, ground-key plug or ball, and wide tee head, with inlet and outlet matching service piping material.
C. Service Boxes for Curb Valves: Similar to AWWA M44 requirements for cast-iron valve boxes. Include cast-iron telescoping top section of length required for depth of burial of valve, plug with lettering "W," and bottom section with base that fits over curb valve and with a barrel approximately 3 inches (75 mm) in diameter.
   1. Shutoff Rods: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and slotted end matching curb valve.

PART 3 - EXECUTION

3.1 EARTHWORK
A. Refer to Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS
A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications.
B. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used, unless otherwise indicated.
C. Do not use flanges or unions for underground piping.
D. Flanges, unions, and special fittings may be used, instead of joints indicated, on aboveground piping and piping in vaults.

3.3 VALVE APPLICATIONS
A. General Application: Use mechanical-joint-end valves for NPS 3 and larger underground installation. Use threaded- or flanged-end valves for installation in vaults. Use corporation valves and curb valves with ends compatible with piping, for NPS 1 and smaller installation.
B. Drawings indicate valve types to be used.

3.4 PIPING INSTALLATION
A. Water-Main Connection: Arrange with utility company for tap of size and in location indicated in water main.
B. Water-Main Connection: Tap water main according to requirements of water utility company and of size and in location indicated.
C. Comply with NFPA 24 for fire-service-main piping materials and installation.
   1. Install copper tube and fittings according to CDA's "Copper Tube Handbook."
D. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.
E. Install PE pipe according to ASTM D 2774 and ASTM F 645.
F. Install PVC, AWWA pipe according to ASTM F 645 and AWWA M23.
G. Bury piping with depth of cover over top at least 24 inches, with top at least 12 inches below level of maximum frost penetration.
H. Extend water-service piping and connect to water-supply source and building-water-piping systems at outside face of building wall in locations and pipe sizes indicated.
   1. Terminate water-service piping at building wall until building-water-piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building-water-piping systems when those systems are installed.
I. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.

3.5 JOINT CONSTRUCTION
A. Make pipe joints according to the following:
   4. PE Piping Insert-Fitting Joints: Use plastic insert fittings and fasteners according to fitting manufacturer's written instructions.
   5. PVC Piping Gasketed Joints: Use joining materials according to AWWA C900. Construct joints with elastomeric seals and lubricant according to ASTM D 2774 or ASTM D 3139 and pipe manufacturer's written instructions.
   6. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, with OD, and with system working pressure.

3.6 ANCHORAGE INSTALLATION
A. Anchorage, General: Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include the following:
   1. Concrete thrust blocks.
   2. Locking mechanical joints.
   4. Bolted flanged joints.
   5. Heat-fused joints.
   6. Pipe clamps and tie rods.
B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:
   2. Gasketed-Joint, PVC Water-Service Piping: According to AWWA M23.
3.7 VALVE INSTALLATION
   A. Comply with AWWA C600 and AWWA M44, as applicable. Install each underground valve with stem pointing up and with valve box/vault.

3.8 BACKFLOW PREVENTER INSTALLATION
   A. Install backflow preventers of type, size, and capacity indicated. Include valves and test cocks. Install according to requirements of plumbing and health department and authorities having jurisdiction.
   B. Do not install backflow preventers that have relief drain in vault or in other spaces subject to flooding.
   C. Do not install bypass piping around backflow preventers.
   D. Support NPS 2-1/2 and larger backflow preventers, valves, and piping near floor and on brick or concrete piers.

3.9 WATER METER BOX INSTALLATION – Not used

3.10 CONCRETE VAULT INSTALLATION – Not used

3.11 CONNECTIONS
   A. Connect water-distribution piping to existing public water main using methods and materials specified on Utility Plans.
   B. Connect water-distribution piping to interior existing domestic water and fire-suppression piping using methods and materials specified on Utility Plans.

3.12 FIELD QUALITY CONTROL
   A. Piping Tests: Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.
   B. Hydrostatic Tests: Test at not less than one-and-one-half times working pressure for two hours.
   C. Prepare reports of testing activities.

3.13 IDENTIFICATION
   A. Install continuous underground warning tape during backfilling of trench for underground water-distribution piping. Locate below finished grade, directly over piping. Underground warning tapes are specified in Section 312000 “Earth Moving.”

3.14 CLEANING
   A. Clean and disinfect water-distribution piping as follows:
      1. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.
      2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.
      3. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or do as follows:
a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours.

b. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow to stand for 3 hours.

c. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.

d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.

B. Prepare reports of purging and disinfecting activities.

END OF SECTION
SECTION 33 31 13
FACILITY SANITARY SEWERS

PART 1 - GENERAL

1.1 SUMMARY
A. Section Includes:
   1. Nonpressure-type transition couplings.
   2. Pressure-type pipe couplings.
   3. Expansion joints and deflection fittings.
   4. Backwater valves.
   5. Cleanouts.
   7. Concrete.

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

1.3 ACTION SUBMITTALS
A. Product Data: For each type of product.
B. Shop Drawings: For manholes. Include plans, elevations, sections, details, and frames and covers.

1.4 INFORMATIONAL SUBMITTALS
A. Coordination Drawings: Manufacturer’s product drawings.
B. Product Certificates: For each type of pipe and fitting.
C. Field quality-control reports.

PART 2 - PRODUCTS

2.1 PVC PIPE AND FITTINGS
A. PVC Type PSM Sewer Piping:
   1. Pipe: ASTM D 3034, SDR 26, PVC Type PSM sewer pipe with bell-and-spigot ends for gasketed joints.
   2. Fittings: ASTM D 3034, PVC with bell ends.

2.2 NONPRESSURE-TYPE TRANSITION COUPLINGS
A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling; for joining underground nonpressure piping. Include ends of same sizes as piping to be joined and include corrosion-resistant-metal tension band and tightening mechanism on each end.
B. Sleeve Materials:
   1. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
2. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

C. Unshielded, Flexible Couplings:
   1. Description: Elastomeric sleeve with stainless-steel shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.

D. Ring-Type, Flexible Couplings:
   1. Description: Elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.

E. Nonpressure-Type, Rigid Couplings:
   1. Description: ASTM C 1461, sleeve-type, reducing- or transition-type mechanical coupling; molded from ASTM C 1440, TPE material; with corrosion-resistant-metal tension band and tightening mechanism on each end.

2.3 BACKWATER VALVES

A. Cast-Iron Backwater Valves:
   1. Description: ASME A112.14.1, gray-iron body and bolted cover, with bronze seat.
   2. Horizontal type; with swing check valve and hub-and-spigot ends.
   3. Combination horizontal and manual gate-valve type; with swing check valve, integral gate valve, and hub-and-spigot ends.
   4. Terminal type; with bronze seat, swing check valve, and hub inlet.

B. PVC Backwater Valves:
   1. Description: Horizontal type; with PVC body, PVC removable cover, and PVC swing check valve.

2.4 CLEANOUTS

A. Cast-Iron Cleanouts:
   1. Description: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.
   3. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

2.5 MANHOLES

A. Standard Precast Concrete Manholes:
   1. Description: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
   2. Diameter: 48 inches minimum unless otherwise indicated.
   3. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
   4. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section; with separate base slab or base section with integral floor.
   5. Riser Sections: 4-inch minimum thickness, of length to provide depth indicated.
6. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated; with top of cone of size that matches grade rings.


8. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.

9. Steps: Individual FRP steps or FRP ladder wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches.

10. Adjusting Rings: Interlocking HDPE rings, with level or sloped edge in thickness and diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.

11. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, with diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope.

B. Manhole Frames and Covers:
   1. Description: Ferrous; 24-inch ID by 7- to 9-inch riser, with 4-inch- minimum-width flange and 26-inch-diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "SANITARY SEWER."

2.6 CONCRETE

A. General: Cast-in-place concrete complying with ACI 318, ACI 350, and the following:
   1. Cement: ASTM C 150/C 150M, Type II.

B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio.
   2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 deformed steel.

C. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes.
   1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.
      a. Invert Slope: 0.1 foot across manhole.
   2. Benches: Concrete, sloped to drain into channel.
      a. Slope: 8.33 percent (1 inch per foot).

D. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 maximum water/cementitious materials ratio.
   2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 deformed steel.
PART 3 - EXECUTION

3.1 EARTHWORK
   A. Excavating, trenching, and backfilling are specified in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION
   A. General Locations and Arrangements: Drawing plans and details to indicate general location and arrangement of underground sanitary sewer piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer’s written instructions.
   B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer’s written instructions for using lubricants, cements, and other installation requirements.
   C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.
   D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
   E. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.
   F. Install gravity-flow, nonpressure, drainage piping according to the following:
      1. Install piping pitched down in direction of flow, at slopes indicated on plans.
      2. Install piping with minimum cover.
      4. Install hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook."
      5. Install PVC corrugated sewer piping according to ASTM D 2321 and ASTM F 1668.
      6. Install PVC Type PSM sewer piping according to ASTM D 2321 and ASTM F 1668.
   G. Install corrosion-protection piping encasement over the following underground metal piping according to ASTM A 674 or AWWA C105/A21.5:
      2. Hubless cast-iron soil pipe and fittings.
      3. Expansion joints and deflection fittings.
   H. Clear interior of piping and manholes of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed. Place plug in end of incomplete piping at end of day and when work stops.

3.3 PIPE JOINT CONSTRUCTION
   A. Join gravity-flow, nonpressure, drainage piping according to the following:

4. Join PVC corrugated sewer piping according to ASTM D 2321.

5. Join PVC Type PSM sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric-gasket joints.

6. Join dissimilar pipe materials with nonpressure-type, flexible or rigid couplings.

B. Pipe couplings, expansion joints, and deflection fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

1. Use nonpressure flexible couplings where required to join gravity-flow, nonpressure sewer piping unless otherwise indicated.
   a. Unshielded flexible or rigid couplings for pipes of same or slightly different OD.
   b. Unshielded, increaser/reducer-pattern, flexible or rigid couplings for pipes with different OD.
   c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

3.4 MANHOLE INSTALLATION

A. General: Install manholes complete with appurtenances and accessories indicated.

B. Install precast concrete manhole sections with sealants according to ASTM C 891.

C. Form continuous concrete channels and benches between inlets and outlet.

D. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3 inches above finished surface elsewhere unless otherwise indicated.

3.5 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318.

3.6 BACKWATER VALVE INSTALLATION

A. Install horizontal-type backwater valves in piping manholes or pits.

B. Install combination horizontal and manual gate-type valves in piping and in manholes.

C. Install terminal-type backwater valves on end of piping and in manholes. Secure units to sidewalls.

3.7 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts, and use cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.
   1. Use Medium-Duty, top-loading classification cleanouts in earth or foot traffic areas.
   2. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic service areas.

B. Set cleanout frames and covers in earth in cast-in-place-concrete block, 18 by 18 by 12 inches deep. Set with tops 1 inch above surrounding grade.

C. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.8 CONNECTIONS

A. Connect nonpressure, gravity-flow drainage piping to building's sanitary building drains specified in Section 221316 "Sanitary Waste and Vent Piping."
B. Make connections to existing piping and underground manholes.
   1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye fitting plus 6-inch overlap with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
   2. Make branch connections from side into existing piping, NPS 4 to NPS 20. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
   3. Make branch connections from side into existing piping, NPS 21 or larger, or to underground manholes by cutting opening into existing unit large enough to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of, and be flush with, inside wall unless otherwise indicated. On outside of pipe or manhole wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.
      a. Use concrete that will attain a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.
      b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.
   4. Protect existing piping and manholes to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

3.9 IDENTIFICATION
   A. Comply with requirements in Section 312000 "Earth Moving" for underground utility identification devices. Arrange for installation of green warning tapes directly over piping and at outside edges of underground manholes.
      1. Use warning tape or detectable warning tape over ferrous piping.
      2. Use detectable warning tape over nonferrous piping and over edges of underground manholes.

3.10 FIELD QUALITY CONTROL
   A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
      1. Submit separate report for each system inspection.
      2. Defects requiring correction include the following:
         a. Alignment: Less than full diameter of inside of pipe is visible between structures.
         b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
         c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
         d. Infiltration: Water leakage into piping.
         e. Exfiltration: Water leakage from or around piping.
      3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
      4. Reinspect and repeat procedure until results are satisfactory.
   B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
1. Do not enclose, cover, or put into service before inspection and approval.

2. Test completed piping systems according to requirements of authorities having jurisdiction.

3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.

4. Schedule testing so that no more than 1000 linear feet of installed sewer remains untested at one time.

5. Submit separate report for each test.

6. Hydrostatic Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction and the following:
   a. Fill sewer piping with water. Test with pressure of at least 10-foot head of water, and maintain such pressure without leakage for at least 15 minutes.
   b. Close openings in system and fill with water.
   c. Purge air and refill with water.
   d. Disconnect water supply.
   e. Test and inspect joints for leaks.

7. Manholes: Perform hydraulic test according to requirements of authorities having jurisdiction and the following:
   a. Seal waste water lines coming into manhole with internal pipe plug. Then fill manhole with water and maintain it full for at least one hour.
   b. The max leakages for hydrostatic testing shall be 0.025 gallons per foot diameter per foot of manhole depth per hour.

C. Leaks and loss in test pressure constitute defects that must be repaired.

D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

END OF SECTION