HARDSCAPE
PROJECT SPECIFICATIONS

SECTION 012300 - ALTERNATES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for alternates.

1.2 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.3 PROCEDURES

A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.

1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.

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

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

D. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

1. Alternate No. 1:
   a. Substitute penal grade stainless steel toilet fixtures for all porcelain fixtures specified.

HANDICAPPED WATER CLOSET (HWC)
(Floor Outlet – Flush Valve) (1.28gpf)

Fixture: Acorn – Penal Ware LR 2140-W-2-RM-FVBO-1.28-ADA

WATER CLOSET (WC)
(Floor Outlet – Flush Valve) (1.28gpf)

Fixture: Acorn – Penal Ware LR 2140-W-2-RM-FVBO-1.28

HANDICAPPED URINAL (HUR)
(Floor Outlet) (0.5gpf)

Fixture: Acorn – Penal Ware 1720-W-3

HANDICAPPED LAVATORY (HLAV)
(Wall Mount) (0.5gpm)

Fixture: Acorn – Penal Ware 1652LRB-1-DMS-04-M-H1-OF

The flush valves for the water closets and the urinals will remain the same. The lavatory faucet is part of the fixture for the stainless fixture.

   b. Base Bid: Porcelain toilet fixtures as specified on the plumbing drawings and in the plumbing specifications

2. Alternate No. 2:
   a. Substitute pressure treated wood railing for steel railing shown. Wood railing shall be same hgt. and shall include a beveled 2x4 cap; 2x6 top and bottom rail with 2x2 wd. pickets at same spacing as base bid railing. Include 2(4x4) posts, 4” apart spaced 6’ o.c. Anchor to side of deck with carriage bolts. Bevel 4x4 posts at top and bottom. Submit shop dwgs to confirm design. Use only galvanized anchors and screws. Countersink all anchors for safety. See detail on sheet A4.2.

b. Base Bid: Cor-ten Steel railing w/ wood cap as shown on the drawings.

3. Alternate No. 3:
   a. Substitute polished 4” CMU for smooth 4” CMU and 8x8 lintel blocks above doors in all areas shown on the drawings for both buildings. All lintels steel reinforced.
   b. Base Bid: Install 4” smooth cmu as shown on the drawings and 8x8 lintel blocks smooth fin. All lintels steel reinforced..

END OF SECTION 012300

SECTION 024116 - STRUCTURE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Demolition and removal of buildings and site improvements.
2. Removing below-grade construction.
3. Disconnecting, capping or sealing, and removing site utilities.
4. Salvaging items for reuse by Owner.

1.2 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.3 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Project site.

1.4 INFORMATIONAL SUBMITTALS

A. Predemolition photographs or video.

B. Inventory of items that have been removed and salvaged.

1.5 FIELD CONDITIONS

A. Buildings to be demolished will be vacated and their use discontinued before start of the Work.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

1. Before building demolition, Owner will remove the following items:

a. Consult Owner for these items.

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

D. On-site storage or sale of removed items or materials is not permitted.

E. Arrange demolition schedule so as not to interfere with Owner's on-site operations or operations of adjacent occupied buildings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

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

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

2.2 SOIL MATERIALS

A. Satisfactory Soils: Comply with requirements in Section 312000 "Earth Moving."

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during building demolition operations.

C. Inventory and record the condition of items to be removed and salvaged.

3.2 PREPARATION

A. Salvaged Items: Comply with the following:

   1. Clean salvaged items of dirt and demolition debris.
   2. Pack or crate items after cleaning. Identify contents of containers.
   3. Store items in a secure area until delivery to Owner.
   4. Transport items to storage area designated by Owner.

5. Protect items from damage during transport and storage.

3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Utilities to be Disconnected: Locate, identify, disconnect, and seal or cap off utilities serving buildings and structures to be demolished.
   1. Arrange to shut off utilities with utility companies.
   2. If removal, relocation, or abandonment of utility services will affect adjacent occupied buildings, then provide temporary utilities that bypass buildings and structures to be demolished and that maintain continuity of service to other buildings and structures.
   3. Cut off pipe or conduit a minimum of 24 inches (610 mm) below grade. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing according to requirements of authorities having jurisdiction.
   4. Do not start demolition work until utility disconnecting and sealing have been completed and verified in writing.

3.4 PROTECTION

A. Existing Facilities: Protect adjacent walkways, loading docks, building entries, and other building facilities during demolition operations.

B. Temporary Shoring: Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent unexpected movement or collapse of construction being demolished.

C. Existing Utilities to Remain: Maintain utility services to remain and protect from damage during demolition operations. Do not interrupt existing utilities serving adjacent occupied or operating facilities unless authorized in writing by Owner and authorities having jurisdiction.

D. Temporary Protection: Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction and as indicated. Comply with requirements in Section 015000 "Temporary Facilities and Controls."

   1. Protect adjacent buildings and facilities from damage due to demolition activities.
   2. Protect existing site improvements, appurtenances, and landscaping to remain.
   3. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.
   4. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
   5. Provide protection to ensure safe passage of people around building demolition area and to and from occupied portions of adjacent buildings and structures.
   6. Protect walls, windows, roofs, and other adjacent exterior construction that are to remain and that are exposed to building demolition operations.
   7. Erect and maintain dustproof partitions and temporary enclosures to limit dust, noise, and dirt migration to occupied portions of adjacent buildings.

E. Remove temporary barriers and protections where hazards no longer exist. Where open excavations or other hazardous conditions remain, leave temporary barriers and protections in place.

3.5 DEMOLITION

A. General: Demolish indicated buildings and site improvements completely. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Do not use cutting torches until work area is cleared of flammable materials. Maintain portable fire-suppression devices during flame-cutting operations.
2. Maintain fire watch during and for at least 24 hours after flame-cutting operations.
3. Maintain adequate ventilation when using cutting torches.
4. Locate building demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

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

1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed trafficways if required by authorities having jurisdiction.
2. Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations.

C. Explosives: Use of explosives is not permitted.

D. Proceed with demolition of structural framing members systematically, from higher to lower level. Complete building demolition operations above each floor or tier before disturbing supporting members on the next lower level.

E. Remove debris from elevated portions of the building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

F. Salvage: Items to be removed and salvaged are indicated on Drawings and as requested by the Owner.

G. Demolish foundation walls and other below-grade construction.

1. Remove below-grade construction, including basements, foundation walls, and footings, completely.

H. Existing Utilities: Demolish existing utilities and below-grade utility structures that are within 20 feet outside footprint indicated for new construction. Abandon utilities outside this area.

I. Below-Grade Areas: Completely fill below-grade areas and voids resulting from building demolition operations with satisfactory soil materials recycled pulverized concrete according to backfill requirements in Section 312000 "Earth Moving."

J. Site Grading: Uniformly rough grade area of demolished construction to a smooth surface, free from irregular surface changes. Provide a smooth transition between adjacent existing grades and new grades.

K. Promptly repair damage to adjacent buildings caused by demolition operations.

3.6 CLEANING

A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.

B. Do not burn demolished materials.

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

END OF SECTION 024116

SECTION 03 1000

CONCRETE FORMWORK

PART 1- GENERAL

1.1 DESCRIPTION

A. Related Work Specified Elsewhere:

1. Concrete reinforcement.
2. Cast-in-place concrete.
3. Concrete finishes.

1.2 SUBMITTALS

A. Product Data: Submit copies of manufacturer's product specifications and installation instructions for manufactured products, including form sealer and release agent.

1.3 QUALITY CRITERIA

A. Industry Standards:

1. American Concrete Institute, ACI 301:Specifications for Structural Concrete for
2. American Concrete Institute, ACI 318:Building Code Requirements for Structural Concrete.
3. American Concrete Institute, ACI 347: Recommended Practice for Concrete Formwork.
4. American Concrete Institute, ACI SP-15: Field Reference Manual.
5. Southern Pine Inspection Bureau (SPIB) Grading Rules.
6. Western Wood Products Association (WWPA) Grading Rules.
7. American Plywood Association (APA) Grading Rules.

B. Allowable Tolerances: Construct formwork within tolerance requirements of ACI 347. Maximum deflection of form-facing material between supports is limited to 0.0025 x span.

C. Temporary Formwork Structural Drawings: Design and engineering of formwork are Contractor’s sole responsibility.

PART 2 – PRODUCTS

2.1 FORMING MATERIALS

A. Lumber for unexposed finished work: No.2 Southern Yellow Pine or equal.

B. Plywood for unexposed concrete: C-C EXT-APA, BB Form Ply.

C. Metal or Plastic Forms: Smooth, undented, clean steel or new plastic forms may be used, with
Architect's approval, to achieve rubbed finish.

D. Earth Forms: Forms for foundations may be cut into earth, provided that earth is dry, stable, level

E. Studs, Wales, Supports and Centering: Types required as indicated on formwork shop drawings.

F. Form Ties:

1. For architectural finishes: Break-back type with 5/8-inch removable vinyl sleeve.
2. For all other conditions: Ties with 1½-inch break back.

G. Form-Release Agent: Type required which will not stain or cause surface imperfections in architectural finishes. Use same brand form-release agent for all forms.

H. Form Sealant:

1. Acceptable products:
   a. General Electric/Silicone Products Dept., SCS-1200.
   b. Dow Chemical Co., #790.
2. Type: One-part silicone.
3. Color: Clear.
4. Primer: Sealant manufacturer's recommended product.

PART 3 - GENERAL FORMWORK CONSTRUCTION

3.1 GENERAL

A. Construct formwork to lines and elevations indicated in accordance with approved permanent structure layout drawings and provisions of ACI 301, ACI 318 and ACI 347, latest edition.

B. Contractor shall assume sole responsibility for design and construction of concrete formwork capable of supporting construction loads, and for maintaining plastic concrete to planes, dimensions, and surfaces shown, within specified tolerances. Care shall be taken in the design to account for uplift, unbalanced and vibratory loads and their effect upon the vertical and lateral stability of formwork. Design shall maintain joints tight and

true.

C. Construct forms for removal without hammering or prying against concrete.

D. Build trap doors into the back of vertical forms to facilitate cleaning, inspection, and deposition of concrete. Box out for accessories, anchors, and openings. Secure items to be built into concrete in forms, including inserts for other trades.

E. Clean forms of dirt, debris, concrete, and foreign matter before each use. Examine forms prior to each reuse and replace units lacking strength, tightness, or visual appearance.

F. Apply form-release agent to forms in accordance with manufacturer's printed instructions prior to placement of reinforcement. Application rate shall be constant to prevent concrete discoloration. Remove excess material immediately.

G. Construct bulkheads with keys at separation of pours except as otherwise noted on drawings.
Bulkhead locations will be as indicated on the shop drawings.

END OF SECTION 03 1000

SECTION 03 2000

CONCRETE REINFORCING

PART 1 - GENERAL

1.1 SUBMITTALS

A. Shop Drawings: Indicate bar bending details, bar lists and placement drawings for reinforcement. Indicate dimensions on placement drawings.
   1. Form of placement drawings, including schedules, details and notes, shall contain same information as contract drawings.
   2. Show wall reinforcement in elevation.
   3. Indicate locations of accessories, conduits and piping to be embedded in concrete.
   4. LEED Reports: Submit letter identifying manufacturing location and percentage of recycled steel content furnished under this section.

B. Mill Tests:
   1. Submit for each heat of reinforcing steel, certifying mill test conducted in accordance with ASTM requirements.
   2. Costs for test shall be borne by Contractor.
   3. Unidentified bundles may be rejected or tested at request of Architect. Cost of test on unidentified bundles shall be borne by Contractor.
   4. Submit three copies of each test report to Architect.
   5. Submit one of report of chemical analysis of reinforcing steel requiring welding to the Architect for review.

1.2 DELIVERY, STORAGE AND HANDLING

A. Deliver reinforcement in bundles with waterproof tags. Maintain tags attached until material is incorporated into work.

B. Deliver and handle material to prevent damage or weakening of reinforcement.

C. Prevent accumulation of rust or debris on reinforcement during storage. Store off ground and under cover.

1.3 QUALITY CRITERIA

A. Reference standards:
   1. American Concrete Institute (ACI) Standards:
      a. ACI 301, Specifications for Structural Concrete for Buildings.
      b. ACI 315, Manual of Standard Practice for Detailing Reinforced Concrete Structures.
      c. ACI 318, Building Code Requirements for Structural Concrete, with supplements.
   2. Concrete Reinforcing Steel Institute (CRSI) Manual of Standard Practice-Placing Reinforcing Bars.
   3. American Welding Society (AWS) AWS D1-4.
   4. American Society for Testing and Materials (ASTM).

PART 2 - PRODUCTS

2.1 REINFORCEMENT

A. Bars: Meeting ASTM A615-07, deformed type for #3 to #10 are Grade 60.

B. Welded Wire Fabric: Meeting ASTM A185-07, cold-drawn, resistance welded.

C. Tie Wire: 16-gauge annealed steel wire.

D. Chairs, Bolsters, Bar Supports, and Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.

E. Provide stainless steel or plastic coated steel components for placement within 1½ inches of weathering surfaces.

2.2 CONCRETE ACCESSORIES

A. Wedge and threaded inserts:
1. Acceptable manufacturers:
   a. Burke Concrete Accessories.
   b. Heckmann Building Products, Inc.
   c. Hohmann and Barnard, Inc.
   d. Southern Slag Products Co.
2. Types: Malleable iron, types as indicated on drawings.

PART 3 - EXECUTION

3.1 REINFORCEMENT FABRICATION AND ERECTION

A. Shop-fabricate reinforcement to shape and dimensions indicated on approved placement drawings. Bent bars shall be bent cold. Fabricate in accordance with ACI 315 and ACI 318.

B. Metal reinforcement, at the time concrete is placed, shall be free from rust scale, oil and other coatings reducing bond. Use no bars with kinks or bends not shown on placement drawings.

C. Place metal reinforcement in accordance with ACI 315, ACI 318 and placement drawings. Secure in position in forms. Minimum slab reinforcement support spacing shall be as recommended by CRSI Manual of Standard Practice. Do not weld items to reinforcing steel.

D. Protective concrete cover over reinforcement shall be as indicated.

E. Splicing of reinforcement will not be permitted except as indicated.

F. Install wire mesh reinforcement in sizes and locations indicated. Lap joints one wire spacing plus 2".

G. Conduit and Pipes: Concrete cover shall be equal to cover for reinforcing bars. Embedded conduit diameter shall not exceed one-third slab or wall thickness. Tie down low conduit on top of bottom reinforcing bars. Space no conduit less than three diameters apart and a minimum 1" separation from parallel reinforcing bars. Use no aluminum conduits or couplings in concrete.

END OF SECTION 03 2000

SECTION 033000 - CAST-IN-PLACE

CONCRETE PART 1 - GENERAL

1.1 DESCRIPTION

A. Related Work Specified Elsewhere:

1. Concrete Formwork
2. Concrete Reinforcement and Accessories
3. Concrete Finishes

B. Definitions:

1. Architectural Concrete: Concrete exposed in finished work on the building's exterior or in interior public spaces receiving no covering finish. Architectural concrete work is generally specified to receive a smooth, rubbed finish, or a special architectural finish. Taped formwork joints, grinding marks, and similar surface defects are not acceptable.
2. Special Architectural Finish: Finish for exposed interior and exterior concrete work, as indicated on the drawings and as defined by ACI 301, Paragraph 6.3.7.

1.2 SUBMITTALS

A. Mix Designs: Submit mix designs for each type and class of concrete.

B. Placing Drawings: Include horizontal and vertical construction joint locations, construction
(pour) sequence, temporary block outs, and openings for equipment access.

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

A. Portland Cement: Meeting ASTM C150, Type I or III, natural color, domestic manufacture.
Use only one brand of cement throughout the project.

B. Normal-Weight Aggregate: Fine and coarse aggregate meeting ASTM C33.

C. Admixtures: Manufactured by Euclid Chemical, Master Builders, Sika Chemical, or W. R.
Grace, or approved equal and meeting the following:

1. Water-Reducing Admixture: Conforms to ASTM C494, Type F or G, and does not contain more chloride ions than are present in municipal drinking water.

2. Water Reducing, Retarding Admixture: Conforms to ASTM C494, Type D, and does not contain more chloride ions than are present in municipal drinking water.

3. High-Range Water-Reducing Admixture (superplasticizer): Conforms to ASTM C494, Type F or G, and does not contain more chloride ions than are present in municipal drinking water.
4. Non-Corrosive, Non-Chloride Accelerator: Conforms to ASTM C494, Type C or E, and does not contain more chloride ions than are present in municipal drinking water. **The admixture manufacturer must have long-term non-corrosive test data from an independent testing laboratory (of at least a year's duration) using an acceptable accelerated corrosion-test method such as one using electrical potential measures.**
5. Air-Entraining Admixture: Conform to ASTM C260.
6. Prohibited Admixture: Calcium chloride, thiocyanates, or admixtures containing more than 0.05% chloride ions are **not** permitted.
7. Certification: Written conformance to the above-mentioned requirements and the chloride ion content of the admixture will be required from the admixture manufacturer prior to mix-design review by the Engineer.

E. Fly ash meeting ASTM C618, Class F may be used in concrete mixes except that fly ash will not be allowed in architectural concrete. Fly ash quantity allowable shall not exceed 100 pounds per cubic yard of concrete, incorporated to replace an equivalent quantity of cement.

F. Water: Clean, potable, and free of alkali, acid, oil or organic matter.

2.2 MIX DESIGNS

A. Establish mix designs for normal weight concrete by using one of the following methods:
1. Field experience method.
2. Laboratory verification method.
3. Water/cement ratio method.

B. The following classes of concrete are required, unless otherwise indicated on the drawings:

CLASS	MINIMUM DESIGN COMPRESSIVE STRENGTH AT 28 DAYS	WEIGHT	SLUMP	W/C
A	3000 psi	135-150 pcf	4" ± 1"	0.45-0.50

2.3 CONCRETE QUALITY

A. Water/Cement Ratio: All concrete subjected to freezing and thawing shall have a

maximum water/cement ratio of 0.50. All concrete subjected to deicers and/or required to be watertight shall have a maximum water/cement ratio of 0.45. All reinforced concrete subjected to brackish water, salt spray or deicers shall have a maximum water-cement ratio of 0.40.

B. Air Content: All concrete exposed to freezing and thawing and/or required to be watertight shall have an air content of 4.5-7.5%. All interior slabs shall have a maximum air content of 3%.

C. Slump: All concrete containing high-range water-reducing admixture (Superplasticizer) shall have a maximum slump of 8 inches unless otherwise approved by the Architect. The concrete shall arrive at the job site at a slump of 2 to 3 inches, be verified, then the high-range water-reducing admixture shall be added to increase the slump to the approved level.

D. Admixture Usage: All concrete must contain the specified water-reducing admixture and/or the specified high-range water-reducing admixture (Superplasticizer). All concrete slabs, placed at air temperatures below 50 degrees F. shall contain the specified non-corrosive, non-chloride accelerator. All concrete required to be air entrained shall contain an approved air-entraining admixture.

PART 3 - EXECUTION

3.1 INSPECTION

A. Preconstruction Meeting: Prior to beginning concrete placement, Contractor shall schedule meeting with the Owner, Architect, Engineer, Testing Agency, concrete supplier, concrete placing and finishing foreman, and other affected sub contractors. Placing procedures, acceptable tolerances and finishes, testing, curing, and protection will be discussed. The Contractor shall be responsible for keeping meeting minutes and distributing to attending parties.

3.2 BATCHING AND MIXING

A. Batch, mix and transport in accordance with ASTM C94/C94M, except where more stringent requirements are specified.

B. Delivery Tickets: With each load of concrete, the concrete producer shall furnish a numbered delivery ticket showing Contractor, name and location of project, date and time batched, truck number, number of cubic yards in load, specified strength, slump, and mix design number.

C. Start mixing time after all ingredients are in the mixer. Minimum mixing shall be 70 revolutions at mixing speed if charged to maximum capacity, or 50 revolutions at mixing speed if charged to less than maximum capacity. Discharge mixture within one hour of initial mixing.

D. When concrete is delivered in a truck mixer or agitator, do not water add water after the

initial introduction of mixing water for the batch, except when on arrival at project site the concrete slump is less than specified, or as allowed herein for hot-weather concreting. Inject additional water into the mixer to bring slump within required limits. Turn the drum or blades an additional 30 revolutions or more at mixing speed until the concrete is within the proper slump limits.

E. Complete concrete discharge within 1-1/2 hours, or before the drum has completed 300 revolutions whichever comes first after the introduction of the mixing water to the cement and aggregates or the introduction of the cement to the aggregates.

F. Deliver concrete at a rate that will assure prompt discharge upon truck arrival. Do not place concrete that has been discharged from mixer truck for longer than 30 minutes.

G. Reject truck mixers with unacceptable batches of concrete. Dispose of concrete legally and clean mixer prior to refilling. The Testing Agency shall perform slump and mix tests on new delivery of previously rejected mixers.

3.3 DEPOSITING CONCRETE

A. Before placing concrete, inspect and approve formwork, reinforcement, sleeves and embedded items.

B. Handle concrete from mixer to final deposit as rapidly as practical by methods preventing segregation or loss of ingredients. Distribute concrete by means equal to a steep-sided, bottom- drop concrete bucket. Do not allow concrete to free-fall over 4'-0". Use buckets with a capacity of not less than ½-cubic yard. Clean transporting and handling equipment at frequent intervals and flush with water before and after each day's run. Do not discharge water into concrete forms.

C. Do not place concrete in forms after initial set has occurred. Re-tempering of concrete that has partially set is prohibited. Do not place concrete while temperature or other environmental conditions or facility limitations prevent proper finishing and curing.

D. Deposit concrete as near final position as possible to avoid re-handling. Place concrete in forms in uniform horizontal layers 1'-6" to 2'-0" in depth, avoiding vertical joints or inclined planes. Do not permit concrete to pile up in forms permitting escape of mortar, or preventing flow of the concrete. Deposit concrete continuously. Vibrate for thorough consolidation to insure a dense, homogeneous mass without voids or pockets. Do not spade concrete at surfaces to receive architectural finishes.

E. Transport and place pumped concrete in accordance with ACI 304 requirements. Brace formwork to handle effects of pump hammer. Employ aggregates of controlled water content for pumped concrete. Do not use aluminum pipes for transporting concrete. Equipment used to transport concrete shall be compatible with concrete reinforcement and desired finishes.

3.4 CONSOLIDATION

A. Use vibrators for concrete consolidation. Place vibrators in concrete rapidly to

penetrate into previous lift blending two layers and minimizing or eliminating entrapped air between concrete and form.

B. Vibrator head shall not be allowed to come within 3 inches of form face.

C. Use vibrators with steady, continuous motion in concrete mass and for long enough duration at each position in a pattern to permit maximum escape of air from concrete.

D. Vibrators shall be 2-1/2 to 2-5/8-inches in diameter, with minimum frequency of 10,000 impulses per minute. Furnish number of vibrators as required to vibrate all concrete immediately upon placing. Maintain spare vibrators at project site in case of breakdown.

3.5 COLD-WEATHER CONCRETING

A. Take cold weather precautions when temperature on job site is below 40 degrees F., in accordance with ACI 306R. Add accelerators, if used, at the concrete producer's plant in accordance with approved mix design.

B. Heat water, aggregates, or both to maintain the concrete temperature at the time of delivery at not less than 55 degrees F. Provide tarps, heaters, insulated forms, or other means to maintain the temperature of deposited concrete at not less than 40 degrees F. for seven days after placement.

3.6 HOT-WEATHER CONCRETING

A. Take hot-weather precautions when temperature on the job site is above 75 degrees F. in accordance with ACI 305R1 Report, Hot Weather Concreting.

B. Add the water-reducing retarders, if used, at concrete producer's plant in accordance with approved mix designs. Where necessary, cool aggregates or use chilled water or both to maintain concrete temperatures as delivered to the job site below 90 degrees F. Reject any truck mixer in which concrete temperatures are above 90 degrees F.

C. In hot weather, up to 10% of design mix water may be added to truck mixers at the job site to replace water lost by evaporation. Mix for a minimum of 30 additional revolutions after adding water. Make slump test and cylinders for compression test specimens from each truck to which water has been added. These additional cylinders do not count in determining frequency of testing as defined in Concrete Testing section. The Contractor shall bear the cost for additional testing.

3.7 FIELD QUALITY CONTROL

A. Testing Agency: An independent testing agency selected and paid by the Owner shall perform concrete testing.

B. Testing and Inspection:

1. Four test cylinders shall be taken from each class of each 100 cubic yards, or less, of concrete placed each day. Concrete selected for the cylinders shall accurately represent the quality of concrete in the placement being tested.

2. Test concrete cylinders as follows:
   a. Test one cylinder for compressive strength at age seven days.
   b. Test two cylinders at age 28 days. These two cylinders constitute one test under the definition of this specification.
   c. If 28-day cylinders break below the specified strength, test the fourth cylinder at 56 days.
3. Perform a slump test in accordance with ASTM C143 at the time each set of cylinders is molded.
4. The laboratory shall sample, mold, transport, store, cure, and prepare for breaking and testing, concrete cylinders in accordance with ASTM C39. The laboratory shall determine the air content of concrete in accordance with ASTM C231 and/or ASTM C173. While the laboratory representative is on the site, he shall observe concrete handling and placement job conditions and report to the Architect/Engineer as to compliance with these specifications. The laboratory shall submit to the Architect/Engineer six copies of test reports stating the date and time batched, date and time sampled, concrete and air temperatures, slump, location of concrete represented by sample, date of test and age of specimen, air content, unit weight, and compressive strength for each concrete test.
5. The Contractor shall provide a wheelbarrow, shovels, mixing boards and workspace for the laboratory representative for molding test cylinders. He shall provide stable, insulated boxes for cylinder storage for the first 24 hours after molding. The storage boxes shall prevent moisture loss and be equipped with thermostatically controlled heat to maintain a temperature between 60 and 80 degrees F. in accordance with ASTM C31/C31M. A slump cone shall be available at all times.
6. Concrete tests will be deemed satisfactory if they meet the methods and standards of ACI 318, Subparagraph 5.6.3 for 28-day tests.
7. Failure to measure up to any of the specified conditions constitutes faulty concrete.
   Unless otherwise directed by the Architect/Engineer, remove faulty concrete and replace with concrete as specified, at no expense to the Owner.
8. Additional tests of faulty concrete may be made only if the Architect/Engineer permits, and at no expense to the Owner. Load tests, if permitted by the Architect/Engineer,

shall be conducted in accordance with the loading criteria as required by the design of the structure, as determined by the Architect/Engineer.

C. Contractor's Duties Relative to Testing:

1. The Contractor shall furnish all labor necessary to assist the testing agency in obtaining and handling samples at the project.
2. The Contractor shall provide and maintain adequate facilities for safe storage and proper curing of concrete test specimens for the sole use of the testing agency for the first 24 hours as required by ASTM C31: Method of Making and Curing Concrete Compression and Flexural Specimens in the Field.

END OF SECTION 033000

SECTION 03 3500

CONCRETE FINISHES

PART 1 – GENERAL

1.1 DESCRIPTION

A. Related Work:

1. Cast-In-Place Concrete
2. Concrete Reinforcement

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation specifications for all manufactured products.

1.3 JOB CONDITIONS

A. Maintain temperature of concrete above 50 degrees F. for seven days after placing. Protect work against frost, rapid drying, and heavy rain.

1.4 QUALITY CRITERIA

A. Applicable Standards: Standards of the following as referenced herein:

1. American Concrete Institute (ACI).
2. American Society for Testing and Materials (ASTM).

PART 2 - PRODUCTS

2.1 CURING AND SEALING COMPOUND

A. Subject to compliance with requirements, available products that may be incorporated into the
Work include, but are not limited to, the following:

1. Euclid Chemical Company, Rez-Seal
2. Gifford-Hill & Company, Sealco
3. Sonneborn Division of Contech, Inc., Kure-N-Seal 0800

B. Type: Clear acrylic-based, non-yellowing, meeting ASTM C309, Type I

2.2 CURING AND HARDENING COMPOUND

A. Subject to compliance with requirements, available products that may be incorporated into the
Work include, but are not limited to, the following:

1. Euclid Chemical Company, Eucosil.
2. Sonneborn Division of Contech, Inc.
3. W.R. Meadows Company, Durehard.

B. Type: Clear, sodium silicate based.

2.3 WET-CURING MATERIALS

A. Sand: Clean natural sand meeting ASTM C144.

B. Moisture-Retaining Cover: Waterproof paper, polyethylene film or burlap-polyethylene sheet meeting ASTM C171.

C. Water: Clean, potable, and free of alkali, acid, oil or organic matter.

2.4 ABRASIVE AGGREGATE

A. Aluminum oxide or emery graded from particles retained on a #50 mesh screen to particles
passed by a ⅛-inch screen.

2.5 CONCRETE BONDING AGENT

A. Subject to compliance with requirements, available products that may be incorporated into the
Work include, but are not limited to, the following:

1. Burke Concrete Accessories, Inc., Bondcrete-S.
2. Euclid Chemical Company, Flexcon.
3. Larsen Products Corporation, Weld-Crete.
4. Sika Chemical Corporation, Sika Latex.
5. Sonneborn Division of Concrete, Inc., Sonocrete.
6. The Upco Company, 705 Bonding Adhesive.

B. Characteristics: Acrylic latex emulsion, non-reversible.

PART 3 - EXECUTION

3.1 SLAB FINISHES

A. Screed floor slabs to an even surface within tolerances prescribed by ACI 301 and ACI 117 (AA) for specified slab finish using a straightedge and screeding strips.

B. Float surfaces on concrete with a wood float in a manner that will compact concrete and produce surface free of depressions or ridges. Test for grade or level and correct as necessary by removing excess or adding and compacting additional concrete. Surfaces to receive float finish include slabs to receive setting beds.

C. Trowel Finish: Apply trowel finish to designated monolithic slab surfaces. After floating, begin first trowel finish operation using power-driven trowel. Begin final troweling when surface produces ringing sound as trowel is moved over surface. Final hand-troweling operation shall consolidate concrete surface free of trowel marks and uniform in texture and appearance. The following surfaces shall receive a trowel finish:

1. Slabs to be exposed in the finished work, except where designated to receive a non-slip broom finish.
2. Slabs designated to receive elastomeric surfacing or seamless flooring.
3. Slabs to receive resilient flooring, carpet, and similar finish materials.

D. Non-Slip Broom Finish: Immediately after trowel finishing, roughen concrete surface by brooming in a direction perpendicular to main traffic route. Coordinate required final finish with Architect before application. Apply non-slip broom finish to pavilion slabs and to exterior concrete slabs, platforms, steps, and ramps.

E. Non-Slip Aggregate Finish: After completion of float finishing, and before beginning trowel finish, distribute 25 pounds of dampened abrasive aggregate per 100 square feet of surface. Tamp aggregate flush with surface using steel trowel, but do not force non-slip aggregate particles below the surface. After broadcasting and tamping, apply trowel finishing as specified. After curing, work surface with steel wire brush, or an abrasive stone and water to expose non- slip aggregate. Apply non-slip aggregate finish to interior concrete stair treads, platforms and ramps.

3.2 FLOOR FINISH TOLERANCE

Interior Slabs:

1. Test Layout: In accordance with ASTM E 1155.
   a. Test Area: Area of concrete placed in a continuous pour.
   b. Test Sections: Area bounded by grid lines, slab edge, or construction joints. c. Sample Measurement Lines: As defined in ASTM E 1155.
2. Flatness and Levelness Tolerance:
   a. Specified Overall Value:
      (1) Floor Flatness, F_F (SOV) = 50 (2) Floor Levelness, F_L (SOV) = 30
   b. Minimum Local Value:
      (1) Floor Flatness, F_F (MLV) = 50 (2) Floor Levelness, F_L (MLV) = 30

3. Timeliness of Tests:
   a. Obtain floor tolerance measurements within 24 hours after slab installation.
   b. Obtain measurements prior to removal of shores and forms supporting floor being measured.

4. Test Reports for Floor Finish Tolerance:
   a. Provide report of test results to Contractor and Architect within 72 hours after slab installation.
   b. Include in the report a running tabulation of all overall FF and overall FL values of slabs installed to date.
5. Acceptance Criteria: Remedial work may be required if either of the following is not met:
   a. The composite value of the entire test area must be equal or greater than either the entire specified overall F-numbers.
   b. The values for any test section must be equal or greater than either of the minimum local F-numbers.
6. Remedial Work:
   a. Remedial work may include grinding, planing, skimming, re-topping, or removal and replacement.
   b. Contractor to submit method and materials proposed for remedial work at each
   location to the Architect for review.
   c. Retest is required within two weeks for all repaired work to confirm conformance with floor finish criteria.
   d. The Contractor is responsible for correction of floors finished out of tolerance.

B. Exterior Slabs:

1. Finish exterior slabs to drain freely.
2. Cut out and replace depressions that hold water.

3.3 PATCHING EXPOSED CONCRETE SURFACES

A. Areas requiring patching shall not exceed two square feet per 1000 square feet of surface area and shall be widely dispersed. Areas having excessive defects as determined by the Architect shall be removed and replaced.

B. Following finishing operation, patch voids, honeycomb, form-tie holes and defects using a mixture of similar proportions to original concrete, deleting coarse aggregate.

C. In preparing areas to receive patch, remove loose particles and chip out adjacent sound concrete to avoid featheredge patches. Patches shall match approved patches on mock-up.

D. Apply a coating of bonding agent to areas being patched taking care to prevent staining of exposed surfaces. Apply bonding agent in accordance with manufacturer's product data.

E. Fill in area with selected mix, bringing to same level as original concrete. Brush out area to match surrounding work. Allow curing.

3.4 CURING

A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures, and maintain at a relatively constant temperature for the time necessary for cement hydration and concrete hardening.

B. Begin initial curing after placing and finishing as soon as free water has disappeared from concrete surface. Keep continuously moist for not less than 72 hours.

C. Begin final curing procedures immediately following initial curing and before the concrete has dried. Continue final curing for at least 168 cumulative hours (not necessarily consecutive) during which the concrete has been exposed to air temperatures above 50 degrees F. Avoid rapid drying at end of final curing period.

D. Curing Methods: Cure concrete by moist curing, by moisture-retaining cover curing, by liquid curing compound, or by combinations thereof, except where manufactured products, in accordance with manufacturer's product data, forbid mixing certain methods.

E. Cure surfaces to receive elastomeric roofing surfacing or coatings using sodium silicate or chlorinated rubber-based curing and sealing compound.

F. Cure floor surfaces that are not designated to receive further finish with sodium silicate or chlorinated rubber-based curing and sealing compound after finishing.

G. Provide moist curing by any of the following methods:

1. Keeping surface of concrete continuously wet by covering with water.
2. Continuous water-fog spray.
3. Covering concrete surface with specified absorptive cover, thoroughly saturating cover with water, and keeping absorptive cover continuously wet.

H. Provide moisture-retaining cover curing as follows: Cover concrete surfaces with specified moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

I. Provide liquid curing-sealing compound as follows: Apply specified membrane-forming, curing-sealing compound to damp concrete surfaces as soon as the concrete has set sufficiently so as not to be marred by the application. Areas subjected to heavy rainfall within three hours after initial application shall be recoated. Maintain continuity of coating and repair damage to coat during entire period.

J. Do not use membrane curing/sealing compounds on surfaces which are to be covered with a coating material applied directly to the concrete or with waterproofing, damp proofing, flooring, paint and coatings and finish materials.

K. Cure formed surfaces of concrete, including undersides of supported slabs and other similar surfaces, by moist curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

L. Curing Unformed Surfaces:

1. Initially cure unformed surfaces, such as slabs and other flat surfaces by moist curing.
2. Final cure unformed surfaces, unless otherwise specified, by any of the methods specified above, as applicable.

3.5 PROTECTION

A. Protect freshly placed concrete from damage due to water, falling objects, or persons marring finish surface of concrete. Surfaces damaged due to lack of protective measures shall be removed and replaced with fresh concrete.

B. Protect finished surfaces from damage due to subsequent work of other trades.

C. Protect exposed floor surfaces from damage during subsequent construction operations, and repair and restore damaged areas to original condition.

END OF SECTION 03 3500

SECTION 042200 - CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

1. Concrete masonry units. (See drawings for type of block with integral color and water proofing selected).

1.2 DEFINITIONS

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

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

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For reinforcing steel. Detail bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315.

C. Samples: For each type and color of the following:

1. Exposed CMUs.
2. Mortar.

1.4 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each type and size of product. For masonry units, include data on material properties material test reports substantiating compliance with requirements.

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

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

1.5 QUALITY ASSURANCE

A. Sample Panels: Build sample panels to verify selections made under Sample submittals and to demonstrate aesthetic effects. Comply with requirements in Section 014000 "Quality Requirements" for mockups.

1. Build sample panels for typical exterior and interior walls in sizes approximately 60 inches (1500 mm) long by 48 inches (1200 mm) high by full thickness.

1.6 FIELD CONDITIONS

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

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

PART 2 - PRODUCTS

2.1 UNIT MASONRY, GENERAL

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

B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work.

C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated. See plans for rated walls if any.

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

2.2 CONCRETE MASONRY UNITS

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

1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.

B. Integral Water Repellent: Provide units made with integral water repellent for exposed units and where indicated.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. BASF Corp. - Construction Chemicals.
    b. Euclid Chemical Company (The); an RPM company.

C. CMUs: ASTM C 90.
1. Density Classification: Normal weight unless otherwise indicated.

2.3 MORTAR AND GROUT MATERIALS

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

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

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

D. Masonry Cement: ASTM C 91/C 91M.

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

    a. Cemex S.A.B. de C.V.
    b. Lafarge North America Inc.

E. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C 979/C 979M. Use only pigments with a record of satisfactory performance in masonry mortar.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Euclid Chemical Company (The); an RPM company.

F. Colored Cement Products: Packaged blend made from portland cement and hydrated lime or masonry cement and mortar pigments, all complying with specified requirements, and containing no other ingredients.

1. Colored Portland Cement-Lime Mix:

    a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

        1) Lafarge North America Inc.

2. Colored Masonry Cement:

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

1) Cemex S.A.B. de C.V.
2) Lafarge North America Inc.

G. Aggregate for Mortar: ASTM C 144.

1. White-Mortar Aggregates: Natural white sand or crushed white stone.
2. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

H. Aggregate for Grout: ASTM C 404.

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

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. BASF Corp. - Construction Chemicals.
b. Euclid Chemical Company (The); an RPM company.

J. Water: Potable.

2.4 REINFORCEMENT

A. Uncoated-Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60 (Grade 420). See structural drawings for additional requirements for expoxy coated, stainless steel or galvanized bars.

B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inch (3.77-mm) steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Heckmann Building Products, Inc.
b. Hohmann & Barnard, Inc.

C. Masonry-Joint Reinforcement, General: ASTM A 951/A 951M.

1. Interior Walls: Hot-dip galvanized, carbon steel.
2. Exterior Walls: Hot-dip galvanized carbon Stainless steel.

3. Wire Size for Side Rods: 0.187-inch (4.76-mm) diameter.
4. Wire Size for Cross Rods: 0.187-inch (4.76-mm) diameter.
5. Spacing of Cross Rods: Not more than 16 inches (407 mm) o.c.
6. Provide in lengths of not less than 10 feet (3 m), with prefabricated corner and tee units.

2.5 TIES AND ANCHORS

A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:

1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M, with ASTM A 153/A 153M, Class B-2 coating.
2. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Rigid Anchors: Fabricate from steel bars 1-1/2 inches (38 mm) wide by 1/4 inch (6.35 mm) thick by 24 inches (610 mm) long, with ends turned up 2 inches (51 mm) or with cross pins unless otherwise indicated.

1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A 153/A 153M.

2.6 EMBEDDED FLASHING MATERIALS

A. Metal Flashing: Provide metal flashing complying with Section 076200 "Sheet Metal Flashing and Trim" and as follows:

1. Fabricate metal drip edges from stainless steel. Extend at least 3 inches (76 mm) into wall and 1/2 inch (13 mm) out from wall, with outer edge bent down 30 degrees and hemmed.
2. Fabricate metal sealant stops from stainless steel. Extend at least 3 inches (76 mm) into wall and out to exterior face of wall. At exterior face of wall, bend metal back on itself for 3/4 inch (19 mm) and down into joint 1/4 inch (6 mm) to form a stop for retaining sealant backer rod.
3. Fabricate metal expansion-joint strips from stainless steel to shapes indicated.

B. Flexible Flashing: Use one of the following unless otherwise indicated:

1. Butyl Rubber Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.040 inch (1.02 mm).

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1) DuPont Building Innovations: E. I. du Pont de Nemours and Company.
2) Wire-Bond.

2. Elastomeric Thermoplastic Flashing: Composite flashing product consisting of a polyester-reinforced ethylene interpolymer alloy.

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1) Hohmann & Barnard, Inc.
2) Mortar Net Solutions.
3) Wire-Bond.

3. EPDM Flashing: Sheet flashing product made from ethylene-propylene-diene terpolymer, complying with ASTM D 4637/D 4637M, 0.040 inch (1.0 mm) thick.

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

1) Carlisle Coatings & Waterproofing Inc.
2) Firestone Specialty Products.
3) Heckmann Building Products, Inc.
4) Wire-Bond.

C. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.7 MISCELLANEOUS MASONRY ACCESSORIES

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

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

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

2.8 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. Use portland cement-lime or masonry cement mortar unless otherwise indicated.

B. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated.

1. For masonry below grade or in contact with earth, use Type S.
2. For reinforced masonry, use Type S.
3. For mortar parge coats, use Type S.
4. For exterior, above-grade, load-bearing and nonload-bearing walls and parapet walls; for interior load-bearing walls; for interior nonload-bearing partitions; and for other applications where another type is not indicated, use Type N.

C. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.

1. Pigments shall not exceed 10 percent of portland cement by weight.
2. Pigments shall not exceed 5 percent of masonry cement by weight.
3. Application: Use pigmented mortar for exposed mortar joints with the following units:

a. Decorative CMUs.
b. Pre-faced CMUs.

D. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.

1. Application: Use colored-aggregate mortar for exposed mortar joints with the following units:

a. Decorative CMUs.
b. Pre-faced CMUs.

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

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
2. Proportion grout in accordance with ASTM C 476, Table 1 or paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi (14 MPa).
3. Provide grout with a slump of 8 to 11 inches (200 to 280 mm) as measured according to ASTM C 143/C 143M.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

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

3.2 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch (12 mm) or minus 1/4 inch (6 mm).
2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch (12 mm).
3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch (6 mm) in a story height or 1/2 inch (12 mm) total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2-inch (12-mm) maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2-inch (12-mm) maximum.
3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2-inch (12-mm) maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2-inch (12-mm) maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2-inch (12-mm) maximum.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm), with a maximum thickness limited to 1/2 inch (12 mm).
2. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch (9 mm) or minus 1/4 inch (6 mm).
3. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm).

3.3 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less-than-nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.

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

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

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

F. Fill cores in hollow CMUs with grout 24 inches (600 mm) under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

3.4 MORTAR BEDDING AND JOINTING

A. Lay hollow CMUs as follows:

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

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

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

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

3.5 MASONRY-JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch (16 mm) on exterior side of walls, 1/2 inch (13 mm) elsewhere. Lap reinforcement a minimum of 6 inches (150 mm).

1. Space reinforcement not more than 16 inches (406 mm) o.c.
2. Space reinforcement not more than 8 inches (203 mm) o.c. in foundation walls and parapet walls.
3. Provide reinforcement not more than 8 inches (203 mm) above and below wall openings and extending 12 inches (305 mm) beyond openings in addition to continuous reinforcement.

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

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

3.6 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

A. Anchor masonry to structural steel and concrete, where masonry abuts or faces structural steel or concrete, to comply with the following:

1. Provide an open space not less than 1/2 inch (13 mm) wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
3. Space anchors as indicated, but not more than 24 inches (610 mm) o.c. vertically and 36 inches (915 mm) o.c. horizontally.

3.7 FLASHING

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

B. Install flashing as follows unless otherwise indicated:

1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
2. At lintels, extend flashing a minimum of 6 inches (150 mm) into masonry at each end. At heads and sills, extend flashing 6 inches (150 mm) at ends and turn up not less than 2 inches (50 mm) to form end dams.
3. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch (13 mm) back from outside face of wall, and adhere flexible flashing to top of metal drip edge.

C. Install single-wythe CMU flashing system in bed joints of CMU walls where indicated to comply with manufacturer's written instructions. Install CMU cell pans with upturned edges located below face shells and webs of CMUs above and with weep spouts aligned with face of wall. Install CMU web covers so that they cover upturned edges of CMU cell pans at CMU webs and extend from face shell to face shell.

3.8 REINFORCED UNIT MASONRY INSTALLATION

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.

1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and that of other loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in TMS 602/ACI 530.1/ASCE 6.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.

1. Comply with requirements in TMS 602/ACI 530.1/ASCE 6 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Limit height of vertical grout pours to not more than 60 inches (1520 mm).

3.9 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

B. Inspections: Special inspections according to structural engineer of record. See structural drawings and special inspections list from structural engineer.

1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
3. Place grout only after inspectors have verified proportions of site-prepared grout.

C. Testing Prior to Construction: One set of tests.

D. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.

E. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.

F. Mortar Test (Property Specification): For each mix provided, according to ASTM C 780. Test mortar for mortar air content and compressive strength.

G. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.

H. Prism Test: For each type of construction provided, according to ASTM C 1314 at seven days and at 28 days.

3.10 PARGING

A. Parge exterior faces of below-grade masonry walls, where indicated, in two uniform coats to a total thickness of 3/4 inch (19 mm). Dampen wall before applying first coat, and scarify first coat to ensure full bond to subsequent coat.

B. Use a steel-trowel finish to produce a smooth, flat, dense surface with a maximum surface variation of 1/8 inch per foot (3 mm per 300 mm). Form a wash at top of parging and a cove at bottom.

C. Damp-cure parging for at least 24 hours and protect parging until cured.

3.11 REPAIRING, POINTING, AND CLEANING

A. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

B. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes.
2. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.

3.12 MASONRY WASTE DISPOSAL

A. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.

1. Do not dispose of masonry waste as fill within 18 inches (450 mm) of finished grade.

B. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.

C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042200

SECTION 042300 - GLASS UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Glass block set in mortar. (See drawings for block types and sizes selected).

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

C. Samples: Glass-block units.

PART 2 - PRODUCTS

2.1 GLASS BLOCK

A. Hollow Glass Block : Hollow units made from transparent glass, with manufacturer's standard edge coating.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. J. Weck GmbH & Co. KG; distributed by Glass Blocks Unlimited.
   b. Mulia Inc.; Distributed by Glass Blocks Unlimited.

2. Glass Color: Match Architect's samples.
3. Pattern: Wavy, light-diffusive design on inner faces, and smooth outer faces.
4. Pattern: Manufacturer's standard decorative pattern to match Architect's sample.
5. Sizes: Manufacturer's standard sizes corresponding to nominal sizes indicated on Drawings.
6. Thick-Faced Block: Units with faces at least 3/4 inch (19 mm) thick.

2.2 MORTAR MATERIALS

A. Portland Cement: ASTM C 150/C 150M, Type I or Type II. Provide natural color or white cement as required to produce mortar color indicated.

1. Where joints are indicated to be raked out and pointed, gray cement may be used for setting mortar.

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

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

D. Colored Cement Product: Packaged blend made from portland cement and hydrated lime or masonry cement and mortar pigments, all complying with specified requirements, and containing no other ingredients.

1. Colored Portland Cement-Lime Mix:

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1) Lafarge North America Inc.

2. Colored Masonry Cement:

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

1) Cemex S.A.B. de C.V.
2) Lafarge North America Inc.

3. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.

E. Aggregate: ASTM C 144, with 100 percent passing No. 8 (2.36-mm) sieve.

1. For pointing mortar and joints narrower than 1/4 inch (6 mm), use aggregate graded with 100 percent passing No. 16 (1.18-mm) sieve.
2. White Aggregates: Natural white sand or crushed white stone.
3. Colored Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

F. Water-Repellent Admixture: Liquid polymeric water-repellent mortar admixture that does not reduce flexural bond strength of mortar.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. BASF Corp. - Construction Chemicals.

G. Water: Potable.

2.3 GLASS UNIT MASONRY ACCESSORIES

A. Asphalt Emulsion: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M or ASTM D 1227.

B. Sealants: Manufacturer's standard elastomeric sealants of base polymer and characteristics indicated below that comply with applicable requirements in Section 079200 "Joint Sealants."

1. : Silicone, nonstaining, S, NS, 50, NT.
2. <Double click to insert sustainable design text for sealants.>

C. Sealant Accessories: Provide sealant accessories, including primers, bond-breaker tape, and cylindrical sealant backing, that comply with applicable requirements in Section 079200 "Joint Sealants."

2.4 MORTAR MIXES

A. General: Do not use admixtures unless otherwise indicated.

1. For mortar in exterior panels, use water-repellent admixture according to admixture manufacturer's written instructions.
2. Limit cementitious materials in mortar to portland cement and lime.

B. Mortar for Glass Unit Masonry Assemblies: Comply with ASTM C 270, Proportion Specification for Type S mortar.

C. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.

D. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.

PART 3 - EXECUTION

3.1 INSTALLING GLASS BLOCK WITH MORTAR

A. Apply a heavy coat of asphalt emulsion to sill and adhere expansion strips to jambs and heads with asphalt emulsion. Allow asphalt emulsion to dry before placing mortar. Trim expansion strips to width required to fit glass block and to full lengths of heads and jambs.

B. Set glass block with completely filled bed and head joints, with no furrowing, accurately spaced and coordinated with other construction. Maintain 3/8-inch (10-mm) exposed joint widths unless otherwise indicated.

C. Use plastic spacers or temporary wedges in mortar joints to produce uniform joint widths and to prevent mortar from being squeezed out of joints.

D. Keep expansion joints free of mortar.

E. Rake out joints indicated to be pointed to a uniform depth sufficient to accommodate pointing material, but not less than joint width.

1. Point joints at exterior face of exterior panels with mortar.

F. Point joints with mortar by filling raked joints and voids. Place and compact pointing mortar in layers not more than 3/8 A (10 mm) thick. Compact each layer thoroughly and allow to become thumbprint hard before applying next layer.

1. Tool exposed joints slightly concave when pointing mortar is thumbprint hard. Use a smooth plastic jointer larger than joint width. Delete last paragraph above and retain first paragraph below if joints are pointed with sealant. See the Evaluations for sealant considerations.

3.2 CLEANING

A. Perform final cleaning of glass unit masonry assemblies when surface is not exposed to direct sunlight. Start at top of panel using generous amounts of clean water. Remove water with clean, dry, soft cloths; change cloths frequently to eliminate dried mortar particles and aggregate.

END OF SECTION 042300

SECTION 055000 - METAL FABRICATIONS

1.1 SUMMARY

A. Section Includes:

1. Miscellaneous steel framing and supports.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 METALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

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

C. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.

D. Steel Tubing: ASTM A 500/A 500M, cold-formed steel tubing.

E. Steel Pipe: ASTM A 53/A 53M, Standard Weight (Schedule 40) unless otherwise indicated.

2.3 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

1. Provide stainless-steel fasteners for fastening aluminum.
2. Provide stainless-steel fasteners for fastening stainless steel.

B. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or

ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.

C. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors. See structural drawings for additional information.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).

D. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

E. Water-Based Primer: Emulsion type, anticorrosive primer for mildly corrosive environments that is resistant to flash rusting when applied to cleaned steel, complying with MPI#107 and compatible with topcoat.

F. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.

G. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

H. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

I. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.4 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Use connections that maintain structural value of joined pieces.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges. Remove sharp or rough areas on exposed surfaces.

C. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended.

D. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Locate joints where least conspicuous.

E. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

F. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors not less than 8 inches (200 mm) from ends and corners of units and 24 inches (600 mm) o.c.

2.5 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

C. Fabricate steel girders for wood frame construction from continuous steel shapes of sizes indicated.

1. Where wood nailers are attached to girders with bolts or lag screws, drill or punch holes at 24 inches (600 mm) o.c.

D. Fabricate steel pipe columns for supporting wood frame construction from steel pipe with steel baseplates and top plates as indicated. Drill or punch baseplates and top plates for anchor and connection bolts and weld to pipe with fillet welds all around. Make welds the same size as pipe wall thickness unless otherwise indicated.

2.6 LOOSE STEEL LINTELS

A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated.

B. Galvanize loose steel lintels located in exterior walls.

2.7 STEEL WELD PLATES AND ANGLES

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

2.8 FINISHES, GENERAL

A. Finish metal fabrications after assembly.

2.9 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.

B. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.

1. Shop prime with universal shop primer unless indicated.

C. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

D. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

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

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

3.2 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

END OF SECTION 055000

SECTION 057300 - DECORATIVE METAL RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Steel and iron decorative railings.
   2. See also: Alternates section for bid alternate for wood railing. Submittals and general requirements of this section are applicable to the bid alternate wood rail.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:

   1. Manufacturer's product lines of railings assembled from standard components.
   2. Grout, anchoring cement, and paint products.

B. Shop Drawings: Include plans, elevations, sections, and attachment details.

C. Samples: For each type of exposed finish required.

D. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.

C. Preconstruction test reports.

D. Evaluation Reports: For post-installed anchors, from ICC-ES.

1.4 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

   1. Build mockups for each form and finish of railing consisting of two posts, top rail, infill area, and anchorage system components.

1.5 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on laboratory mockups. Payment for these services will be made by Contractor. Retesting of products that fail to meet specified requirements shall be done at Contractor's expense.

1. Build laboratory mockups at testing agency facility; use personnel, materials, and methods of construction that will be used at Project site.
2. Test railings according to ASTM E 894 and ASTM E 935.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Steel and Iron Decorative Railings: Provide a custom designed and made or pre-manufactured railing may be submitted for approval. Design must meet all applicable code requirements and design criteria shown on the drawings.

B. Product Options: Information on Drawings and in Specifications establishes requirements for system's aesthetic effects and performance characteristics.

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design railings, including attachment to building construction.

B. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:

a. Uniform load of 50 lbf/ft. (0.73 kN/m) applied in any direction.
b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Infill of Guards:

a. Concentrated load of 50 lbf (0.22 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m).
b. Infill load and other loads need not be assumed to act concurrently.

2.3 METALS, GENERAL

A. Brackets, Flanges, and Anchors: Same metal and finish as supported rails unless otherwise indicated.

B. Extruded Bars and Shapes, Including Extruded Tubing: ASTM B 221 (ASTM B 221M), Alloy 6063-T5/T52.

C. Extruded Structural Pipe and Round Tubing: ASTM B 429/B 429M, Alloy 6063-T6.

D. Drawn Seamless Tubing: ASTM B 210 (ASTM B 210M), Alloy 6063-T832.

E. Plate and Sheet: ASTM B 209 (ASTM B 209M), Alloy 5005-H32.

F. Die and Hand Forgings: ASTM B 247 (ASTM B 247M), Alloy 6061-T6.

G. Castings: ASTM B 26/B 26M, Alloy A356.0-T6.

2.4 STEEL AND IRON

A. Tubing: ASTM A 500/A 500M (cold formed).

B. Bars: Hot-rolled, carbon steel complying with ASTM A 29/A 29M, Grade 1010.

C. Plates, Shapes, and Bars: ASTM A 36/A 36M.

D. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.

2.5 FASTENERS

A. Fastener Materials: Unless otherwise indicated, provide the following:
   1. Uncoated Steel Components: Plated-steel fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating where concealed; Type 304 stainless-steel fasteners where exposed.
   2. Galvanized-Steel Components: Plated-steel fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating.
   3. Dissimilar Metals: Type 304 stainless-steel fasteners.

B. Post-Installed Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193.
   1. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) Group 2 (A4) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).

2.6 MISCELLANEOUS MATERIALS

A. Wood Rails: Clear, straight-grained hardwood rails secured to recessed metal subrail.

1. Species: Manufacturers standard species for exterior use and as approved by Owner.
2. Finish: Manufacturer's standard or Penetrating oil.
3. Staining: As selected by Architect from manufacturer's full range.

B. Polyurethane Topcoat: Complying with MPI#72 and compatible with undercoat.

2.7 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Connections: Fabricate railings with welded or nonwelded connections unless otherwise indicated.

C. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

1. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 1 welds; no evidence of a welded joint.

D. Brazed Connections: Connect copper-alloy railings by brazing. Cope components at connections to provide close fit, or use fittings designed for this purpose. Braze corners and seams continuously.

1. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and brazed surface matches contours of adjoining surfaces.

E. Mechanical Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

F. Form changes in direction by bending or by inserting prefabricated elbow fittings.

G. Bend members in jigs to produce uniform curvature for each configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

H. Close exposed ends of hollow railing members with prefabricated end fittings.

I. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Fit exposed connections together to form tight, hairline joints.

B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

1. Set posts plumb within a tolerance of 1/16 inch in 3 feet (2 mm in 1 m).
2. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet (5 mm in 3 m).

C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1. Coat concealed surfaces of that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

D. Anchor posts to wood surfaces with flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members. See drawings for design intent.

E. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

END OF SECTION 057300

SECTION 061000

ROUGH CARPENTRY

PART 1 - GENERAL

1.1 DESCRIPTION

A. Related work specified elsewhere:

1. Section 031000 - Concrete Formwork
2. Section 061920 - Prefabricated Wood Trusses (Trussed Rafters)

1.2 DELIVERY, STORAGE AND HANDLING

A. Immediately upon delivery to job site, place materials in areas protected from weather.

B. Store materials a minimum of 6 inches above ground on blocking, and cover with protective waterproof covering, providing for adequate air circulation and ventilation.

C. Do not store seasoned materials in wet or damp portions of building.

D. Protect sheet materials from having corners broken and surfaces damaged.

1.3 QUALITY ASSURANCE

A. Industry Standards:

1. Grading Rules and Standards:
   a. American Lumber Standards Committee (ALSC)
   b. APA – The Engineered Wood Association: Engineered Wood Construction Guide,2007 Edition
   c. National Forest Products Association (NFPA)
   d. National Institute of Standards and Technology:
      (1) PS-1: Construction and Industrial Plywood
      (2) PS-20-10: American Softwood Lumber Standard
   e. Southern Forest Products Association (SFPA): 1977 Grading Rules (and Supplements)
   f. Southern Pine Inspection Bureau (SPIB)
   g. West Coast Lumber Inspection Bureau (WCLIB)
   h. Western Wood Products Association (WWPA): Wood Frame Design for Commercial/Multifamily Construction, Revised R-87

2. Preservation-Treated Materials:
   a. American Wood-Preservers' Association (AWPA): Book of Standards
   b. American Wood Preservers Bureau (AWPB): Standards of the American Wood Preservers Bureau
   c. American Wood Preservers Institute (AWPI)

PART 2 -PRODUCTS

2.1 MATERIALS

A. General:

1. Dimensions: Indicated lumber dimensions are nominal. Actual dimensions conform to industry standards established by ALSC and the rules-writing agencies.
2. Provide materials that are suitable for intent and purpose specified for Work under this section. Any species meeting code requirements is acceptable unless otherwise specified. Sizes indicated are nominal. Conform to PS-20-10 for actual sizes. Provide S4S lumber, surfaced four sides, unless otherwise indicated.
3. Moisture Content:19% maximum at time of permanent closing in of building or structure, except as otherwise indicated.

B. Lumber:

1. Framing lumber graded and stamped under ALSC rules and WWPA or SFPA.

2. Structural Lumber: As indicated on the plans.

3. Light framing, 2- to 4-inch thickness, 2- to 12-inches wide:

   a. General Framing: Standard Grade
   b. Plates, Blocking, Bracing and Nailers: Standard Grade
   c. General Utility Purposes: Standard Grade
   d. Lumber in contact with concrete, concrete slabs, or exterior masonry walls: #2Southern Pine or #2 Douglas Fir, minimum, preservative-treat in accordance with specified standards in paragraph below.
   e. Studs: See Stud Schedule on Plans

C. Sheet Materials:

1. Plywood, Thicknesses Indicated:
   a. Roof Decking: APA-rated 5/8" (19/32" minimum) sheathing with a minimum
      Exposure 1 bond classification and a minimum span rating of 32/16.
   b. Floor Decking: ¾-inch tongue-and-groove APA Sturd-I-Floor sheathing with a minimum Exposure 1 bond classification and a minimum span rating of 24 inches.
   c. Exterior Wall ½" (7/16” minimum) Sheathing: APA-rated sheathing with

a minimum Exterior C-C bond classification and a minimum span rating of 24/16.

2. Building Paper: Meeting ASTM D 226-97a, Type I, 15 pounds per square, unperforated asphalt-saturated organic felt.

D. Treated Materials:

1. Preservative-Treated Materials:
   a. Solid lumber including sill plates, beams, joists, studs, posts and solid sawn decking shall be treated in accordance with AWPA Standard U1-10 to the requirements of Use Category 3B-Commodity A. All sawn lumber shall be dried after treatment such that each piece shall have a maximum moisture content of 19%.
   b. Composite lumber including plywood sheathing, LVL beams, and PSL beams shall be treated in accordance with AWPA Standard U1-10 to the requirements of Use Category 3B-Commodity F. Plywood sheathing shall be dried after treatment such that each piece shall have a maximum moisture content of 19%. Composite lumber shall be composed only of soft wood veneers, without lumber cores, with or without overlap, and shall meet U.S. National Institute of Standards and Technology PS-1 (Industrial Plywood), glued only with waterproof adhesives.
2. Locations: As indicated, required by code, and noted in this section.
3. Lumber in contact with concrete or masonry shall be preservative treated.

E. Miscellaneous Specialties:

1. Metal Items:
   a. Acceptable Manufacturers:
      1) Cleveland Steel Specialty Company
      2) Harlen Metal Products, Inc.
      3) Kant Sag Division of United Steel Products Company
      4) Silver Metal Products, Inc.
      5) Simpson Company
      6) Or approved equal.
   b. Roof Sheathing Clips: 6063 T-6 extruded aluminum alloy or galvanized steel H- type clips; size for sheathing thickness.
2. Insulation Baffle:
   a. Acceptable Product: Air Vent, Inc; Air Flash Insulation Baffle No. AF344-24 or approved equal.
   b. Characteristics: Pre-formed ABS plastic approximately 48 inches long by 18 inches wide with 1-inch deep troughs between framing members.

F. Hardware:

1. General:
   a. Provide nails, bolts, nuts, washers, screws, expansion bolts, clips, powder-actuated fasteners, beam hangers, hold-downs, and similar hardware necessary for complete installation of indicated materials.

Provide hot-dipped galvanized nails for all preservative-treated lumber.
b. Provide hardware to adequately resist design loads and meet codes.
c. Provide hardware of proper type to secure materials to substrates encountered.

2. Adhesive for adhering floor deck to framing:
   a. Acceptable Products:
      1) DAP, Inc.: DAP 4000
      2) Miracle Adhesives Corporation: SFA-66, Sub-Floor and Construction Adhesive
      3) Rexnord Chemical Products, Inc.: PL400
      4) Surebond, Inc.: SB400
      5) Or approved equal.
   b. Characteristics: Meets requirements of FHA UM-60, AFG-01, IBCO-2465, and BOCA 69-26
3. Provide anchors and fasteners for securing wood items, unless noted otherwise, as follows:
   a. Bolts, Nuts, Studs, and Lag Screws: Conform to ANSI B18.2.1 and B18.5.
   b. Wood Screws: Conform to ANSI B18.6.1 and Fed. Spec FF-S-111; style and material best suited for use.
   c. Nails, Brads, Staples and Spikes: Conform to Fed. Spec. FF-N-105B, type and size best suited for use.
   d. Nails, Spikes, Bolts, Studs, and Lag Screws for Exterior Exposed-to-View Locations and Other Exterior Framing: Hot-dip galvanized in accordance with ASTM A153-01, Class D.

G. Inspection:

1. Grade Marks:
   a. General: Identify lumber and plywood by official grade mark of agency approved by ALSC Board of Review.
   b. Lumber Grading: Grade stamp to contain:
      1) Symbol of grading agency
      2) Mill number or name
      3) Grade of lumber
      4) Species, species grouping, or combination designation
      5) Rules under which graded, where applicable, and
      6) Condition of seasoning at time of manufacture
         a. Conform to PS 20-70 (Reaffirmed 1981) with amendments, for grading of species used. Current edition of applicable association grading rules governs. All lumber 2-inches or less in thick-ness shall bear grade mark of an ALSC Board of Review-approved agency.
         b. Softwood Plywood: Appropriate grade trademark of APA, indicate:
      1) Type, grade, class and identification index.
      2) Inspection and testing agency mark.
         a. Treated Lumber and Plywood: Identify each piece with appropriate stamp indicating compliance with requirements; verify that stamp contains treatment name, manufacturer and location; third-party inspection agency; species; and AWPA classification.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Accurately lay out work to provide correct openings to receive work of other trades.

1. Lay out work in accordance with tolerances indicated below.
2. Cut wood framing and carpentry Work square on bearings, closely fitted, accurately set to required lines and levels, and rigidly secured in place.
3. Install wood framing, blocking, rough bucks, and furring required by drawings and necessary for proper installation of millwork and other finish-carpentry items.

B. Brush-apply preservative treatment to cut ends of treated lumber; use same type material used for original treatment.

C. Temporary Supports:

1. Make wood centering or other necessary supports for openings in masonry walls accurate and strong. Coordinate with masonry lintel schedule. Properly brace and secure in position until masonry has thoroughly set.
2. Provide blocking indicated on drawings and required. Secure blocking firmly with anchors at not more than 2 feet o.c.

D. Sills: Fasten bottom plates of walls with bolts for bearing and shear walls, and with powder-actuated fasteners for non-bearing walls as described in Contract Documents. In addition to these requirements, set plates measuring less than 3 feet in length in solid bed of specified construction adhesive.

E. Stud Framing:

1. Provide single bottom plate and double top plates for partitions.
2. Provide studs in continuous lengths without splices.
3. Toenail studs to bottom plate; end nail to lower top plate.
4. Overlap upper top plate full width at corners and intersections.
5. Face nail upper top plate to lower top plate; stagger joints 4 feet minimum.
6. Nail bottom plate to wood construction.
7. Provide triple studs at corners and partition inter-sections.
8. Frame openings for load bearing partitions unless otherwise indicated in drawings or by local code as follows:
   a. Openings Less Than 6 Feet: Single king stud, single jack stud each side of openings and headers.
   b. Openings Over 6 Feet: Single king stud, double jack stud each side of opening

and headers.

9. Frame openings for non-load-bearing partitions with single king stud, single jack stud each side of opening and headers, unless noted.
10. Load-Bearing Walls: Space studs as indicated on drawings.
11. Non-Load-Bearing Interior Partitions:
    a. General: Space studs 2 feet o.c.
    b. Walls Receiving Ceramic Tile: Space studs 1'- 4" o.c., maximum, unless lesser spacing is indicated on drawings.

F. Headers:

1. Provide continuous headers of same width as studs and depth required to span opening with required plywood flitch plate, unless noted otherwise.

2. Toenail headers to studs and opening framing.
3. Lap headers at intersections with bearing partitions, or tie with metal straps.
4. Plywood shall be continuous per drawings where indicated as part of the header.

G. Posts and Columns:

1. Frame wood columns and posts to true end bearings.
2. Extend posts or columns down to supports of such design so as to hold them securely in position.
3. Securely fasten column at top to beam or girder using anchors described in Contract Documents.

H. Beams and Girders:

1. Built-Up Members:
    a. Stagger individual members of each beam or girder so that no more than half the members will have a joint over any one support. In all cases, however, joints shall occur over supports. Use built-up members only if allowed by contract documents.
    b. Stagger-nail built-up members 9 inches on center, or bolt if shown on drawings. Set with crown edge up with full bearing at ends and intermediate support.
2. Pre-Fabricated Members:
    a. 1650 Glulam Headers by Weyerhaeuser, or approved equal, may be used in place of built-up 2x framing members. Size shall be same as built-up member.
    b. Solid LVL or PSL members may be used in place of built-up LVL members. Size shall be same as sum of built-up members.
3. Lay hard burned brick or steel bearing plates at masonry wall making a true level bearing. Allow ½-inch air space around sides and ends.
4. Wood shims are not acceptable under ends.
5. Do not notch framing members. I. Nailing:

1. Stud to Plate:
    a. 2x4 - End nail, two 16d.
    b. 2x6 - End nail, three 6d.

c. 2x8 - End nail, four 16d.
d. 2x10 - End nail, five 6d.
e. 1-3/4 by 5-1/2 Inch LVL - End nail, three 6d.
f. 1-3/4 by 7-1/4 Inch LVL - End nail, four 16d.
g. 1-3/4 by 9-1/4 Inch LVL - End nail, five 16d.
h. 1-3/4 by 11-1/4 Inch LVL - End nail, six 16d.

2. Top Plates: Spiked together, 24 inches on center, 16d.
3. Top Plates: Laps and intersections, two 16d.
4. Backing and Blocking: Two 16d, each end.
5. Corner Studs and Angles: 16d, 24 inches on center.

J. Joist Framing:

1. Install with crown edge up.
2. Locate minimum of two joists directly below stud walls for partitions running parallel with joists, unless otherwise noted in Contract Documents.
3. Support ends of each member with minimum of 3 inches of bearing on wood or steel.
4. Lap members framing from opposite sides of beams, girders or partitions a minimum of 4 inches, or tie opposing members by toe-nailing or use of metal connectors.
5. Notches in joists:
   a. Notches in middle third of joists are prohibited.
   b. Notches in top or bottom of joists: Maximum of one-sixth member depth. c. Notched ends: Maximum of one-third depth of member.
6. Bored holes: Maximum one-third depth of member and 2 inches minimum distance from edge of hole to top or bottom of joists.

K. Solid Bridging for Wood Joists:

1. Size: 2 inches by depth of joist by length required.
2. Offset bridging to permit end nailing.
3. Provide one row of blocking for spans up to 16 feet; two rows of blocking for spans over16 feet.

L. Rafter/Trussed Rafter Framing:

1. Cut rafters to set on exterior wall plates. Shim and toenail with 3-16d to top plate.
2. Place with crown side up at 16 inches on center unless noted otherwise.
3. Place rafters directly opposite each other to frame at ridge and nail to ridge member unless noted otherwise. Provide bridging at one-third points.
4. Attach trussed rafters or other end supports with framing anchors described in Contract Documents.

M. Solid Blocking for Studs:

1. Install in continuous horizontal row at mid-height of partitions and at plywood sheathing joints, unless noted otherwise.
2. Wedge, align and anchor blocking with nails.
3. Coordinate blocking with locations of finishing materials, fixtures, specialty items, and trim.

N. Masonry Wall Plates:

1. Anchor 2x6 and 2x8 wall plates to top of block walls with 5/-8-inch diameter anchor bolts at 32 inches on center unless noted otherwise.
2. Set plates on masonry bearing walls true and level to provide full bearing. Use mortar as specified in Division 4 for leveling if leveling is required.

O. Insulation Baffle:

1. Install insulation baffles on rafters and roof trusses at juncture of bearing wall at soffits and sloped member before roof deck installation.
2. Fasten to sloping member in accordance with manufacturer's product data.

P. Sheet Material Installation:

1. Plywood or OSB Roof Deck:
   a. Provide with face grain perpendicular to supports; terminate panels over supports; stagger end joints of adjacent panels.
   b. Allow 1/16-inch between end joints and 1/8-inch between edge joints for expansion and contraction.
   c. Attach plywood with 8d cement-coated nails spaced at 6-inches o.c. along each support and 12-inches o.c. intermediate.
   d. Install roof-sheathing clips at roof sheathing midspan.
   e. NOTE: Use of staples for deck fastening is permitted if allowed by local code; 1½- inch minimum staple length, 16-gauge, 3/8-inch crown minimum; space at 4 inches o.c. at edges, 8 inches at intermediate, unless otherwise required by local code or drawings.
2. Plywood or OSB Floor Decking:
   a. Lay with face grain perpendicular to supports; terminate panels over supports; stagger end joints in adjacent panels.
   b. Provide 2-inch lumber blocking between joists at panel edges, unless tongue-and- groove edges are used or otherwise noted.
   c. Allow 1/16-inch space between all edges for expansion and contraction.
   d. Lay glue bead on each joist for glue-and-nail construction. Install in accordance with manufacturer's product data.
   e. Attach plywood using 6d ring-shank or spiral-thread nails at 6 inches o.c. at edges,12 inches o.c. intermediate; set nails. Eight-penny (8d) cement-coated nails may be substituted at same spacing.
3. Gypsum Sheathing:
   a. Install on exterior studs requiring fire rating with specified fasteners spaced at 8 inches o.c., unless otherwise indicated, along each framing member.
   b. Locate fasteners ⅜-inch from edges and ends. Install sheathing material using material of greatest practicable length to avoid horizontal joints.
   c. Stagger horizontal joints where required; terminate panel vertical edges over framing members.
4. Plywood or OSB Sheathing:
   a. Install on exterior studs requiring fire rating with specified fasteners spaced

at 6 inches o.c., unless otherwise indicated, along each framing member.

b. Locate fasteners ⅜-inch from edges and ends. Install sheathing material using material of greatest practicable length to avoid horizontal joints unless noted otherwise.

c. Stagger horizontal joints where required; terminate panel vertical edges overframing members.

5. Building Paper:

a. Install over sheathing shingle-fashion; lap horizontal joints 4 inches minimum and vertical joins 6 inches minimum.

b. Fasten through sheathing to each stud using 1⅛-inch long, 11-gauge galvanized roofing nails with 7/16-inch minimum diameter heads at 2 inches from top and bottom paper edges and at paper center.

c. Wrap paper into rough openings; fasten to interior stud face; X-cut at rough opening vertical and horizontal intersection.

Q. Tolerances, unless indicated otherwise:

1. Variation from plumb: ¼-inch in 10 feet height, non-cumulative.
2. Variation in horizontal squaring diagonals: ½-inch.
3. Variation in room horizontal squaring diagonals: ¼-inch.
4. Variation in walls from tangent line (straightness): ¼-inch in 10 feet, non-cumulative.
5. Variation in location of walls from dimension: ±¼-inch.
6. Location of dimensioned openings: ±⅜-inch.
7. Variation in rough opening size: +¼-inch, -⅛-inch.

END OF SECTION 06 1000

SECTION 061053 - MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Framing with dimension lumber.
2. Wood blocking and nailers.
3. Plywood backing panels.
4. Bid Alternate wood railing.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product.

1.3 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For the following, from ICC-ES:

1. Preservative-treated wood.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece or omit grade stamp and provide certificates of grade compliance issued by grading agency.
3. Dress lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content of Lumber: 15 percent for 2-inch nominal (38-mm actual) thickness or less, 19 percent for more than 2-inch nominal (38-mm actual) thickness unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

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

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat all miscellaneous carpentry unless otherwise indicated.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.

1. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
2. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D 5664, and design value adjustment factors shall be calculated according to ASTM D 6841.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.

C. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.

D. Application: Treat items indicated on Drawings, and the following:
1. Plywood backing panels.

2.4 DIMENSION LUMBER FRAMING

A. Other Framing: No. 2 grade 9unless indicated otherwise on structural documents) of the following species:
1. Southern pine; SPIB.

2.5 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.
3. Grounds.

B. Dimension Lumber Items: Construction or No. 2 grade lumber of any species.

C. Concealed Boards: 15 percent maximum moisture content of the following species and grades:

1. Mixed southern pine or southern pine, [**No. 2**] [**No. 3**] grade; SPIB.

2.6 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: Plywood, DOC PS 1,, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch (19-mm) nominal thickness.

2.7 FASTENERS

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

1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

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

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

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

B. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry accurately to other construction. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

C. Install plywood backing panels only if required by authorities having jurisdiction over cmu walls.

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

E. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

F. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
2. ICC-ES evaluation report for fastener.

3.2 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061053

SECTION 061323 - HEAVY TIMBER CONSTRUCTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes framing using timbers and round wood poles.

1.2 DEFINITIONS

A. Timbers: Lumber of 5 inches nominal (114 mm actual) or greater in least dimension.

B. Poles: Round wood members, called either "poles" or "posts" in the referenced standards.

C. Inspection agencies, and the abbreviations used to reference them, include the following:
   1. NLGA: National Lumber Grades Authority.
   2. SPIB: Southern Pine Inspection Bureau (The).

1.3 INFORMATIONAL SUBMITTALS

A. Certificates of Inspection: Issued by lumber-grading agency for exposed timber not marked with grade stamp.

1.4 QUALITY ASSURANCE

A. Schedule delivery of materials to avoid extended on-site storage and to avoid delaying the Work.

B. Store materials under cover and protected from weather and contact with damp or wet surfaces. Provide for air circulation within and around stacks and under temporary coverings.

PART 2 - PRODUCTS

2.1 TIMBER

A. Comply with DOC PS 20 and with grading rules of lumber-grading agencies certified by ALSC's Board of Review as applicable.

   1. Factory mark each item of timber with grade stamp of grading agency.
   2. For exposed timber indicated to receive a stained or natural finish, apply grade stamps to surfaces that are not exposed to view, or omit grade stamps and provide certificates of grade compliance issued by grading agency.

B. Timber Species and Grade: Southern pine; Dense Select Structural, SPIB. (Unless noted otherwise on the structural engineering documents).

C. Appearance is important for exposed structures.

D. Moisture Content: Provide timber with 19 percent maximum moisture content at time of dressing.

E. Dressing: Provide dressed timber (S4S) unless otherwise indicated.

2.2 ROUND WOOD POLES

A. Round Wood Poles: Clean-peeled wood poles complying with ASTM D 3200; with at least 80 percent of inner bark removed and with knots and limbs cut flush with the surface.

B. Species: Southern Pine.

2.3 TIMBER CONNECTORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Simpson Strong-Tie Co., Inc.
2. USP Structural Connectors.

B. Provide bolts, 3/4 inch (19 mm) unless otherwise indicated, complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); provide nuts complying with ASTM A 563 (ASTM A 563M); and, where indicated, provide flat washers.

C. Provide shear plates, 4 inches (102 mm) in diameter, complying with ASTM D 5933.

D. Materials: Unless otherwise indicated, fabricate from the following materials:

1. Structural-steel shapes, plates, and flat bars complying with ASTM A 36/A 36M.
2. Round steel bars complying with ASTM A 575, Grade M 1020.
3. Hot-rolled steel sheet complying with ASTM A 1011/A 1011M, Structural Steel, Type SS, Grade 33.

E. Hot-dip galvanize steel assemblies and fasteners after fabrication to comply with ASTM A 123/A 123M or ASTM A 153/A 153M.

2.4 MISCELLANEOUS MATERIALS

A. End Sealer: Manufacturer's standard, transparent, colorless wood sealer that is effective in retarding the transmission of moisture at cross-grain cuts and is compatible with indicated finish.

B. Penetrating Sealer: Manufacturer's standard, transparent, penetrating wood sealer that is compatible with indicated finish.

2.5 FABRICATION

A. Shop fabricate members by cutting and restoring exposed surfaces to match specified surfacing. Finish exposed surfaces to remove planing or surfacing marks, and to provide a finish equivalent to that produced by machine sanding with No. 120 grit sandpaper.

B. Coat crosscuts with end sealer.

C. Seal Coat: After fabricating and surfacing each unit, apply a saturation coat of penetrating sealer on surfaces of each unit except for treated wood where the treatment included a water repellent.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Erect heavy timber framing true and plumb. Provide temporary bracing to maintain lines and levels until permanent supporting members are in place.

B. Fitting: Fit members by cutting and restoring exposed surfaces to match specified surfacing.

1. Predrill for fasteners using timber connectors as templates.
2. Finish exposed surfaces to remove planing or surfacing marks, and to provide a finish equivalent to that produced by machine sanding with No. 120 grit sandpaper.
3. Coat crosscuts with end sealer.

C. Install timber connectors as indicated.

1. Install bolts with orientation as indicated or, if not indicated, as directed by Architect.

3.2 ADJUSTING

A. Repair damaged surfaces and finishes after completing erection. Replace damaged heavy timber framing if repairs are not approved by Architect.

END OF SECTION 061323

SECTION 061516 - WOOD ROOF DECKING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes solid-sawn wood roof decking

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Research/Evaluation Reports: For glued-laminated wood roof decking indicated to be of diaphragm design and construction, from ICC-ES.

1.4 QUALITY ASSURANCE

1.5 WOOD ROOF DECKING, GENERAL

A. General: Comply with DOC PS 20 and with applicable grading rules of inspection agencies certified by ALSC's Board of Review.

B. Standard for Solid-Sawn Wood Roof Decking: Comply with AITC 112.

C. Roof Decking Species: Southern pine.

D. Roof Decking Nominal Size: As shown on the structural drawings.

E. Roof Decking Grade: As shown on the structural drawings.

F. Grade Stamps: Factory mark each item with grade stamp of grading agency. Apply grade stamp to surfaces that are not exposed to view.

G. Moisture Content: Provide wood roof decking with 15 percent maximum moisture content at time of dressing.

H. Face Surface: Smooth.

I. Edge Pattern: Vee grooved.

1.6 ACCESSORY MATERIALS

A. Fastener Material: Hot-dip galvanized steel.

B. Sealants: Latex, complying with applicable requirements in Section 079200 "Joint Sealants" and recommended by sealant manufacturer and manufacturer of substrates for intended application.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Pecora Corporation.
b. Tremco Incorporated.

PART 2 - EXECUTION

2.1 INSTALLATION

A. Install solid-sawn wood roof decking to comply with AITC 112.

1. Locate end joints for lay-up indicated.

a. Use 12d nails for 2-by-6 and 2-by-8 roof decking.
b. Use 30d nails for 3-by-6 and 3-by-8 roof decking.

B. Anchor wood roof decking, where supported on walls, with bolts as indicated.

C. Apply joint sealant to seal roof decking at exterior walls at the following locations:

1. Between roof decking and supports located at exterior walls.
2. Between roof decking and exterior walls that butt against underside of roof decking.
3. Between tongues and grooves of roof decking over exterior walls and supports at exterior walls.

2.2 PROTECTION

A. Provide water-resistive barrier over roof decking as the Work progresses to protect roof decking until roofing is applied.

END OF SECTION 061516

SECTION 074113.16 - STANDING-SEAM METAL ROOF PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes standing-seam metal roof panels.

1.2 PREINSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, fascias, drip edges, closures, and accessories; and special details.

C. Samples: For each type of metal panel indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Warranties: Sample of special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.6 QUALITY ASSURANCE

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

B. UL-Certified, Portable Roll-Forming Equipment: UL-certified, portable roll-forming equipment capable of producing metal panels warranted by manufacturer to be the same as factory-formed products. Maintain UL certification of portable roll-forming equipment for duration of work.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.

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

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Finish Warranty Period: 20 years from date of Substantial Completion.

C. Special Weathertightness Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that fail to remain weathertight, including leaks, within specified warranty period.

1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 1592:

1. Wind Loads: As indicated on Drawings.
2. Other Design Loads: As indicated on Drawings.
3. Deflection Limits: For wind loads, no greater than 1/240 of the span.

B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) when tested according to ASTM E 1680 or ASTM E 283 at the following test-pressure difference:

1. Test-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa).

C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 1646 or ASTM E 331 at the following test-pressure difference:

1. Test-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa).

D. Hydrostatic-Head Resistance: No water penetration when tested according to ASTM E 2140.

E. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.

1. Uplift Rating: UL 90.

F. FM Global Listing: Provide metal roof panels and component materials that comply with requirements in FM Global 4471 as part of a panel roofing system and that are listed in FM Global's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Global markings.

1. Fire/Windstorm Classification: Class 1A- 90.
2. Hail Resistance: SH.

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

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 STANDING-SEAM METAL ROOF PANELS

A. General: Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates, and accessories required for weathertight installation.

1. Steel Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E 1514.

B. Vertical-Rib, Seamed-Joint, Standing-Seam Metal Roof Panels (Basis of Design manufactuer and product named on drawings): Formed with vertical ribs at panel edges and a flat pan between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels, engaging opposite edge of adjacent panels, and mechanically seaming panels together.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Berridge Manufacturing Company.

2. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A 653/A 653M, G90 (Z275) coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A 792/A 792M, Class AZ50 (Class AZM150) coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.

a. Nominal Thickness: 0.022 inch (0.56 mm)].
b. Exterior Finish: Two-coat fluoropolymer.
c. Color: See plans for color selection.

3. Clips: One-piece fixed to accommodate thermal movement.

a. Material: 0.028-inch- (0.71-mm-) nominal thickness, zinc-coated (galvanized) Joint Type: As standard with manufacturer.
4. Panel Coverage: 16 inches (406 mm).
5. Panel Height: 1.5 inches (38 mm).

2.3 UNDERLAYMENT MATERIALS

A. Felt Underlayment: ASTM D 226/D 22M, Type II (No. 30), asphalt-saturated organic felts.

B. Slip Sheet: Manufacturer's recommended slip sheet, of type required for application.

2.4 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C 645; cold-formed, metallic-coated steel sheet, ASTM A 653/A 653M, G90 (Z275 hot-dip galvanized) coating designation or ASTM A 792/A 792M, Class AZ50 (Class AZM150) coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

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

1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal panels.
2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

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

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

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing; 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
2. Joint Sealant: ASTM C 920; as recommended in writing by metal panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

2.5 FABRICATION

A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

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

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

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

2.6 FINISHES

A. Panels and Accessories:

1. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat.
2. Three-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat.
3. Concealed Finish: White or light-colored acrylic or polyester backer finish.

PART 3 - EXECUTION

3.1 PREPARATION

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

3.2 UNDERLAYMENT INSTALLATION

A. Felt Underlayment: Apply at locations indicated below, in shingle fashion to shed water, and with lapped joints of not less than 2 inches (50 mm).

1. Apply over the entire roof surface.

B. Slip Sheet: Apply slip sheet over underlayment before installing metal roof panels if required by manufacturer.

C. Flashings: Install flashings to cover underlayment to comply with requirements specified in Section 076200 "Sheet Metal Flashing and Trim."

3.3 METAL PANEL INSTALLATION

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

1. Install clips to supports with self-tapping fasteners.
2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
3. Seamed Joint: Crimp standing seams with manufacturer-approved, motorized seamer tool so clip, metal roof panel, and factory-applied sealant are completely engaged.
4. Watertight Installation:

    a. Apply a continuous ribbon of sealant or tape to seal joints of metal panels, using sealant or tape as recommend in writing by manufacturer as needed to make panels watertight.
    b. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
    c. At panel splices, nest panels with minimum 6-inch (152-mm) end lap, sealed with sealant and fastened together by interlocking clamping plates.

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

C. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

3.4 CLEANING AND PROTECTION

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

END OF SECTION 074113.16

SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Manufactured reglets with counterflashing.
2. Formed low-slope roof sheet metal fabrications.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For sheet metal flashing and trim.

1. Include plans, elevations, sections, and attachment details.
2. Distinguish between shop- and field-assembled work.
3. Include identification of finish for each item.
4. Include pattern of seams and details of termination points, expansion joints and expansion-joint covers, direction of expansion, roof-penetration flashing, and connections to adjoining work.

C. Samples: For each exposed product and for each color and texture specified.

1.4 INFORMATIONAL SUBMITTALS

A. Product certificates.

B. Product test reports.

C. Sample warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.6 QUALITY ASSURANCE

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

1. For copings and roof edge flashings that are SPRI ES-1 tested, shop shall be listed as able to fabricate required details as tested and approved.

1.7 WARRANTY

A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

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

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

C. SPRI Wind Design Standard: Manufacture and install copings and roof edge flashings tested according to SPRI ES-1 and capable of resisting the following design pressure:

1. Design Pressure: As indicated on Drawings

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 SHEET METALS

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

B. Metallic-Coated Steel Sheet: Provide zinc-coated (galvanized) steel sheet according to ASTM A 653/A 653M, G90 (Z275) coating designation or aluminum-zinc alloy-coated steel sheet according to ASTM A 792/A 792M, Class AZ50 (Class AZM150) coating designation, Grade 40 (Grade 275); prepainted by coil-coating process to comply with ASTM A 755/A 755M.
   1. Exposed Coil-Coated Finish:
      a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
   2. Color: Match roof panel color.

2.3 UNDERLAYMENT MATERIALS

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

B. Slip Sheet: Rosin-sized building paper, 3 lb/100 sq. ft. (0.16 kg/sq. m)minimum.

2.4 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.
   1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
      a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
      b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
      c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
   2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
   3. Fasteners for Aluminum-Zinc Alloy-Coated Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

C. Solder:
   1. For Zinc-Coated (Galvanized) Steel: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead or Grade Sn60, 60 percent tin and 40 percent lead with maximum lead content of 0.2 percent.

D. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.

E. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

F. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

2.5 MANUFACTURED REGLETS

A. Reglets: Units of type, material, and profile required, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with factory-mitered and -welded corners and junctions and with interlocking counterflashing on exterior face, of same metal as reglet.
   1. Material: Galvanized steel, 0.022 inch (0.56 mm) thick.
   2. Finish: Match roof color – 2 coat fluoropolymer finish.

2.6 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.

   1. Obtain field measurements for accurate fit before shop fabrication.
   2. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
   3. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

B. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.

   1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with butyl sealant concealed within joints.
   2. Use lapped expansion joints only where indicated on Drawings.

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

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

E. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.

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

G. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.

2.7 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Roof Edge Flashing (Gravel Stop) and Fascia Cap: Fabricate in minimum 96-inch- (2400-mm-) long, but not exceeding 12-foot- (3.6-m-) long sections. Furnish with 6-inch- (150-mm-) wide, joint cover plates. Shop fabricate interior and exterior corners.

1. Fabricate from the Following Materials:
   a. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch (0.71 mm) thick.

B. Copings: Fabricate in minimum 96-inch- (2400-mm-) long, but not exceeding 12-foot- (3.6-m-) long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and interior leg. Miter corners, fasten and seal watertight. Shop fabricate interior and exterior corners.

1. Fabricate from the Following Materials:
   a. Aluminum-Zinc Alloy-Coated Steel: 0.040 inch (1.02 mm) thick.

C. Counterflashing and Flashing Receivers: Fabricate from the following materials:
1. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch (0.56 mm) thick.

D. Roof-Penetration Flashing: Fabricate from the following materials:
1. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch (0.71 mm) thick.

PART 3 - EXECUTION

3.1 UNDERLAYMENT INSTALLATION

A. Felt Underlayment: Install felt underlayment, wrinkle free, using adhesive to minimize use of mechanical fasteners under sheet metal flashing and trim. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches (50 mm).

3.2 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.

2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
3. Space cleats not more than 12 inches (300 mm) apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
5. Torch cutting of sheet metal flashing and trim is not permitted.

B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.
1. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet (3 m) with no joints within 24 inches (600 mm) of corner or intersection.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with sealant concealed within joints.

D. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

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

F. Seal joints as required for watertight construction. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

1. Do not solder metallic-coated steel and aluminum sheet.
2. Do not use torches for soldering.
3. Heat surfaces to receive solder, and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

G. Rivets: Rivet joints in uncoated aluminum where necessary for strength.

3.3 ROOF FLASHING INSTALLATION

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

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

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

D. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches (100 mm) over base flashing. Lap counterflashing joints minimum of 4 inches (100 mm).

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

3.4 CLEANING AND PROTECTION

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

B. Clean and neutralize flux materials. Clean off excess solder.

C. Clean off excess sealants.

D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.

END OF SECTION 076200

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Silicone joint sealants.
2. Latex joint sealants.
3. Urethane joint sealants.

1.2 PRECONSTRUCTION TESTING

A. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers eight samples of materials that will contact or affect joint sealants. Use manufacturer's standard test method to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.

B. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates. Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.

1.3 ACTION SUBMITTALS

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

B. Samples: For each kind and color of joint sealant required.

C. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.4 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Preconstruction compatibility and adhesion test reports.

C. Preconstruction field-adhesion test reports.

D. Field-adhesion test reports.

E. Warranties.

1.5 QUALITY ASSURANCE

A. Preinstallation Conference: Conduct conference at Project site.

1.6 WARRANTY

A. Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

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

B. Special Manufacturer's Warranty: Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

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

1. Suitability for Immersion in Liquids. Where sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247. Liquid used for testing sealants is deionized water, unless otherwise indicated.

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

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

2.2 SILICONE JOINT SEALANTS

A. Mildew-Resistant Neutral-Curing Silicone Joint Sealant: ASTM C 920.

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

    a. BASF Building Systems.
    b. Dow Corning Corporation.
    c. GE Advanced Materials - Silicones.
    d. May National Associates, Inc.
    e. Pecora Corporation.
    f. Polymeric Systems, Inc.
    g. Schnee-Morehead, Inc.
    h. Sika Corporation; Construction Products Division.
    i. Tremco Incorporated.

2. Type: Single component (S).
3. Grade: nonsag (NS).
4. Class: 100/50.
5. Uses Related to Exposure: Nontraffic (NT).

2.3 URETHANE JOINT SEALANTS

A. Urethane Joint Sealant: ASTM C 920.

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

    a. BASF Building Systems.
    b. Bostik, Inc.
    c. Lymtal, International, Inc.
    d. May National Associates, Inc.
    e. Pacific Polymers International, Inc.
    f. Pecora Corporation.
    g. Polymeric Systems, Inc.
    h. Schnee-Morehead, Inc.
    i. Sika Corporation; Construction Products Division.
    j. Tremco Incorporated.

2. Type: Single component (S) or multicomponent (M).
3. Grade: Pourable (P) or nonsag (NS).
4. Class: 100/50.
5. Uses Related to Exposure: Traffic (T).

2.4 LATEX JOINT SEALANTS

A. Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. BASF Building Systems.
b. Bostik, Inc.
c. May National Associates, Inc.
d. Pecora Corporation.
e. Schnee-Morehead, Inc.
f. Tremco Incorporated.

2.5 JOINT SEALANT BACKING

A. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin) Type O (open-cell material) Type B (bicellular material with a surface skin) or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

B. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer.

2.6 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials.

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

PART 3 - EXECUTION

3.1 PREPARATION

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

1. Remove laitance and form-release agents from concrete.
2. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.

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

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

3.2 INSTALLATION

A. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

B. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

C. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.

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

3.3 FIELD QUALITY CONTROL

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

1. Extent of Testing: Test completed and cured sealant joints as follows:

    a. Perform 10 tests for the first 1000 feet (300 m) of joint length for each kind of sealant and joint substrate.

2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.

B. Evaluation of Field-Adhesion 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.

3.4 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces.

1. Joint Locations:
    a. Isolation and contraction joints in cast-in-place concrete slabs.
    b. Tile control and expansion joints.
    c. Joints between different materials listed above.
    d. Other joints as indicated.
2. Joint Sealant: Urethane.
3. Joint-Sealant Color: As indicated by manufacturer's designations Match Architect's sample As selected by Architect from manufacturer's full range of colors.

B. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

    a. Construction joints in cast-in-place concrete.
    b. Control and expansion joints in unit masonry.
    c. Joints in exterior insulation and finish systems.
    d. Joints between metal panels.
    e. Joints between different materials listed above.
    f. Perimeter joints between materials listed above and frames of doors, windows and louvers.
    g. Control and expansion joints in ceilings and other overhead surfaces.
    h. Other joints as indicated.

2. Joint Sealant: Silicone.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

C. Joint-Sealant Application: Interior joints in horizontal traffic surfaces.

1. Joint Locations:

    a. Isolation joints in cast-in-place concrete slabs.

b. Control and expansion joints in brick flooring.
c. Control and expansion joints in tile flooring.
d. Other joints as indicated.

2. Joint Sealant: Urethane.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

D. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

a. Control and expansion joints on exposed interior surfaces of exterior walls.
b. Perimeter joints of exterior openings where indicated.
c. Vertical joints on exposed surfaces of interior GWB walls and partitions.
d. Perimeter joints between interior wall surfaces and frames of interior doors and windows.
e. Other joints as indicated.

2. Joint Sealant: Latex.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

E. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Sealant Location:

a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
b. Tile control and expansion joints where indicated.
c. Vertical joints in masonry walls and around door and window openings in masonry walls.
d. Other joints as indicated.

2. Joint Sealant: Silicone.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION 07920

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes hollow-metal work.

1.2 DEFINITIONS

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

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include elevations, door edge details, frame profiles, metal thicknesses, preparations for hardware, and other details.

C. Schedule: Prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Product test reports.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Ceco Door; ASSA ABLOY.
2. DKS Steel Door & Frame Systems, Inc.

2.2 EXTERIOR HOLLOW-METAL DOORS AND FRAMES

A. Extra-Heavy-Duty Doors and Frames: SDI A250.8, Level 3. (for all doors).

1. Physical Performance: Level A according to SDI A250.4.

2. Doors:

   a. Type: As indicated in the Door and Frame Schedule.
   b. Thickness: 1-3/4 inches (44.5 mm).
   c. Face: Metallic-coated steel sheet, minimum thickness of 0.053 inch (1.3 mm), with minimum A40 (ZF120) coating.
   d. Edge Construction: Model 2, Seamless.
   e. Core: Manufacturer's standard insulation material.

3. Thermal-Rated Doors: Provide doors fabricated with thermal-resistance value (R-value) of not less than 2.1 deg F x h x sq. ft./Btu (0.370 K x sq. m/W) when tested according to ASTM C 1363.
4. Frames:

   a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch (1.3 mm), with minimum A40 (ZF120) coating.
   b. Construction: Full profile welded.

5. Exposed Finish: Prime.

2.3 FRAME ANCHORS

A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch (1.0 mm) thick, with corrugated or perforated straps not less than 2 inches (51 mm) wide by 10 inches (254 mm) long; or wire anchors not less than 0.177 inch (4.5 mm) thick.
2. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch-(9.5-mm-) diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.

B. Floor Anchors: Formed from same material as frames, minimum thickness of 0.042 inch (1.0 mm), and as follows:

1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

2.4 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.

C. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z (12G) coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.

D. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

E. Power-Actuated Fasteners in Concrete: From corrosion-resistant materials.

F. Grout: ASTM C 476, except with a maximum slump of 4 inches (102 mm), as measured according to ASTM C 143/C 143M.

2.5 FABRICATION

A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Hollow-Metal Doors:

1. Exterior Doors: Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.

C. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

1. Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
2. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
3. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.
4. Jamb Anchors: Provide number and spacing of anchors as follows:

    a. Masonry Type: Locate anchors not more than 16 inches (406 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c., to match coursing, and as follows:

        1) Two anchors per jamb up to 60 inches (1524 mm) high.
        2) Three anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
        3) Four anchors per jamb from 90 to 120 inches (2286 to 3048 mm) high.
        4) Four anchors per jamb plus one additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 120 inches (3048 mm) high.

5. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers.

    a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.

b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

D. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.

1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.

E. Stops and Moldings: Provide stops and moldings around glazed lites and louvers where indicated. Form corners of stops and moldings with mitered hairline joints.
1. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
2. Provide loose stops and moldings on inside of hollow-metal work.
3. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

2.6 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.

1. Shop Primer: SDI A250.10.

2.7 ACCESSORIES

A. Grout Guards: Formed from same material as frames, not less than 0.016 inch (0.4 mm) thick.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Hollow-Metal Frames: Install hollow-metal frames for doors, transoms, sidelites, borrowed lites, and other openings, of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
   a. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
   b. Install frames with removable stops located on secure side of opening.
   c. Install door silencers in frames before grouting.
   d. Remove temporary braces necessary for installation only after frames have been properly set and secured.

e. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
f. Field apply bituminous coating to backs of frames that will be filled with grout containing antifreezing agents.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.

a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.

3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.

a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.

B. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Steel Doors:

a. Between Door and Frame Jambs and Head: 1/8 inch (3.2 mm) plus or minus 1/32 inch (0.8 mm).
b. Between Edges of Pairs of Doors: 1/8 inch (3.2 mm) to 1/4 inch (6.3 mm) plus or minus 1/32 inch (0.8 mm).
c. At Bottom of Door: [**3/4 inch (19.1 mm)**] [**5/8 inch (15.8 mm)**] plus or minus 1/32 inch (0.8 mm).
d. Between Door Face and Stop: 1/16 inch (1.6 mm) to 1/8 inch (3.2 mm) plus or minus 1/32 inch (0.8 mm).

3.2 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow-metal work immediately after installation.

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

D. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

E. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 081113

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Mechanical door hardware for the following:

a. Swinging doors.

1.2 ACTION SUBMITTALS

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

B. Samples: For each exposed product and for each color and texture specified.

C. Other Action Submittals:

1. Door Hardware Schedule: Prepared by or under the supervision of Installer, detailing fabrication and assembly of door hardware, as well as installation procedures and diagrams. Coordinate final door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

a. Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents.
b. Content: Include the following information:

1) Identification number, location, hand, fire rating, size, and material of each door and frame.
2) Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
3) Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
4) Description of electrified door hardware sequences of operation and interfaces with other building control systems.

2. Keying Schedule: Prepared by or under the supervision of hardware supplier or manufacturer, detailing Owner's final keying instructions for locks.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and an Architectural Hardware Consultant who is available during the

course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.

B. Architectural Hardware Consultant Qualifications: A person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and who is currently certified by DHI as follows:

1. For door hardware, an Architectural Hardware Consultant (AHC).

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

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

E. Accessibility Requirements: For door hardware on doors in an accessible route, comply with Georgia Accessibility Code.

1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
2. Comply with the following maximum opening-force requirements:

a. Interior, Non-Fire-Rated Hinged Doors: (5 lbf.) Applied perpendicular to door.
b. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.

3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than ½ inch high.
4. Adjust door closer sweep periods so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door.

F. Keying Conference: Conduct conference at Project site to comply with requirements in Section 01310 "Project Management and Coordination."

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver keys and permanent cores to Owner by registered mail or overnight package service.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Three (3) years from date of Substantial Completion, unless otherwise indicated.

    a. Locks: Limited Lifetime Warranty from date of Substantial Completion.
    b. Manual Closers: Ten (10) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. Provide door hardware for each door as scheduled in Part 3 "Door Hardware Schedule" Articles to comply with requirements in this Section.

1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturers' products.

B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Schedule" Article. Products are identified by using door hardware designations, as follows:

1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in Part 3 "Door Hardware Schedule" Article.

2.2 CONTINUOUS HINGES

A. Continuous Hinges: BHMA A156.26; Fabricated to full height of door and frame and to template screw locations; with components finished after milling and drilling are complete.

B. Continuous, Gear-Type Hinges: Extruded-aluminum, pin-less, geared hinge leaves joined by a continuous extruded-aluminum channel cap; with concealed, self-lubricating thrust bearings.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:

    a. Bommer Industries, Inc.
    b. Select Products Limited.
    c. Stanley Commercial Hardware; Div. of The Stanley Works.
    d. Zero International.

2.3 MECHANICAL LOCKS AND LATCHES

A. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.

1. Curved Lip Strikes: For locks with antifriction latchbolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.

B. Mortise Locks: BHMA A156.13; Operational Grade 1 Security Grade 2; stamped steel case with steel or brass parts; Series 1000.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product**:** Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:

a. Best Access Systems; Div. of Stanley Security Solutions, Inc.
   1) 45H Series
b. SARGENT Manufacturing Company; an ASSA ABLOY Group company.
   1) 8200 Series
c. DORMA M9000 Series.
d. Schlage Commercial Lock Division; an Ingersoll-Rand company.
   1) L9000 Series

C. Mortise Auxiliary Locks: BHMA A156.5; Grade 1; with strike that suits frame.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:

a. Best Access Systems; Div. of Stanley Security Solutions, Inc.
b. DORMA-USA.
c. SARGENT Manufacturing Company; an ASSA ABLOY Group company.
d. Schlage Commercial Lock Division; an Ingersoll-Rand company.

2.4 LOCK CYLINDERS

A. Lock Cylinders: Tumbler type, “PATENTED KEY SYSTEM” SFIC constructed from brass or bronze.

1. Manufacturer: Same manufacturer as for locking devices.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:

    a. Best Access Systems; Div. of Stanley Security Solutions, Inc.
        1) CORMAX

B. Construction Master Keys: Provide 10 construction master keys and 2 control keys.

C. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.

2.5 KEYING

A. Keying System: Factory registered complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference.
1. Grand Master Key System: Change keys, a master key, and a grand master key operate cylinders.

    a. Master key or grand master key locks to Owner's “BEST” System.

B. Keys: Nickel silver.

1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:

    a. Notation: **"DO NOT DUPLICATE”.**

2. Quantity: Provide the following:

    a. Cylinder Core Change Keys: Three.
    b. Master Keys: Six.
    c. Grand Master Keys: Six.
    d. Control Keys Two Permanent and Construction.

2.6 OPERATING TRIM

A. Operating Trim: BHMA A156.6; stainless steel, unless otherwise indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:

a. Burns Manufacturing Incorporated.
b. Don-Jo Mfg., Inc.
c. Hiawatha, Inc.
d. Rockwood Manufacturing Company.
e. Trimco.

2.7 SURFACE CLOSERS

A. Surface Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide multi-sized closers, adjustable to meet field conditions and requirements for opening force.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:

a. LCN Closers; an Ingersoll-Rand company.
   1) 4041 Series
b. Norton Door Controls; an ASSA ABLOY Group company.
   1) 7500 Series
c. SARGENT Manufacturing Company; an ASSA ABLOY Group company.
   1) 280 Series
d. DORMA USA
   1) 8916 Series
e. Stanley Security Solutions; Div. of The Stanley Black & Decker Corp. company.
   1) D4550 Series

2.8 MECHANICAL STOPS AND HOLDERS

A. Wall- and Floor-Mounted Stops: BHMA A156.16; cast brass, bronze, or stainless steel base metal.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:

    a. Architectural Builders Hardware Mfg., Inc.
    b. Baldwin Hardware Corporation.
    c. Burns Manufacturing Incorporated.
    d. Don-Jo Mfg., Inc.
    e. Hiawatha, Inc.
    f. Rockwood Manufacturing Company.
    g. Trimco.

2.9 DOOR GASKETING

A. Door Gasketing: BHMA A156.22; fabricated to full height and width of opening indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:

    a. National Guard Products.
    b. Pemko Manufacturing Co.; an ASSA ABLOY Group company.
    c. Reese Enterprises, Inc.
    d. Zero International.

2.10 THRESHOLDS

A. Thresholds: BHMA A156.21; fabricated to full width of opening indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:

    a. National Guard Products.
    b. Pemko Manufacturing Co.; an ASSA ABLOY Group company.
    c. Reese Enterprises, Inc.
    d. Zero International.

2.11 METAL PROTECTIVE TRIM UNITS

A. Metal Protective Trim Units: BHMA A156.6; fabricated stainless steel; with manufacturer's standard machine or self-tapping screw fasteners.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:

    a. Baldwin Hardware Corporation.
    b. Burns Manufacturing Incorporated.
    c. Don-Jo Mfg., Inc.
    d. Hiawatha, Inc.
    e. Rockwood Manufacturing Company.
    f. Trimco.

2.12 AUXILIARY DOOR HARDWARE

A. Auxiliary Hardware: BHMA A156.16.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:

    a. Baldwin Hardware Corporation.
    b. Don-Jo Mfg., Inc.
    c. Rockwood Manufacturing Company.
    d. Trimco.
    e. Burns Manufacturing Incorporated.

2.13 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.

1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt
2. Fire-Rated Applications:

    a. Steel Through Bolts: For the following unless door blocking is provided:

        1) Surface mounted overhead stops.
        2) Closers to doors and frames.

3. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
4. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.14 FINISHES

A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.

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

PART 3 - EXECUTION

3.1 INSTALLATION

A. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.

B. Wood Doors: Comply with DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."

C. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
2. Custom Steel Doors and Frames: HMMA 831.
3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

D. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work. Do not install surface-mounted items until finishes have been completed on substrates involved.

1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

E. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

F. Lock Cylinders: Install construction cores to secure building and areas during construction period.

1. Furnish permanent cores to Owner for installation.

G. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 07920 "Joint Sealants."

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

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

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

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

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

3.2 FIELD QUALITY CONTROL

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

3.3 DOOR HARDWARE SCHEDULE

Entrance Restroom Building

HW SET 1

DOORS: 03

EACH TO HAVE:

1	CONT. HINGE	662HD	AL	ST
1	LOCKSET	45H7TD14M	630	BE
1	LOCK GUARD	PMLP-111	630	DJ
1	CLOSER	D4550 HCS SN	689	ST
1	KICK PLATE	10 X 2 LDW .050 B4E	630	TR
1	SET SEALS	316AS	A	PM
1	DOOR BOTTOM	18100CNB	C	PM
1	THRESHOLD	1715AK-FHSL14200	AK	PM
1	DRIP CAP	346C @ 05	C	PM

HW SET 2

DOORS: 02, 01

EACH TO AHAVE:

1	CONT. HINGE	662HD	AL	ST
1	PUSH PLATE	1001-11	630	TR
1	PULL PLATE	1014-3B	630	TR
1	DEADLOCK	48H7R	630	BE
1	CLOSER	D4550 REG ARM SN	689	ST
1	FLOOR STOP	1248	626	TR
1	KICK PLATE	10 X 2 LDW .050 B4E	630	TR
1	SET SEALS	316AS	A	PM
1	DOOR BOTTOM	18100CNB	C	PM
1	THRESHOLD	1715AK-FHSL14200	AK	PM

NOTE: PREP PUSH/ PULL FOR DEADLOCK CYLINDERS

Pavilion Restroom Building

HW SET 1

DOORS: 06

EACH TO HAVE:

1	CONT. HINGE	662HD	AL	ST
1	LOCKSET	45H7TD14M	630	BE
1	LOCK GUARD	PMLP-111	630	DJ
1	CLOSER	D4550 HCS SN	689	ST
1	KICK PLATE	10 X 2 LDW .050 B4E	630	TR
1	SET SEALS	316AS	A	PM
1	DOOR BOTTOM	18100CNB	C	PM
1	THRESHOLD	1715AK-FHSL14200	AK	PM
1	DRIP CAP	346C @ 05	C	PM

HW SET 2

DOORS: 04, 05

EACH TO AHAVE:

1	CONT. HINGE	662HD	AL	ST
1	PUSH PLATE	1001-11	630	TR
1	PULL PLATE	1014-3B	630	TR
1	DEADLOCK	48H7R	630	BE
1	CLOSER	D4550 REG ARM SN	689	ST
1	FLOOR STOP	1248	626	TR
1	KICK PLATE	10 X 2 LDW .050 B4E	630	TR
1	SET SEALS	316AS	A	PM
1	DOOR BOTTOM	18100CNB	C	PM
1	THRESHOLD	1715AK-FHSL14200	AK	PM

NOTE: PREP PUSH/ PULL FOR DEADLOCK CYLINDERS

MANUFACTURER ABBREVIATIONS:

BE	BEST
DJ	DON JO
PM	PEMKO
ST	STANLEY
TR	TRIMCO

END OF SECTION 08710

096700 – FLUID-APPLIED FLOORING

KEY QUARTZ B-125 – BASIS OF DESIGN PRODUCT
1/8" Epoxy Decorative Quartz Resinous Flooring
UV Light Resistant Epoxy Grout/Sealer

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Fluid applied seamless flooring and integral formed base.

2. Joint, edge, and termination strips.

3. Prior to installation of structural floor slab, advise [General Contractor] [Construction Manager], in writing, of all requirements of concrete substrate regarding finish, level tolerance, curing and below substrate vapor barrier; see INSPECTION in Part 3.

4. Locate all flexible joints required. See submittals below.

5. Accessories necessary for complete installation.

B. Related Sections:

1. Cast-in-Place Concrete: Section 03300.
   a. Concrete sub-floor to be level (maximum variation not to exceed ¼ inch in 10 feet) and to have a steel troweled finish. No curing agents or other additives which could prevent bonding should be used unless the mechanical surface preparation method completely removes the curing agent residue or sealer.
   b. Slabs on grade must have an efficient puncture resistant vapor barrier placed directly under the slab.

2. Sealants: Section 07920.

3. Adjacent floor finishes: Division 9.

1.02 REFERENCE STANDARDS

The publications listed below from a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

A. American Society for Testing and Materials (ASTM) Publications:

C-307 Test Method for Tensile Strength of Chemical-Resistant Mortars.

C-501 Test Method for Relative Resistance to Wear Unglazed Ceramic Tile by the Taber Abraser.

C-531 Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, and Monolithic Surfacing.

C-579 Test Methods for Compressive Strength of Chemical-Resistant Mortars and Monolithic Surfaces.

C-580 Test Method for Flexural Strength and Modulus of Elasticity of Chemical-Resistant Mortars, Grouts, and Monolithic Surfacing.

C-884 Test Method for Thermal Compatibility Between Concrete and an Epoxy Resin Overlay.

D-570 Water Absorption of Plastics.

D-695 Compression Properties of Rigid Plastic.

B. Military Specifications (Mil. Spec.)

MIL D-3 134 F (Impact Resistance) Section 4.7.3.

MIL D-3 134 F (Indentation Resistance) Section 4.7.4.

MIL D-3234 F (Resistance to Elevated Temperature) Section 4.7.5.

C. ACI 301 Specifications for Structural Concrete for Buildings (most recent edition). Committee in Concrete 403 bulletin 59-43, Bond Strength to Concrete.

1.03 DEFINITIONS

A. Epoxy Resin Flooring specified under this section is referenced on the drawings as EPOXY FLOOR SYSTEM.

1.04 SYSTEM DESCRIPTION

A. System shall be 1/8 inch textured epoxy surfacing with broadcast colored quartz to form a decorative skid-resistant surface. Surface finish shall be a clear two component UV light resistant epoxy grout and and sealer.

1.05 SUBMITTALS

A. Samples: Submit 6 by 6 inch cured samples of flooring system indicating color combination and non-skid properties. Approved samples will be used during installation for product match.

B. Certified Test: Submit two copies of suppliers/ manufacturers written certification that flooring system meets or exceeds required properties.

C. Manufacturers Application Instructions: Submit descriptive data and specific recommendations for mixing, application, curing including any precautions of special handling instructions required to comply with the Occupational Safety and Health Act.

D. Shop Drawings: Shop Drawings shall be furnished showing installation of cove base and termination details, and details at floor material transitions and where adjoining equipment.

1. Locate and provide detailing for flexible joints required for flooring in area of installation.

E. Maintenance Instructions: Submit current copies of the flooring manufacturer's printed recommendations on maintenance methods and products. Submit in accordance with Section 01730 - Operation and Maintenance Manuals.

1.06 QUALITY ASSURANCE

A. Materials used in the floor surfacing shall be the products of a single manufacturer.

B. Installation shall be performed by an applicator with minimum 5 years experience in work of similar nature and scope. Installer must be approved by the manufacturer of the floor surfacing materials. The contractor shall furnish a written statement from the manufacturer that the installer is acceptable.

C. Installer to verify locations of all flexible joints required by the provisions of this Section and by the recommendations of the related material manufacturers.
1. Joint locations may or may not be shown in drawings.
2. Refer to drawings required under SUBMITTALS above.

D. Installer to keep daily log of the date of installation, room number, type, color, and method of application of product being installed. Log must be available for inspection by the Architect upon request.

E. Contractor to have proven experience with specified system.

F. Portable mock-up: Prior to starting application of flooring, provide full scale portable mock-up to establish acceptable quality, durability, and appearance. Mock-up size must not be less than 4 square feet.
1. Acceptable mock-up to be standard of quality for installed work.
2. Unacceptable installed work to be removed and replaced until acceptable. Aesthetically unacceptable but well bonded work may be overlaid or recoated per Manufacturer’s instructions if thickness clearances permit.

G. Qualifications:
1. Installer: Must be acceptable to Architect, and Manufacturer.

1.07 PROJECT CONDITIONS

A. Maintain the ambient room and the floor temperatures at 60 degrees Fahrenheit, or above, for a period extending from 72 hours before, during and after floor installation. Concrete to receive surfacing shall have cured for at least 28 days and shall have been free of water for at least 7 days.

B. Dew Point: Substrate temperature must be minimum of 5 degrees above dew point prior to, during or up to 24 hours after application of flooring system.

C. Illumination: Apply flooring system only where a minimum of 30 footcandles exist when measured 3 feet from surface.

D. Advise other trades of fixtures and fittings not to be installed until flooring is cured and protected.

1.08 PROTECTION

A. Protect adjacent surfaces not scheduled to receive the flooring by masking, or by other means, to maintain these surfaces free of the flooring material.

B. Provide adequate ventilation and fire protection at all mixing and placing operations. Prohibit smoking or use of spark or flame producing devices within 50 feet of any mixing or placing operation.

C. Provide polyethylene or rubber gloves or protective creams for all workmen engaged in applying products containing epoxy.

1.09 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. All materials shall be delivered to project site in original manufacturer's sealed containers including type of material, batch numbers, date of manufacture, and pertinent labels intact and legible.

B. Store materials in dry protected area at a temperature between 60° F to 80° F.

C. Follow all manufacturer's specific instructions and prudent safety practices for storage and handling.

1.10 WARRANTY

A. Contractor to guarantee work under this Section to be free from defects of material and installation for the duration of the warranty period. Defects occurring during warranty period shall be repaired, in a manner satisfactory to the Owner and the Architect, at no additional cost to the Owner.
1. Warranty Period: One (1) Year.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Specification based on Key Resin Company "Key Quartz B-125" grouted and sealed with Key #512 two component UV light resistant epoxy.
Key Resin Company: 888-943-4532, www.keyresin.com

B. Alternative manufacturers must have as a minimum the standards set forth in this specification and must be preapproved in accordance with project requirements.

2.02 MATERIALS

A. Cementitious Tile Backboard: Not applicable.

B. Flexible Membrane for crack treatment: 100% solids flexible epoxy.

C. Prime Coat: Two component penetrating epoxy or optional moisture vapor control epoxy system. Silica filler added to primer resin for overlaying and leveling ceramic or quarry tile.

D. Aggregates:

1. Blended quartz sand for base.
2. Color coated quartz with a minimum Mohs. hardness of 6.

E. Matrix: Matrix-epoxy/aggregate composition.

F. Grout and Topcoat(s): Clear two component UV light resistant epoxy.

2.04 MIXING

A. Apply ceramic granular flooring to specified physical properties.

B. Physical Properties:
1. Weight:
   1.00 lbs/sq.ft. per 1/8 inch thickness.
2. Compressive Strength:
   a. ASTM C-579
   b. 11,500 psi
3. Tensile Strength:
   a. ASTM C-307
   b. 2,400 psi
4. Flexural Strength:
   a. ASTM C-580
   b. 4,300 psi
5. Indentation:
   a. MIL-D-3134F Sec. 4.7.4
   b. Withstands 2,000 psi for 30 mins. without indentation
6. Impact Resistance:
   a. MIL-D-3134F, Sec. 4.7.3
   b. 16 ft/lbs.; no chipping, cracking, or delamination
7. Adhesive Strength to Concrete:
   a. ACI Committee 403
   b. 300 psi (100% concrete failure)
8. Water Absorption:
   a. ASTM-D-570
   b. 0.10
9. Abrasion Resistance:
   a. ASTM-C-501
   b. 32 mg. max.
10. Thermal Shock Resistance:
    a. ASTM-C-884
    b. passes
11. Thermal Coefficient of Expansion:
    a. ASTM-C-531
    b. 22 x 10^{-6} in/ in/ °F

C. Provide slip-resistant, cleanable textured finish. Samples to be approved by Owner and Architect.

D. Provide 4-6 inch integral coved base, typically.

2.05 FINISHES

A. Color as selected by Architect from the manufacturer's standard patterns.

PART 3 EXECUTION

3.01 PREPARATION

A. Obtain Architect's approval of mock-up before installing flooring; see QUALITY ASSURANCE in **PART 1.**

B. Preparation of Surface:

1. Inspect surfaces to receive flooring and verify that condition is smooth and free from conditions that will adversely affect execution, permanence, or quality of work.

    a. Remove all projections, all debris detrimental to flooring system, and dirt, oil contaminates, grease, and surface coatings affecting bond.

2. Notify Architect in writing prior to commencing work of any conditions deemed unsatisfactory for the installation; installation of flooring materials is understood as acceptance of the substrate as satisfactory.

3. Ceramic tile or quarry tile: Not applicable.

4. Concrete: The General Contractor shall be responsible for hiring an independent testing service to test for moisture content and moisture vapor emission rate; install no flooring over concrete until the concrete has been cured and is sufficiently dry to achieve permanent bond with flooring as determined by material manufacturer's recommended bond and moisture tests.

    a. Effectively remove concrete laitance by steel shot blasting or other method approved by flooring manufacturer.

    b. Concrete slab shall have an efficient puncture-resistant reinforced moisture vapor barrier 15 mils thick minimum directly under the concrete slab (for slab on grade). Do not use vapor barrier manufactured with recycled material. Testing must be done to verify that the moisture vapor emission rate of the slab does not exceed that as recommended by the manufacturer at time of installation of the flooring or at any future date. Moisture vapor emission and moisture content testing must conform with the requirements of ASTM F-1869-98 (Calcium Chloride Test) and ASTM F-2170-02 (Relative Humidity Probe Test). If test results show excessive levels of moisture content or vapor emission rate, apply manufacturer’s recommended moisture vapor emission control material.

    c. Treat cracks in concrete using manufacturer's recommended practice. Rout out crack and fill with rigid epoxy; coat with flexible membrane in accordance with manufacturer's recommendation to reduce cracking through flooring system. Refer to section 3.02.B.

3.02 INSTALLATION

A. Install all floor materials in strict conformance with manufacturer's instructions.

B. Route out all cracks (larger than 1/32" width) and fill with Key Crack Filler or other material approved by Manufacturer of floor materials. Apply Key #580 Flexible Membrane across the crack and 12 inches on either side at a spread rate of 50 square feet per gallon to achieve 30-35 mils dry. Optional membrane reinforcement: Fiberglass scrim cloth is applied (using Key #502 Primer) to top of cured membrane or by applying scrim cloth onto surface of tacky Key #580.

C. Prime entire surface with recommended primer or moisture vapor control treatment, apply prior to installation of crack isolation membrane and also use to fill cracks. For properly prepared tile substrates, add filler powder to epoxy primer to create a slurry consistency. Flat trowel tight against tile to fill grout joints flush. Allow to cure. If grout joints are not completely flush, repeat procedure until joints are filled flush with tile surface. Subsequent grinding and/or leveling may be necessary to eliminate raised tile edges ("crowning") that may telegraph through the epoxy topping. For areas that slope to drain, add fume silica to create a paste consistency or use Key #510-CV epoxy paste.

D. Apply epoxy binder and broadcast decorative aggregate in two applications to achieve a minimum thickness of 1/8 inch.

E. Apply UV light resistant epoxy grout coat and topcoat(s) to provide a uniform, dense surface.

F. Match finished work to approved samples, uniform in thickness, sheen, color, pattern and texture, and free from defects detrimental to appearance.

G. Apply temporary protection until floor is fully cured. The General Contractor shall protect the finished floor from the time that the sub-contractor completes the work.

H. Integral Cove Base: Where scheduled, provide integral cove base formed from flooring over tile backerboard as specified under 09250 - Gypsum Drywall. Optional: provide cove trim strip at top of base as recommended by flooring manufacturer and trowel material up wall to form smooth, integral transition and base 4-6 inches high unless otherwise indicated or scheduled.

END OF SECTION

SECTION 099300 - STAINING AND TRANSPARENT FINISHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes surface preparation and application of wood stains and transparent finishes on the following substrates:

1. Exterior Substrates:
   a. Exposed framing.
   b. Dressed lumber (finish carpentry or woodwork).
   c. Wood decks and ramps.

2. Interior Substrates:
   a. Exposed framing.
   b. Dressed lumber (finish carpentry or woodwork).

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.

B. Samples: For each type of finish system and in each color and gloss of finish required.

1.3 QUALITY ASSURANCE

A. Mockups: Apply mockups of each finish system indicated and each color selected to verify preliminary selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each type of finish system and substrate.

   a. All wood surfaces: Provide samples on each type of wood surface to be stained. These are separate samples minimum of 18” in length or 1’ square area.
   b. Provide samples for both buildings, all signs, platforms and boardwalks.

2. Final approval of stain color selections will be based on mockups.

   a. If preliminary stain color selections are not approved, apply additional mockups of additional stain colors selected by Architect at no added cost to Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Behr Process Corporation.
2. Benjamin Moore & Co.
3. Sherwin Williams.

B. Basis-of-Design Product: Subject to compliance with requirements, provide products indicated in wood finish systems schedules or comparable products by one of the following:

1. Sherwin Williams

C. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to products listed:
1. Superdeck exterior waterborne Solid Color Stain for exterior horizontal wood surfaces. For platforms, boardwalks and bridges.
2. Superdeck oil based semitransparent stain: where noted on plans.
3. Superdeck waterborne clear sealer for front monument sign that is not stained.

2.2 MATERIALS, GENERAL

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products List."

B. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

C. Stain Colors: See drawings for colors and required samples.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Exterior Wood Substrates: 15 percent, when measured with an electronic moisture meter.

C. Maximum Moisture Content of Interior Wood Substrates: 15 percent, when measured with an electronic moisture meter.

D. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

E. Proceed with finish application only after unsatisfactory conditions have been corrected.

1. Beginning finish application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and finishing.

1. After completing finishing operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean and prepare surfaces to be finished according to manufacturer's written instructions for each substrate condition and as specified.

1. Remove dust, dirt, oil, and grease by washing with a detergent solution; rinse thoroughly with clean water and allow to dry. Remove grade stamps and pencil marks by sanding lightly. Remove loose wood fibers by brushing.
2. Remove mildew by scrubbing with a commercial wash formulated for mildew removal and as recommended by stain manufacturer.

3.3 APPLICATION

A. Apply finishes according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."

B. Apply finishes to produce surface films without cloudiness, holidays, lap marks, brush marks, runs, ropiness, or other surface imperfections.

3.4 CLEANING AND PROTECTION

A. Protect work of other trades against damage from finish application. Correct damage by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

B. At completion of construction activities of other trades, touch up and restore damaged or defaced finished wood surfaces.

END OF SECTION 099300

SECTION 101434 – BUILDING PANEL SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Exterior Panel signs for entry restroom building and pavilion restroom building.

   2. Provide signs identifying each Men's Toilet Room, Women's Toilet Room, Building Number Sign if required by local authorities. Location by Architect in field. All signs are wall mounted adjacent to doors in accordance with accessibility standards. Owner to determine sign messaging.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified.

C. Sign Schedule: Use same designations specified or indicated on Drawings or in a sign schedule. Owner may edit sign messaging to be different from names of spaces on drawings.

1.3 INFORMATIONAL SUBMITTALS

A. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 WARRANTY

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

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Thermal Movements: For exterior signs, allow for thermal movements from ambient and surface temperature changes.

B. Accessibility Standard: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1] for signs. Comply with current Georgia Accessibility Code.

2.2 SIGNS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

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1. Advance Corporation; Braille-Tac Division.
2. Allen Industries, Inc.
3. Allen Markings International.
4. APCO Graphics, Inc.
5. ASE, Inc.
6. ASI Sign Systems, Inc.
7. Best Sign Systems Inc.
8. Bunting Graphics, Inc.
9. Clarke Systems.
10. Diskey Sign Company.
11. Fossil Industries, Inc.
12. InPro Corporation.
13. Mohawk Sign Systems.
14. Nelson-Harkins Industries.
15. Poblocki Sign Company, LLC.
16. Seton Identification Products.
17. Supersine Company (The); Division of Stamp-Rite, Inc.
18. Vista System.
19. Vomar Products, Inc.

B. Panel Sign: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:

1. Solid-Sheet Sign**,** Returns, and Back: Aluminum sheet with finish specified in "Surface Finish and Applied Graphics" Subparagraph below and as follows:

    a. Surface-Applied Graphics: Applied baked enamel or powder coat.

2. Sign-Panel Perimeter: Finish edges smooth.

    a. Edge Condition, Vertical Edges.
    b. Corner Condition in Elevation: Rounded to radius indicated.

3. Frame: Entire perimeter.

    a. Material: Aluminum

    b. Profile: Square.
    c. Corner Condition in Elevation: Rounded to radius.
    d. Finish and Color: As selected by Architect from manufacturer's full range.

4. Mounting: Surface mounted to wall with concealed anchors. Field locate signs with Architects approval and in compliance with ADA Law and local accessibility requirements.
5. Surface Finish and Applied Graphics:

    a. Integral Metal Finish: As selected by Architect from full range of industry finishes.
    b. Baked-Enamel or Powder-Coat Finish and Graphics: Manufacturer's standard, in color as selected by Architect from manufacturer's full range.
    c. Painted Finish and Graphics: Manufacturer's standard, factory-applied exterior-grade sign paint, in color as selected by Architect from manufacturer's full range.
    d. Overcoat: Manufacturer's standard baked-on clear coating.

2.3 ACCESSORIES

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

1. Use concealed fasteners and anchors unless indicated to be exposed.
2. For exterior exposure, furnish stainless-steel devices unless otherwise indicated.
3. Exposed Metal-Fastener Components, General:

    a. Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.

4. Sign Mounting Fasteners:

    a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material or screwed into back of sign assembly, unless otherwise indicated.

2.4 FABRICATION

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

1. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
2. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
3. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.

4. Internally brace signs for stability and for securing fasteners.
5. Provide rebates, lugs, and brackets necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.

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

C. Subsurface-Engraved Graphics: Reverse engrave back face of clear face-sheet material. Fill Brackets: Fabricate brackets, fittings, and hardware for bracket-mounted signs to suit sign construction and mounting conditions indicated. Modify manufacturer's standard brackets as required.

1. Aluminum Brackets: Factory finish brackets with baked-enamel or powder-coat finish to match sign-background color.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Install signs so they do not protrude or obstruct according to the accessibility standard.
3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
4. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

B. Mounting Methods:

1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.

a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.
b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.

2. Projecting Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.

a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place spacers on studs, place sign in position, and push until

spacers are pinched between sign and substrate, embedding the stud ends in holes. Temporarily support sign in position until adhesive fully sets.

C. Remove temporary protective coverings and strippable films as signs are installed.

END OF SECTION 10434

SECTION 102113.19 - PLASTIC TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes solid-plastic toilet compartments configured as toilet enclosures and urinal screens**.** See drawings for location, configuration, type and color selections.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For toilet compartments. Include plans, elevations, sections, details, and attachment details.

C. Samples for each type of toilet compartment material indicated.

1.3 INFORMATIONAL SUBMITTALS

A. Product certificates.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 for toilet compartments designated as accessible.

2.2 SOLID-PLASTIC TOILET COMPARTMENTS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Accurate Partitions Corp.; ASI Group.

B. Toilet-Enclosure Style: Overhead braced.

C. Urinal-Screen Style: Wall hung.

D. Door, Panel, and Pilaster Construction: Solid, high-density polyethylene (HDPE) panel material, not less than 1 inch (25 mm) thick, seamless, with eased edges, and with homogenous color and pattern throughout thickness of material.

1. Integral Hinges: Configure doors and pilasters to receive integral hinges.
2. Heat-Sink Strip: Manufacturer's standard continuous, extruded-aluminum or stainless-steel strip fastened to exposed bottom edges of solid-plastic components to hinder malicious combustion.
3. Color and Pattern: in each room (See drawings for color and pattern selection).

E. Pilaster Shoes and Sleeves (Caps): Manufacturer's standard design; polymer or stainless steel as approved by the Owner.

1. Polymer Color and Pattern: Matching pilaster.

F. Brackets (Fittings):
1. Full-Height (Continuous) Type: Manufacturer's standard design; stainless steel.

2.3 HARDWARE AND ACCESSORIES

A. Hardware and Accessories: Manufacturer's standard operating hardware and accessories.

1. Material: Stainless steel.
2. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible.

B. Hardware and Accessories: Manufacturer's heavy-duty stainless-steel operating hardware and accessories.

1. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible.

C. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.

D. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless-steel, hot-dip galvanized-steel, or other rust-resistant, protective-coated steel compatible with related materials.

2.4 FABRICATION

A. Fabrication, General: Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories where required for attachment of toilet accessories.

B. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.

C. Door Size and Swings: Unless otherwise indicated, provide 24-inch- (610-mm-) wide, in-swinging doors for standard toilet compartments and 36-inch- (914-mm-) wide, out-swinging doors with a minimum 32-inch- (813-mm-) wide, clear opening for compartments designated as accessible.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.

1. Maximum Clearances:

a. Pilasters and Panels: 1/2 inch (13 mm).
b. Panels and Walls: 1 inch (25 mm).

2. Full-Height (Continuous) Brackets: Secure panels to walls and to pilasters with full-height brackets.

a. Locate bracket fasteners so holes for wall anchors occur in masonry or tile joints.
b. Align brackets at pilasters with brackets at walls.

3.2 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION 102113.19

SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Public-use washroom accessories.
2. Childcare accessories.
3. Underlavatory guards.
4. Custodial accessories.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: Full size, for each exposed product and for each finish specified.

1.3 INFORMATIONAL SUBMITTALS

A. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 WARRANTY

A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 PUBLIC-USE WASHROOM ACCESSORIES

A. Toilet Tissue (Roll) Dispenser: (See schedule on plans)

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. American Specialties, Inc.
b. Bobrick Washroom Equipment, Inc.
c. Bradley Corporation.

2. Mounting: Partition mounted, and/or wall surface mounted. (See plans for locations)
3. Material and Finish: Stainless steel, No. 4 finish (satin).

B. Liquid-Soap Dispenser: (See plans for scheduled item)

C. Grab Bar (See plans for scheduled item):

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. American Specialties, Inc.
b. Bobrick Washroom Equipment, Inc.
c. Bradley Corporation.

2. Mounting: Flanges with concealed fasteners.

3. Material: Stainless steel, 0.05 inch (1.3 mm) thick.

a. Finish: Smooth, No. 4 finish (satin).

4. Outside Diameter: 1-1/4 inches (32 mm).
5. Configuration and Length: As indicated on Drawings.

D. Sanitary-Napkin Disposal Unit (See plans for scheduled item):

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. American Specialties, Inc.
b. Bobrick Washroom Equipment, Inc.
c. Bradley Corporation.

2. Mounting: Surface mounted.(See plans for locations)

3. Door or Cover: Self-closing, disposal-opening cover and hinged face panel with tumbler lockset.
4. Receptacle: Removable.

5. Material and Finish: Stainless steel, No. 4 finish (satin).

E. Mirror Unit (See plans for scheduled item):

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. American Specialties, Inc.
b. Bobrick Washroom Equipment, Inc.
c. Bradley Corporation.

F. Coat Hook (See plans for scheduled item):

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. American Specialties, Inc.
b. Bobrick Washroom Equipment, Inc.
c. Bradley Corporation.

2. Description: Double-prong unit.

3. Material and Finish: Stainless steel, No. 4 finish (satin).

2.3 WARM-AIR DRYERS

A. High Speed Warm-Air Dryer (See plans for scheduled item):

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. American Specialties, Inc.
b. Bobrick Washroom Equipment, Inc.
c. Bradley Corporation.
d. Excel Dryer Inc.
e. World Dryer Corporation.

2. Mounting: Surface mounted, with low-profile design.
3. Operation: Electronic-sensor activated with timed power cut-off switch.

a. Operation Time: 30 to 40 seconds.

4. Cover Material and Finish: Stainless steel, No. 4 finish (satin).
5. Electrical Requirements: See basis of design product specified on drawings.

2.4 CHILDCARE ACCESSORIES

A. Diaper-Changing Station (See plans for scheduled item):

1. Manufacturers: Subject to compliance with requirements, [**provide products by the following**] [**provide products by one of the following**] [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:

a. American Specialties, Inc.
b. GAMCO Specialty Accessories; a division of Bobrick.
c. Koala Kare Products.

2. Description: Horizontal unit that opens by folding down from stored position and with child-protection strap.

a. Engineered to support minimum of [**250-lb (113-kg)**] <**Insert value**> static load when opened.

3. Mounting: Surface mounted, with unit projecting not more than 4 inches (100 mm) from wall when closed.
4. Operation: By pneumatic shock-absorbing mechanism.
5. Material and Finish: HDPE in manufacturer's standard color.
6. Liner Dispenser: Built in.

2.5 UNDERLAVATORY GUARDS

A. Underlavatory Guard (If not scheduled on drawings but provide as specified herein):

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Plumberex Specialty Products, Inc.
b. Truebro by IPS Corporation.

2. Description: Insulating pipe covering for supply and drain piping assemblies that prevents direct contact with and burns from piping; allow service access without removing coverings.

3. Material and Finish: Antimicrobial, molded plastic, white.

2.6 CUSTODIAL ACCESSORIES

A. Mop and Broom Holder (If not scheduled on plans, provide as specified herein):

1. Manufacturers: Subject to compliance with requirements, [**provide products by the following**] [**provide products by one of the following**] [**available manufacturers**

offering products that may be incorporated into the Work include, but are not limited to, the following]:

a. AJW Architectural Products.
b. American Specialties, Inc.
c. Bobrick Washroom Equipment, Inc.
d. Bradley Corporation.

2. Description: Unit with shelf, hooks, holders, and rod suspended beneath shelf.

3. Length: 36 inches (914 mm).
4. Hooks: Four.
5. Mop/Broom Holders: Three, spring-loaded, rubber hat, cam type.
6. Material and Finish: Stainless steel, No. 4 finish (satin).

a. Shelf: Not less than nominal 0.05-inch- (1.3-mm-) thick stainless steel.
b. Rod: Approximately 1/4-inch- (6-mm-) diameter stainless steel.

2.7 FABRICATION

A. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Grab Bars: Install to withstand a downward load of at least 250 lbf (1112 N), when tested according to ASTM F 446.

END OF SECTION 102800

SECTION 104416 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 COORDINATION

A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Fire Extinguishers: Type, size, and capacity for each mounting bracket indicated. Locate one fire extinguisher and bracket in each janitors space. Wall mounted location by Owner and as approved by local fire marshal.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Ansul Incorporated; Tyco International.
b. Guardian Fire Equipment, Inc.
c. Kidde Residential and Commercial Division.

2. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B.

B. Multipurpose Dry-Chemical Type: UL-rated 10lb nominal capacity, with monoammonium phosphate-based dry chemical in manufacturer's standard enameled container.

2.3 MOUNTING BRACKETS

A. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or red baked-enamel finish.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Amerex Corporation.
b. Ansul Incorporated; Tyco International.
c. Guardian Fire Equipment, Inc.
d. Kidde Residential and Commercial Division.

B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.

1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.

a. Orientation: Vertical.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged fire extinguishers.

B. Install fire extinguishers and mounting brackets in locations indicated above and in compliance with requirements of authorities having jurisdiction.

1. Mounting Brackets: 54 inches (1372 mm) above finished floor to top of fire extinguisher.

C. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 104416

SECTION 22 1000

PIPING AND ACCESSORIES

PART 1 - GENERAL

1.1 MECHANICAL GENERAL

A. Section 23 0010 is applicable.

1.2 PIPING SYSTEMS

A. Domestic Water System.

B. Sanitary Sewer System.

1.3 PIPE AND FITTINGS

A. Any one piping system may employ a variety of fittings and materials depending upon size, system temperature and pressure. Threaded or welded fittings may be employed in a single system. Welded fittings shall be long radii. Weld-o-lets and thread-o-lets may be used.

B. Copper pipe and tubing may be used in any water or drain system provided the system pressure does not exceed the rated internal working pressure for the temperature and jointing method used as listed in the "Copper Tube Handbook" by the Copper Development Association, Inc., 412/6, Table 11. Copper pipe and tubing shall be type L ASTM B 88, joints with "lead-free" solder.

1.4 SYSTEM PRESSURE

A. Rated working pressure of pipe, fittings, valves, and joints shall be in excess of system maximum pressure and system maximum temperature at the point of installation.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. Domestic Water System:
   1. Pipe:
      a. Type L copper ASTM B88 for all sizes above slab.
      b. Type K copper ASTM B88 for all below slab.
      c. Water service underground to building shall be cement lined ductile iron Class 50.
   2. Fittings and Joints:
      a. Copper pipe: Wrought copper fittings with lead free solder joints or mechanical grooved coupling joints.
      b. Water service underground to building shall be push-on type for pipe and standard mechanical joints for fittings. Joints shall conform to AWWA C111.
   3. Exposed Fixtures:
      a. Pipe: Chrome-plated brass and chrome-plated soft copper tubing.
      b. Fittings: Plated brass threaded.

B. Sanitary Sewer System:
   1. Pipe:
      a. Above ground and underground: PVC-Schedule 40
      b. Fixture waste arms: Copper Type DWV.
   2. Fittings and Joints:
      a. PVC-Drainage waste & vent pattern Schedule-40.

2.2 VALVES

A. General: Valves 2" and smaller shall be bronze, threaded, or solder pattern; 2" and larger shall be iron body, bronze trim, threaded, grooved, or flanged through 4". Size 5" and larger shall have flanged or grooved connections. All valves shall be Class 125 unless noted otherwise. Use only lubricated plug cocks in gas system.

B. Manufacturers:
   1. All valves of a single class, such as; bronze, solder ball, iron body, flanged globe, or butterfly, shall be by one manufacturer. All classes of valves need not be by the same manufacturer.
   2. Globe and Check Valves: Stockham, Hammond, Jenkins, Kitz, Milwaukee, Victaulic, or Crane.
   3. Ball Valves: Hammond, Apollo, Kitz, Watts, Victaulic, or Crane.
   4. Lubricated Plug Valves: Rockwell, Homestead, Victaulic, or Crane.
   5. Butterfly Valves: Dezurik, Hammond, Kitz, Milwaukee, Grinnell, Victaulic, or Crane.

C. Gate Valves: Shall not be used.

D. Ball Valves:
   1. Ball Valves: 150 WSP, 600 WOG bronze body, chrome-plated, solid bronze ball, smooth bore, large or full port, with open post and stem keyway, gasketed stem, teflon seat, threaded only. Ball valves used for balancing shall have infinitely-adjustable memory stops. Valves on insulated pipe shall have extended handles of sufficient height to accommodate 2" of insulation.

2.3 UNIONS

A. Unions shall be installed in water systems to facilitate assembly of piping and permit removal of pumps, tanks, water heaters, flow-limiting valves, check valves, strainers, and control valves.

B. Unions 3" and smaller shall be malleable iron, ground joint with brass seats; 4" and larger use flanges. In copper piping, unions shall be all brass with ground joint.

C. Flanges of valves or equipment are considered as unions.

D. Systems using mechanical couplings, the couplings are considered unions.

E. Dielectric unions shall be installed at each piping joint and equipment connection between ferrous and non-ferrous materials. Dielectric union shall be standard products manufactured for service indicated, to effectively isolate ferrous from non-ferrous piping (electrical conductance), prevent galvanic action and stop corrosion. ClearFlow Dielectric Waterway is also acceptable when used with a threaded union or grooved coupling.

2.4 SLEEVES

A. Defined as holes provided to permit passage of pipe, and on insulated pipes, pipe and insulation, through floors and walls. Soil, waste and vent, and supply pipes for plumbing fixture connection, require no wall sleeves.

B. Masonry: Sleeves shall be formed with Schedule 40 steel pipe, and shall be sized large enough to accommodate pipe insulation to be continuous through sleeve on systems indicated. Pipe sleeve shall extend a minimum of 1" on both sides of wall.

C. Concrete:

1. Walls and floors, except floors on grade, shall be formed by any device which insures a neat circular hole of proper size, such as pipe, sheet metal, polyethylene hats, diamond drilled and others.
2. Structural floor sleeves require extension above the floor surface to prevent water passage down the sleeves shall be made with Schedule 40 black steel pipe, extended 1" above the floor.

D. Other Sleeves: Where pipes pass through wood, drywall, plaster partitions, or suspended ceilings, sleeves shall be neatly cut holes and sealed with caulk.

E. Sealing of Annular Space: For sleeves in masonry and concrete walls and elevated floor slabs, the non-rated, annular space shall be closed by packing with silicone RTV foam. Sleeves in exterior walls shall be sealed with a "Link-seal" assembly or packed with fiberglass and sealed at both ends with weather-resistant non-hardening caulk. Where escutcheons are not required, the annular space shall be neatly sealed at the sleeve end. Pipe passing through ducts and plenums shall be sealed air tight. Annular spaces in sleeves that pass through fire resistive or fire rated partitions, floors, or ceilings, shall be closed with 3M Fire Barrier Penetration Sealing System, or approved product.

F. Unused Holes in floors and walls made for pipe or duct penetrations shall be plugged to match wall or floor and neatly finished.

G. Sleeves sized for pipe diameter plus full thickness insulation passage.

2.5 ACCESS PANELS

A. Refer to section 23 0010.

2.6 ESCUTCHEONS

A. Escutcheons are annular shaped metal plates installed to cover annular space around pipes entering walls, floors and ceilings, and are installed for decorative purposes. They shall be chrome-plated steel, with fastening method to insure they remain in position. Fastening method may be set screw or multiple spring fingers contacting pipe.

B. Escutcheons for water closet, plated supply pipes, and shower arms shall be chrome-plated brass with set screw.

C. Escutcheons are not to be installed on the bell of any soil or drains pipe; on any pipe larger than 4"; on insulated pipe if exterior diameter of insulation is larger than 4"; or on pipes which do not enter the wall or floor at approximately right angles.

2.7 FLASHING

A. Shall be sheet lead, 4 pounds per square foot, and extend out from pipe and drain edge no less than 12".

B. Roof drains, floor drains, area drains, and equipment room drains installed where membrane water-proofing is installed shall be flashed.

C. Vent stacks and other pipes through roof shall be flashed. Flashing may be caulked into pipe bell if flush with finished roof, or on 3" and larger may employ 4 pound boot flashing. Vents shall extend a minimum of 12" above finished roof elevation at penetration. Refer to roof pipe portals for piping through roof other than sanitary vents or overflow drains.

2.8 CLEANOUTS FOR SOIL, WASTE, AND RAINWATER SYSTEMS

A. Shall be provided at the base of each stack, and at each change in direction greater than 45. Cleanouts shall be of the same nominal size as the pipe up to and including 4" pipe and not less than 4" in larger pipe. The distance between cleanouts in horizontal soil and waste lines shall

not be more than 50 feet for lines up to and including 3 inches; 80 feet on lines 4" and larger. All cleanouts shall be made with a caulking ferrule having a cast brass cleanout screw plug having a raised nut less than 1" high; except that cleanouts underground under floor slabs shall be extended through the slabs, flush with the floor line provided with counter sunk caps.

B. Cleanouts shall be J.R. Smith, and according to the following table:

C. Cleanouts shall be J.R. Smith, and according to the following table. Equivalent cleanouts by Zurn, Josam, Mifab, Wade, Watts Drainage, and Ancon are acceptable.

1.	Exposed Piping, Cast Iron	4470	
2.	Exterior or Unfinished Area Floors, (Cast Iron)	4031	
3.	Finished Ceramic or Quarry Tile Floors	4031	
4.	Vinyl Tile Floors (Recessed top for Tile Insert)	4151	
5.	All Walls		4472
6.	Carpeted Area Floors (Carpet Cleanout Markers)	4031-X	

2.9 DRAINS

A. Drains shall be J.R. Smith and according to the following schedule. Equivalent drains by Zurn, Josam, Mifab, Wade, Watts Drainage, and Ancon are acceptable.

1.	Floor Drain (FD) Nickel Brass Top, Flashing Collar (5" Square Top)	2010-NB
2.	Equipment Room Drain (ERD)	2110

2.10 PROTECTIVE PANS

A. Provide protective pans under or around individual pipes passing over electric bus duct, panel boards, and as required by Code. Pans shall not be provided under sprinkler piping. The pan shall be constructed of 12-gauge black iron with a 6-inch lip, the corners welded to make the pan water-tight. Each pan shall be given three coats of Rust-O-leum paint and shall be supported by hangers. Provide 1" drain to floor. The pan shall extend 6 inches either side of piping.

2.11 STRAINERS

A. Shall be bronze or iron body in sizes to and including 2", iron body in larger sizes - strainer screen shall be stainless steel with 1/10" perforation, those over 5" - 1/2" perforations. Strainers over 1" shall have valved blow-offs.

2.12 ADDITIONAL PIPING ITEMS

A. Wherever welded, piping is connected to equipment, valves, or other items requiring maintenance, servicing, or possible removal; the connecting joint shall be flanged, union, or mechanical coupling.

2.13 WATER HAMMER ARRESTORS - (WHA)

A. A manufactured water hammer arrestor shall be provided at the top of each riser and on each fixture branch to prevent water hammer.

B. Each water hammer arrestor shall be sized and certified according to the Plumbing and Drainage Institute "Standard P.D.I. - WH201".

C. Acceptable manufacturers are Smith, Watts, Sioux Chief, or PPP Inc.

2.14 HOSE BIBB (HB)

A. Valve shall be polished chrome, brass construction.

B. Provide loose key tee handle with vacuum breaker backflow preventer and 3/4" hose thread with 1/2" inlet pipe size.

C. Acceptable Manufacturer and Model Number:

1.	Woodford	26P-1/2" w/loose key handle
2.	T & S Brass	B736-POL
3.	Chicago	293 W/E22 vacuum breaker.

2.15 WALL HYDRANT (WH)

A. Cast bronze, non-freeze wall hydrant with satin finish face, 3/4" threaded hose outlet, integral vacuum breaker backflow preventer, internal pressure relief, bronze construction throughout with loose tee key handle to access box and operate valve.

B. Acceptable manufacturer and model number:

1.	Josam Series	71000-52
2.	Woodford	B67
3.	Smith	5509QT - RB

PART 3 - EXECUTION

3.1 LAYING OF UNDERGROUND

A. Excavation shall be only wide enough to install the pipe.

B. Pipe laid in ditch shall be supported on no less than 75% of its length, per joint, and bell holes shall be provided for bell and spigot pipes, this counted as unsupported length.

C. Backfill shall be clean earth or clay if within one foot of pipe - no debris, rocks, cinders, or metal scrap may be used as backfill. Backfill shall be carefully placed on both sides of pipe and tamped, thereafter placed in maximum 6" layers for first two feet, compacting each layer. Completed backfill shall test 98% Standard Proctor. If rock is encountered, it shall be removed 6" lower than pipe and replaced with clean earth or clay.

D. Water service pipe shall be installed per manufacturer's recommendations and shall be anchored and thrust-blocked as required.

E. PVC sewer pipe shall be installed per manufacturer's recommendations, and shall meet ASTM D2321.

3.2 INSTALLATION OF PIPING

A. All piping shall be properly supported or suspended on stands, clamps, hangers, etc., of approved design and make as specified. Supports shall be designed to permit free expansion and contraction while minimizing vibration. Pipes shall be anchored where shown by means of steel clamps, or other approved means, securely fastened to the pipe and rigidly attached to the building construction.

B. Screw threads shall be cut clean and true; screw joints shall be made tight without caulking. No bushings shall be used. All pipe 2" and smaller shall be reamed out after cutting to nominal internal diameter and to remove all burrs.

C. Drawings indicate generally the size and location of piping, and while sizes must not be decreased, the right is reserved to change runs and sizes of pipes in order to accommodate conditions at the job. Piping shall conform to the following requirements:

1. Piping shall be properly graded to provide drainage and prevent noise and water hammer. Proper provision shall be made for expansion and contraction in all portions of pipe work, to prevent undue strains on piping or on fixtures or apparatus connected thereto.

2. Pipe Nipples: Any piece of pipe 3 inches in length and shorter shall be considered a nipple. All nipples shall be extra-heavy. Close nipples shall not be used.
3. All piping connections to coils and equipment shall be made with offsets provided with screwed or flanged unions so arranged that the coils may be removed or equipment can be serviced or removed without dismantling the piping. Unions shall not be directly screwed to coil header piping connection.

3.3 PIPE JOINTS

A. Threaded Pipe: Threads shall be machine-cut, accurately-aligned, with burrs removed from cut end inside.

B. Unlike Pipe:
1. Water: Dielectric fittings shall be provided in all systems between all connections of dissimilar metals. Steel to copper - copper thread to solder adapter.
2. Soil: Steel to cast iron - steel to threaded boss on iron fittings - copper to cast iron - copper to solder-to-thread adapter to threaded boss on iron fitting. Lead to cast iron - lead solder wiped to brass ferrule, ferrule caulked to hub on iron fitting.

C. Welded Pipe: Pipes and pipes to fittings shall be butt welds, except pipes 1" and smaller shall have socket weld-type fittings.

D. Soldered and Brazed Pipe: Procedure shall be as described in "Copper Tube Handbook" by Copper Development Associations, Inc., No. 412/6. All soldered joints shall be thoroughly cleaned before application of the solder. All soldered joints for tubing larger than 2" in size shall be made with the simultaneous application of two or three blow torches.

E. Flanged Joints: Gaskets shall be red rubber.

3.4 TESTING

A. The following testing requirements for piping systems are considered as minimum and unless different from Code or local inspectors' requirements shall be provided. Where requirements differ from Code, the more stringent requirement shall be used.

B. The soil, waste and vent, & rainwater piping shall be tested before pipe is covered and/or fixtures are installed, by capping or plugging and filling the system with water, allowing it to stand filled for 1 hour. If tested in sections, each section shall be subjected to not less than a 10' head. All outside storm water piping 8" and less in diameter shall be tested in this manner.

C. Test cold water and hot water piping, before fixtures and faucets are connected, by applying a hydrostatic pressure of 125 psig for 1 hour.

D. Test piping under floor slabs and in floor fill before slabs are poured.

E. Screwed & soldered piping and piping with mechanical couplings which are not tight under tests shall be taken down and reassembled. Joints in cast iron hub and spigot pipe not tight under test shall be dug out, re-poured, and caulked. Joints in cast iron no-hub pipe shall be taken down and reassembled using new couplings.

F. Test each fixture for soundness, stability of support, and operation.

G. All tests shall be made in the presence of and to the satisfaction of Plumbing and other inspectors of the County/City and to the satisfaction of the Architect or representative.

H. Piping systems may be tested in sections but a final test may be required of the entire piping system at the completion of the system in the presence of the Architect or representative. Tests shall be made while pipe is exposed to view where possible.

3.5 GRADES

A. All pipes shall be graded for drainage.

B. Water Systems: Only as required to drain pipe after water is shut-off - in either direction - to drain valves, plugs, fixtures, or hydrants.

C. Drains: 1" in 25'.

D. Soil Waste and Vent: As required by Code.

3.6 INSPECTING SANITARY SYSTEM:

A. At completion of project, a video inspection shall be made of the sanitary and storm system 4" and larger. This inspection shall be performed by an independent contractor, with a minimum of 3 years of experience in doing this type of work. A copy of the video shall be provided to the owner, with a drawing indication or some method of identifying where the video was taken.

B. The contractor shall smoke test entire new and existing sanitary and vent systems. This test shall be done by an independent contractor with a minimum of 3 years of experience.

END OF SECTION

SECTION 22 1113

FACILITY WATER DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes water-distribution piping and related components outside the building for water service and fire-service mains.

B. Utility-furnished products include water meters that will be furnished to the site, ready for installation.

1.2 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.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control test reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 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. Include marking "NSF-pw" on piping.
2. Comply with NSF 61 Annex G for materials for water-service piping and specialties for domestic water.

1.6 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 200, 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 200, 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.

a. Gaskets: AWWA C111, rubber.

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. Refer to Section 33 0500 "Common Work Results for Utilities" for commonly used joining materials.

B. Brazing Filler Metals: AWS A5.8, BCuP Series.

C. Bonding Adhesive for Fiberglass Piping: As recommended by fiberglass piping manufacturer.

D. 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.

a. Standard: AWWA C219.

2.4 GATE VALVES

A. AWWA, Cast-Iron Gate Valves:

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

a. American AVK Co.
b. American Cast Iron Pipe Company.
c. Crane; Crane Energy Flow Solutions.
d. EJ.
e. McWane, Inc.
f. Mueller Co.
g. NIBCO INC.
h. U.S. Pipe and Foundry Company.
i. Engineer’s approved equivalent.

2. Nonrising-Stem, Resilient-Seated Gate Valves:

a. Description: Gray- or ductile-iron body and bonnet; with bronze or gray- or ductile-iron gate, resilient seats, bronze stem, and stem nut.

1) Standard: AWWA C509.
2) Minimum Pressure Rating: 200 psig.
3) End Connections: Mechanical joint.
4) Interior Coating: Complying with AWWA C550.

3. Nonrising-Stem, High-Pressure, Resilient-Seated Gate Valves:

a. Description: Ductile-iron body and bonnet; with bronze or ductile-iron gate, resilient seats, bronze stem, and stem nut.

1) Standard: AWWA C509.
2) Minimum Pressure Rating: 250 psig.
3) End Connections: Push on or mechanical joint.
4) Interior Coating: Complying with AWWA C550.

2.5 GATE VALVE ACCESSORIES AND SPECIALTIES

A. Tapping-Sleeve Assemblies:

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

a. American Cast Iron Pipe Company.
b. Clow Valve Company; a subsidiary of McWane, Inc.
c. EJ.
d. Flowserve Corporation.
e. Kennedy Valve Company; a division of McWane, Inc.
f. M & H Valve Company; a division of McWane, Inc.
g. McWane, Inc.
h. Mueller Co.
i. U.S. Pipe and Foundry Company.
j. Engineer’s approved equivalent.

2. Description: Sleeve and valve compatible with drilling machine.

a. Standard: MSS SP-60.
b. Tapping Sleeve: Cast- or ductile-iron or stainless-steel, two-piece bolted sleeve with flanged outlet for new branch connection. Include sleeve matching size and type of pipe material being tapped and with recessed flange for branch valve.
c. Valve: AWWA, cast-iron, nonrising-stem, resilient-seated gate valve with one raised face flange mating tapping-sleeve flange.

B. Valve Boxes: Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over valve and with a barrel approximately 5 inches in diameter.

1. Operating Wrenches: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.

C. Indicator Posts: UL 789, FMG-approved, vertical-type, cast-iron body with operating wrench, extension rod, and adjustable cast-iron barrel of length required for depth of burial of valve.

2.6 CORPORATION VALVES AND CURB VALVES

A. Manufacturers:

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

    a. Amcast Industrial Corporation.
    b. Ford Meter Box Company, Inc. (The).
    c. Jones, James Company.
    d. Master Meter, Inc.
    e. Mueller Co.
    f. Red Hed Manufacturing Company; a division of Everett J. Prescott, Inc.
    g. Engineer’s approved equivalent.

B. Service-Saddle Assemblies: Comply with AWWA C800. Include saddle and valve compatible with tapping machine.

1. Service Saddle: Copper alloy with seal and AWWA C800, threaded outlet for corporation valve.
2. Corporation Valve: Bronze body and ground-key plug, with AWWA C800, threaded inlet and outlet matching service piping material.
3. Manifold: Copper fitting with two to four inlets as required, with ends matching corporation valves and outlet matching service piping material.

C. 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.

D. 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 "WATER," and bottom section with base that fits over curb valve and with a barrel approximately 3 inches 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.

2.7 WATER METERS

A. Water meters will be furnished by utility company.

2.8 BACKFLOW PREVENTERS

A. Double-Check, Backflow-Prevention Assemblies:

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

    a. Conbraco.
    b. FEBCO.

c. Hersey.
d. Watts; a Watts Water Technologies company.
e. Wilkins.
f. Engineer’s approved equivalent.

2. Standard: AWWA C510.

3. Operation: Continuous-pressure applications, unless otherwise indicated.
4. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.
5. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.
6. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
7. Configuration: Designed for horizontal, straight through flow.
8. Accessories: Ball valves with threaded ends on inlet and outlet of NPS 2 and smaller; OS&Y gate valves with flanged ends on inlet and outlet of NPS 2-1/2 and larger.

2.9 WATER METER BOXES

A. Utility Boxes:

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

a. Carson Industries.
b. CDR Systems Corp.
c. Brooks Products, Inc..
d. Engineer’s approved equivalent.

B. Description: Cast-iron body and cover for disc-type water meter, with lettering "WATER METER" in cover; and with slotted, open-bottom base section of length to fit over service piping.

1. Option: Base section may be cast-iron, PVC, clay, or other pipe.

C. Description: Cast-iron body and double cover for disc-type water meter, with lettering "WATER METER" in top cover; and with separate inner cover; air space between covers; and slotted, open-bottom base section of length to fit over service piping.

D. Description: Polymer-concrete body and cover for disc-type water meter, with lettering "WATER" in cover; and with slotted, open-bottom base section of length to fit over service piping. Include vertical and lateral design loadings of 15,000 lb minimum over 10 by 10 inches square.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Refer to Section 31 2000 "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.

E. Underground water-service piping NPS 3/4 to NPS 3 shall be soft copper tube, ASTM B 88, Type K ASTM B 88, Type L; wrought-copper, solder-joint fittings; and brazed joints.

F. Underground water-service piping NPS 4 and NPS 6 shall be any of the following:

1. Soft copper tube, ASTM B 88, Type K ASTM B 88, Type L; wrought-copper, solder-joint fittings; and brazed joints.
2. Ductile-iron, push-on-joint pipe; ductile-iron, push-on-joint fittings; and gasketed joints.
3. NPS 4 and NPS 6: NPS 6 PVC, AWWA Class 150 pipe; PVC, AWWA Class 150 molded fittings; and gasketed joints.

G. Water Meter Box Water-Service Piping NPS 3/4 to NPS 2 shall be same as underground water-service piping.

H. Aboveground and Vault Water-Service Piping NPS 3/4 to NPS 3 shall be hard copper tube, ASTM B 88, Type K ASTM B 88, Type L; wrought-copper, solder-joint fittings; and brazed joints.

I. Aboveground and vault water-service piping NPS 4 and NPS 6 shall be the following:

1. Hard copper tube, ASTM B 88, Type K ASTM B 88, Type L; wrought-copper, solder-joint fittings; and brazed joints.
2. Ductile-iron, grooved-end pipe; ductile-iron, grooved-end appurtenances; and grooved joints.

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 UL/FMG, nonrising-stem gate valves for installation with indicator posts. Use corporation valves and curb valves with ends compatible with piping, for NPS 2 and smaller installation.

B. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Underground Valves, NPS 3 and Larger: AWWA, cast-iron, nonrising-stem, metal high-pressure, resilient-seated gate valves with valve box.
2. Underground Valves, NPS 4 and Larger, for Indicator Posts: UL/FMG, cast-iron, nonrising-stem gate valves with indicator post.
3. Use the following for valves in vaults and aboveground:

    a. Gate Valves, NPS 2 and Smaller: Bronze, nonrising stem.
    b. Gate Valves, NPS 3 and Larger: AWWA, cast iron, OS&Y rising stem, metal seated.

3.4 PIPING SYSTEMS - COMMON REQUIREMENTS

A. See Section 33 0500 "Common Work Results for Utilities" for piping-system common requirements.

3.5 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. Make connections larger than NPS 2 with tapping machine according to the following:

1. Install tapping sleeve and tapping valve according to MSS SP-60.
2. Install tapping sleeve on pipe to be tapped. Position flanged outlet for gate valve.
3. Use tapping machine compatible with valve and tapping sleeve; cut hole in main. Remove tapping machine and connect water-service piping.
4. Install gate valve onto tapping sleeve. Comply with MSS SP-60. Install valve with stem pointing up and with valve box.

D. Make connections NPS 2 and smaller with drilling machine according to the following:

1. Install service-saddle assemblies and corporation valves in size, quantity, and arrangement required by utility company standards.
2. Install service-saddle assemblies on water-service pipe to be tapped. Position outlets for corporation valves.

3. Use drilling machine compatible with service-saddle assemblies and corporation valves. Drill hole in main. Remove drilling machine and connect water-service piping.
4. Install corporation valves into service-saddle assemblies.
5. Install manifold for multiple taps in water main.
6. Install curb valve in water-service piping with head pointing up and with service box.

E. Install PVC, AWWA pipe according to ASTM F 645 and AWWA M23.

F. Bury piping with depth of cover over top at least 48 inches, with top at least 12 inches below level of maximum frost penetration.

G. 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.

H. Sleeves are specified in Section 22 0517 "Sleeves and Sleeve Seals for Plumbing Piping."

I. Mechanical sleeve seals are specified in Section 22 0517 "Sleeves and Sleeve Seals for Plumbing Piping."

J. 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.

3.6 JOINT CONSTRUCTION

A. See Section 33 0500 "Common Work Results for Utilities" for basic piping joint construction.

B. Make pipe joints according to the following:
1. 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.
2. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, with OD, and with system working pressure.

3.7 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.
3. Set-screw mechanical retainer glands.
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:

1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.
2. Gasketed-Joint, PVC Water-Service Piping: According to AWWA M23.
3. Fire-Service-Main Piping: According to NFPA 24.

C. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.8 VALVE INSTALLATION

A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.

B. MSS Valves: Install as component of connected piping system.

C. Corporation Valves and Curb Valves: Install each underground curb valve with head pointed up and with service box.

3.9 WATER METER INSTALLATION

A. Install water meters, piping, and specialties according to utility company's written instructions.

B. Water Meters: Install displacement-type water meters, NPS 2 and smaller, in meter boxes with shutoff valves on water meter inlets. Include valves on water meter outlets and valved bypass around meters unless prohibited by authorities having jurisdiction.

C. Water Meters: Install compound-type water meters, NPS 3 and larger, in meter vaults. Include shutoff valves on water meter inlets and outlets and valved bypass around meters. Support meters, valves, and piping on brick or concrete piers.

3.10 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.

3.11 WATER METER BOX INSTALLATION

A. Install water meter boxes in paved areas flush with surface.

B. Install water meter boxes in grass or earth areas with top 2 inches above surface.

3.12 CONNECTIONS

A. See Section 33 0500 "Common Work Results for Utilities" for piping connections to valves and equipment.

B. Connect water-distribution piping to existing water main. Use tapping sleeve and tapping valve.

C. Connect water-distribution piping to interior domestic water and fire-suppression piping.

D. Connect waste piping from concrete vault drains to storm-drainage system. See Section 33 4100 "Storm Utility Drainage Piping" for connection to storm-sewer piping.

3.13 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.

1. Increase pressure in 50-psig increments and inspect each joint between increments. Hold at test pressure for 1 hour; decrease to 0 psig. Slowly increase again to test pressure and hold for 1 more hour. Maximum allowable leakage is 2 quarts per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.

C. Prepare reports of testing activities.

3.14 IDENTIFICATION

A. Install continuous underground detectable 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 31 2000 "Earth Moving."

B. Permanently attach equipment nameplate or marker indicating plastic water-service piping, on main electrical meter panel. See Section 33 0500 "Common Work Results for Utilities" for identifying devices.

3.15 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 22 1113

SECTION 22 1313

FACILITY SANITARY SEWERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Nonpressure-type transition couplings.
   2. Backwater valves.
   3. Cleanouts.
   4. Encasement for piping.
   5. Concrete.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For manholes. Include plans, elevations, sections, details, and frames and covers.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings:

   1. Show system piping in profile. Draw profiles to horizontal scale of not less than 1 inch equals 50 feet and to vertical scale of not less than 1 inch equals 5 feet. Indicate manholes and piping. Show types, sizes, materials, and elevations of other utilities crossing system piping.

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 Corrugated Sewer Piping:

   1. Pipe: ASTM F 949, PVC corrugated pipe with bell-and-spigot ends for gasketed joints.
   2. Fittings: ASTM F 949, PVC molded or fabricated, socket type.
   3. Gaskets: ASTM F 477, elastomeric seals.

B. PVC Type PSM Sewer Piping:

1. Pipe: ASTM D 3034, SDR 35, PVC Type PSM sewer pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: ASTM D 3034, PVC with bell ends.
3. Gaskets: ASTM F 477, elastomeric seals.

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 Cast-Iron Soil Pipes: ASTM C 564, rubber.
2. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
3. 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.

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

a. Dallas Specialty & Mfg. Co.
b. Fernco Inc.
c. Logan Clay Pipe.
d. Mission Rubber Company, LLC; a division of MCP Industries.
e. NDS Inc.
f. Plastic Oddities.
g. Engineer’s approved equivalent.

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.

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

a. Fernco Inc.
b. Logan Clay Pipe.
c. Mission Rubber Company, LLC; a division of MCP Industries.
d. Engineer’s approved equivalent.

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

a. ANACO-Husky.
b. Engineer's approved equivalent.

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

a. Jay R. Smith Mfg. Co.
b. Josam Company.
c. Tyler Pipe; a subsidiary of McWane Inc.
d. Watts; a Watts Water Technologies company.
e. Zurn Industries, LLC.
f. Engineer's approved equivalent.

3. Horizontal type; with swing check valve and hub-and-spigot ends.
4. Combination horizontal and manual gate-valve type; with swing check valve, integral gate valve, and hub-and-spigot ends.
5. 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Canplas LLC.
b. IPS Corporation.
c. NDS Inc.
d. Plastic Oddities.
e. Sioux Chief Manufacturing Company, Inc.
f. Zurn Industries, LLC.
g. Engineer's approved equivalent.

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.

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

a. Jay R. Smith Mfg. Co.
b. Josam Company.
c. MIFAB, Inc.
d. Tyler Pipe; a subsidiary of McWane Inc.
e. Watts; a Watts Water Technologies company.
f. Zurn Industries, LLC.
g. Engineer’s approved equivalent.

3. Top-Loading Classification(s): Extra-Heavy Duty.
4. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

2.5 ENCASEMENT FOR PIPING

A. Standard: ASTM A 674 or AWWA C105/A21.5.

B. Material: Linear low-density polyethylene film of 0.008-inch or high-density, cross-laminated polyethylene film of 0.004-inch minimum thickness.

C. Form: Tube.

D. Color: Black.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Section 31 2000 "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 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.

D. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.

E. Install gravity-flow, nonpressure, drainage piping according to the following:

1. Install piping pitched down in direction of flow, at minimum slope of 0.5 percent unless otherwise indicated.
2. Install piping NPS 6 and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place-concrete supports or anchors.
3. Install piping with 48-inch minimum cover.
4. Install hub-and-spigot, cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook."
5. Install hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook."
6. Install ductile-iron, gravity sewer piping according to ASTM A 746.
7. Install PVC corrugated sewer piping according to ASTM D 2321 and ASTM F 1668.
8. Install PVC Type PSM sewer piping according to ASTM D 2321 and ASTM F 1668.

F. Install corrosion-protection piping encasement over the following underground metal piping according to ASTM A 674 or AWWA C105/A21.5:

1. Ductile-iron pipe and fittings.
2. Expansion joints and deflection fittings.

G. 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:

1. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
2. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.
3. Join hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.

4. Join ductile-iron, gravity sewer piping according to AWWA C600 for push-on joints.
5. Join PVC corrugated sewer piping according to ASTM D 2321.
6. 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.
7. Join dissimilar pipe materials with nonpressure-type, flexible 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 couplings for pipes of same or slightly different OD.
    b. Unshielded, increaser/reducer-pattern, flexible 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 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318.

3.5 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.

3.6 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 Light-Duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.
2. Use Medium-Duty, top-loading classification cleanouts in paved foot-traffic areas.
3. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic service areas.
4. Use Extra-Heavy-Duty, top-loading classification cleanouts in roads.

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.

3.7 CONNECTIONS

A. Connect nonpressure, gravity-flow drainage piping to building's sanitary building drains specified in Section 22 1316 "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.

C. Connect to grease interceptors specified in Section 22 1323 "Sanitary Waste Interceptors."

3.8 CLOSING ABANDONED SANITARY SEWER SYSTEMS

A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:

1. Close open ends of piping with at least 8-inch- thick, brick masonry bulkheads.
2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.

B. Abandoned Manholes: Excavate around manhole as required and use either procedure below:

1. Remove manhole and close open ends of remaining piping.
2. Remove top of manhole down to at least 36 inches below final grade. Fill to within 12 inches of top with stone, rubble, gravel, or compacted dirt. Fill to top with concrete.

C. Backfill to grade according to Section 31 2000 "Earth Moving."

3.9 IDENTIFICATION

A. Comply with requirements in Section 31 2000 "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 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. Submit separate report for each test.
5. Hydrostatic Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction and the following:

    a. Fill sewer piping with water. Test with pressure of at least 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.

6. Manholes: Perform hydraulic test according to ASTM C 969.

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 22 1313

SECTION 22 3000

PLUMBING - MAJOR EQUIPMENT

PART 1 - GENERAL

1.1 MECHANICAL GENERAL:

A. Section 23 0010 is applicable.

PART 2 - PRODUCTS

2.1 WATER HEATER (HWH-1 & 2)

A. The heater shall be a commercial, storage type, electric heater, glass lined with magnesium anode and completely insulated with outer jacket and baked enamel finish, with temperature pressure relief valve and 2000 watt element. Heater shall meet or exceed ASHRAE Standard 90A.

B. The tank capacity shall be 10 gallon and warranted against leaks for 3 years. Unit shall sit in drain pan.

C. Acceptable Manufacturer and Model Number:

1.	A.O. Smith	Model DEL-10
2.	Bradford White	Model LD-12UT3
3.	State	Model LD-10-10MS

END OF SECTION

SECTION 22 4000

PLUMBING - FIXTURES

PART 1 - GENERAL

1.1 MECHANICAL-GENERAL

A. Section 23 0010 is applicable.

1.2 CHROME PLATED PIPE

A. Shall be used for supplies and drains exposed to view adjacent to all fixtures and where designated elsewhere. Plated pipe need not be installed for fixtures installed in cabinets having enclosed doors.

PART 2 - PRODUCTS

2.1 FIXTURES

A. Fixtures and accessory model numbers specified are given for the purpose of establishing minimum quality. Equivalent fixtures and/or accessories by manufacturers listed in Part B are acceptable, unless noted otherwise.

B. Acceptable Manufacturers:

1.	Fixtures:	Kohler, American Standard, Toto
2.	Faucets:	Encore CHG, Delta, Chicago, Symmons, Moen, T & S Brass, Kohler, Zurn, Speakman, Sloan
3.	Supplies:	McGuire, Zurn, Brasscraft
4.	Water Closet Seats:	Beneke, Bemis, Olsonite, Church, Centoco
5.	Drinking Fountains:	Halsey Taylor, Elkay, Sunroc, Oasis
6.	Fixture Carriers:	J.R. Smith, Josam, Zurn
7.	Flush Valves:	Sloan, Zurn, Delaney

C. Handicapped water closet fixture shall be coordinated with toilet room plans so that trip levers and/or flush valve handles are located on the wide side of stall and meet ADA requirements.

D. All fixtures shall be white unless noted otherwise.

2.2 **HANDICAPPED WATER CLOSET (HWC)**

A. (Floor Outlet - Flush Valve - High Efficiency) (1.28 gpf)

1.	Fixture:	Kohler K-4301
2.	Flush Valve:	Sloan Regal 140-1.28 ADA
3.	Seat:	Beneke 523-SS

2.3 **WATER CLOSET (WC)**

A. (Floor Outlet - Flush Valve - High Efficiency) (1.28 gpf)

1.	Fixture:	Kohler K-4349
2.	Flush Valve:	Sloan Regal 154-1.28
3.	Seat:	Beneke 523-SS

2.4 **HANDICAPPED URINAL (HUR)**

A. (Floor Outlet - Flush Valve)(0.5 gpf)

1.	Fixture:	Kohler K-4920-R-0
2.	Flush Valve:	Sloan Regal 195-0.5-ADA
3.	Commercial Carrier:	J.R. Smith

2.5 **HANDICAPPED WALL HUNG LAVATORY (HLAV)**

A. (H & CW)

1.	Fixture:	Kohler K-2005 (20" x 18")
2.	Faucet:	Delta 501-WFHDF
3.	Drain:	Kohler K-13885
4.	Supplies:	Brasscraft SS-CS400A
5.	P-Trap:	Kohler K-8998*
6.	Covers:	Truebro 103
7.	Commercial Carrier:	J.R. Smith

2.6 HANDICAPPED DRINKING FOUNTAIN (HEDF)

A. (Single Wall Hung Unit) (Stainless Steel Finish)(Glass Filler)

1.	Fixture:	Murdock A171400F-BF2S
2.	Supply:	Brasscraft R1912A
3.	P-Trap:	Kohler K-8998*

2.7 **JANITOR'S MOP SINK (MS)**

A. (Floor Receptor)

1.	Fixture:	Acorn Terrazo-Ware TSH-24-KH36
2.	Faucet:	Chicago 897 Rough Chrome Finish

PART 3 - EXECUTION

3.1 FIXTURE INSTALLATION

A. All fixtures shall be installed straight, level and three or more fixture units shall be equally spaced. Each wall-hung fixture shall be secured against down movement when the weight of 150 pounds is applied to the front edge of the unit. Also, there shall be no vertical up movement when 50 pounds pull is applied to the underside of the front edge of the fixture. All pipe in piping chase shall be anchored so there will be no movement of supply lines extending through the chase walls. Flush valves, faucets, wall hydrants, hose bibbs, and lavatory p-traps shall be installed so there will be no movement in any direction when fixture is installed.

B. Fixtures shall be grouted at walls and floors. Grouting between wall and floor fixtures, and in the wall around fixture supply lines shall not be used for purposes of anchorage.

C. Fixtures shall be checked on final inspection for spacing, level installation, soundness and stability, all parts will be checked for normal operation. Only fixtures meeting the above requirements will be accepted.

D. All countertop sinks that are ADA accessible shall be provided with trap guard protection for all piping.

E. All fixtures, including those on which only connection is made shall be cleaned. Fixtures shall be cleaned with only household detergents or cleaning powders and clear warm water. The Contractor shall be held responsible to see that the fixture trim and fixtures are not damaged during cleaning by acids, industrial cleaners or strong solvents.

END OF SECTION

SECTION 23 0010

MECHANICAL GENERAL

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. Specification: This Specification is intended to cover all portions of this building.

B. Reference Codes: This installation shall comply with the following Codes and Regulations.
1. 2012 International Plumbing Code with 2014 & 2015 Georgia Amendments.
2. 2012 International Building Code with 2014, 2015 & 2017 Georgia Amendments.
3. 2009 International Energy Conservation Code with 2011 & 2012 Georgia Supplements & Amendments.
4. 2012 International Fuel Gas Code with 2014 & 2015 Georgia Amendments.
5. 2012 International Fire Code with 2014 Georgia Amendments.
6. 2012 International Mechanical Code with 2014 & 2015 Georgia Amendments.
7. NFPA 101 - 2012 Life Safety Code
8. NFPA No. 13 - 2013 "Standard for the Installation of Sprinkler Systems".
9. NFPA No. 70 - 2014, "National Electric Code".
10. State of Georgia Chapter 120-3-3, "Rules and Regulations for the State Minimum Fire Safety Standards", 2015.

C. Reference Standards: This installation shall comply with the following standards.
1. Manufacturers Standardization Society of the Valve and Fittings Industry (1815 North Ft. Meyer Drive, Arlington, VA 22209). MSS-SP-58-2009, called MSS-SP-58. MSS-SP-127-2014a, called MSS-SP-127.
2. American Society of Heating and Ventilating and Air Conditioning Engineers Guide, Fundamentals, 2013 Edition.
3. Sheet Metal and Air Conditioning Contractor National Association (SMACNA) HVAC Duct Construction Standards, Metal & Flexible, 3rd Edition, 2005; Fire, Smoke, and Radiation Damper Installation Guide for HVAC Systems, 5th Edition, 2002; and Seismic Restraint Manual Guidelines for Mechanical Systems, 3rd Edition, 2008.
4. American Society of Sanitary Engineers (ASSE) Standards, Latest Editions.
5. North American Insulation Manufacturers Association (NAIMA) Fibrous Glass Duct Liner Standard, Third Edition, 2002.

1.2 REGULATIONS

A. Attention is called to the fact all work shall be done in accordance with all applicable City, County, and State regulations; which regulations shall be considered as minimum requirements, and shall not alter the arrangement and pipe sizes indicated on the Drawings, except where they conflict.

1.3 DRAWINGS

A. The work is shown on the Drawings by Sutton Architectural Services, Inc.

1.4 PROTECTION OF PUBLIC

A. If contractor must operate any potentially dangerous devices before all specified safety valves controls and devices are installed, contractor shall notify the Architect in writing. Contractor shall not operate such devices under these conditions until arrangements for supervision by competent operators have been instituted and Architect's written approval has been issued.

1.5 EXCAVATION, SHORING AND BRACING

A. Excavate and back-fill for the installation of all underground work.

B. Provide all shoring and bracing per OSHA to prevent cave-ins during the construction period.

1.6 SHOP DRAWINGS

A. Shop drawings shall be submitted for, but not limited to, the following items:
   1. All Scheduled Equipment
   2. Ductwork & Accessories
   3. Hangers
   4. Piping & Accessories
   5. Supports
   6. Vibration Isolation
   7. Fixtures
   8. Roof Portals
   9. Control Systems
   10. Duct Systems
   11. Insulation
   12. Filters
   13. Access Panels
   14. Louvers

B. Provide a complete list of all accessories and options (indicate factory or field-installed) for all scheduled mechanical equipment, including air distribution devices. Provide manufacturer-generated summary sheet for air distribution devices, delineating sizes, colors, and accessories for all devices on project. Provide manufacturer-generated specifications and ratings sheets for each individual piece of air conditioning and heating equipment. Generic photocopies from manufacturers catalog shall not be accepted.

C. In addition to cut sheets; provide a summary sheet indicating exactly what pipe material, joining methods, valves, etc. provided in the various piping systems described in Section 22 1000.

D. Contract Drawings are diagrammatic and indicate generally the size and location of ductwork and equipment. While duct sizes shall not be decreased, it is recognized that job site conditions may require re-routing or re-sizing of ductwork, and the contractor shall be responsible for this coordination. Ductwork that has to be re-sized and/or re-routed as a result of this coordination effort shall be the contractor's responsibility and at contractor's expense. Ductwork re-sized shall be equivalent, per Duct-u-lator, to that shown on Drawings.

E. Steel fabrication Shop Drawing under Division 05 shall be coordinated with all Division 23 rooftop equipment and roof openings. The resulting coordination shall be confirmed and verification shall be submitted with associated equipment and roof curbs.

1.7 **MOTORS, WIRING, AND ELECTRICAL EQUIPMENT**

A. All motors required for this work shall be built in accordance with the latest standards of National Electrical Manufacturer's Association, and shall be especially designed for quiet operation. All motors shall be selected for operation within their nameplate amperage. Adjustable bases shall be provided with motors and equipment which have belt drives. Per 2007 Energy Independence & Securities ACT (EISA), 2010 DOE Small Motor Rule (10 CFR Part 31 Energy Conservation Program: Energy Standard for small Electric Motors), and

ASHRAE/IES Standard 90.1; all motors over 1 HP shall be NEMA "Premium" efficiency. All motors over 1 HP shall be compatible for use with variable speed drives (VFDs).

1. All motors controlled by variable speed drives (VFDs) (Pumps, Cooling Tower Fans, AHUs, etc.) shall be inverter-duty-rated, and shall shall be provided with a bearing protection shaft grounding ring. Ring shall be maintenance-free, circumferential, conductive micro-fiber shaft grounding ring, and shall be installed on the AC motor to discharge shaft currents to ground. Basis of Design is Aegis NEMA SGR, or approved product.

B. All electrical materials shall comply with requirements of the National Electric Code. All contactors, starters, relays, and panels used in this work, which are included in Underwriters Label Service, shall be new and bear the National Board of Fire Underwriters inspection label. Material not included in Underwriters Label Service shall be new and conform to NEMA or other applicable industry standard.

C. Division 26, ELECTRICAL, provides for the furnishing of conduit and wire from electrical source to electrical use, called "path of power", and for the installation of certain line voltage devices specified in Division 22 and 23 which lie in the "path of power", including:
   1. Manual switches.
   2. Line voltage thermostats.
   3. Solid-state speed controllers.
   4. Aquastats for domestic hot water circulating pumps.
   5. Starters

D. The "path of power" terminates at contactors or control panels of the following listed items of equipment. These control panels contain starters/contactors for the motors or heaters installed on or within the unit and are specified in Division 23. Any wiring past the point of termination described above is Division 23 work.
   1. Domestic Water Heaters.
   2. Electric Heaters.
   3. Fans

E. Division 26, ELECTRICAL, provides for electrical power to any given item of equipment at the voltage and phase required by the primary use only. If the item of equipment contains devices such as fans, thermostats, motorized dampers, or other controls which require other than primary voltage for their proper function, then transformers shall be furnished under Division 23 for that purpose.

F. Voltage and phase for Division 22 and 23 equipment shall be as specified by Division 26. Division 22 and 23 contractor shall submit a list of all mechanical equipment requiring electrical connections to the electrical contractor, prior to release of any equipment, for coordination with the Division 26 contractor. A copy of this list that has been reviewed and approved by the General Contractor shall be submitted to the Architect with the submittal for mechanical equipment. Failure to include this list may result in the rejection of the entire mechanical equipment submittal.

G. The control power source (point of connection for control power) for major equipment except those single phase fans which are thermostatically-controlled and those items listed in C above, are provided at the combination starters.

H. The automatic control signal for STOP-START of major equipment is furnished and installed to and from combination starters as part of Division 23.

I. All other conduit and wire, not in "path of power" described above, is included in Division 23.

J. If any Divisions contractor makes a change by submittal, by delivery, by wiring rearrangement or power requirements, which results in increased costs, the contractor initiating the change shall bear all cost increases.

K. All motors 1 HP and larger shall be NEMA "Premium" high efficiency motors with nominal and minimum full load efficiencies equal to or greater than those specified by the State Energy Code. All motors shall be compatible for use with variable frequency drives (VFDs) per NEMA. Specifications shall be submitted for each motor furnished.

L. Starters or contactors shall be furnished in Division 23 for each motor.
   1. Magnetic starters shall be NEMA standard sizes adequate for the load served, Size 00, 1,2,3,4. Half sizes and/or quarter sizes are not acceptable.
   2. Overload relays shall protect all three phases with an adjustable current setting and trip class to allow field adjustment for specific motor FLA. Interchangeable heater elements are not acceptable. Overload relay shall provide phase failure, phase loss, locked rotor and stall protection.
   3. Units shall have NEMA-1 enclosures for dry, indoor mounting and NEMA 3R for weather exposed mounting areas.
   4. Installed accessories shall include Hand-Off-Auto operation switch with 22mm style operator interfaces (unless otherwise noted). Include LED pilot light indicators for Hand, Off, Auto, Run, and Overload conditions. All pilot devices shall be water-tight and dust-tight.
   5. The starter shall provide a provision for Fireman's Override operation. When activated, the starter run the motor in any mode (Hand, Off or Auto) regardless of other inputs or lack of inputs either manual or auto.
   6. Provide a manual reset pushbutton on the starter cover to restore normal operation after a trip or fault condition.
   7. Starters shall consist of a horsepower rated magnetic contactor with a minimum of 2 NO and 2 NC auxiliary contacts
   8. Single Phase Motor Starter Control: The single phase motor starter shall consist of a manually operated quick-make toggle mechanism lockable in the "Off" position which shall also function as the motor disconnect. Starter shall provide adjustable thermal overload protection, run status pilot light and fault pilot light. The starter must include the capability to operate in both manual and automatic control modes. Cerus Industrial, model BAS-1P or approved equivalent.
   9. All motor starters shall include a 5-year factory warranty as standard.
   10. All motor starters shall be of the same manufacturer and shall be Cerus Industrial, or equivalent by General Electric, Square-D, Westinghouse, Allen-Bradley, Furnas, Mitsubishi, Siemens, or Cutler-Hammer subject to full compliance with all criteria.

M. Where power wiring to Division 23 equipment is not within the equipment curb, roof curb and boots shall be provided under Division 26. The portal location shall be coordinated with Division 23 equipment power inlet requirements, and located not to block access for equipment servicing.

1.8 ACCESS PANELS

A. Shall be provided to permit operation of concealed valves, dampers, or equipment. The following table lists types of Bilco access frames and doors. Panels of equivalent construction by Titus, Milcor, Hohmann and Barnard, or Zurn are acceptable.

B. Wall:
   1. Sheetrock Style G

2. Plaster Style A
3. Masonry Style C

C. Ceiling:
1. Sheetrock Style G
2. Plaster Style A
3. Concealed spline Style D
4. Lay-in tile None

D. Fire Rated Wall or Ceiling Style F (U.L. Listed)

E. Sizes shall be: Small valves - 12" x 12". Multiple valves, dampers, duct smoke detectors - 24" x 24".

F. Access panels shall be insulated for sound barrier equivalent to wall in which it is installed.

G. Acoustical Tile: Coordinate with tile installed to provide a removal tile at access point. Install a colored thumb tack to mark the access panel of above ceiling equipment, control instrument, valves, or relay.

1.9 WARRANTY

A. Contractor shall operate the air conditioning, heating, & ventilating systems; and plumbing systems for a period of one week to the satisfaction of the Architect. Thereafter, the contractor shall guarantee and be responsible for all materials and workmanship (parts and labor) for a period of one (1) year following the date of acceptance by the Architect.

B. Contractor shall also provide maintenance for the one (1) year period by providing four (4) periodic inspections at approximately three-month intervals, which shall include the following.
1. Check all bearings, align, and oil, or grease.
2. Check belt tensions and pulley adjustments and adjust as necessary.
3. Check filters and advise Owner when change is necessary.
4. Check refrigerant charges and oil levels and replenish as necessary.
5. Check and re-calibrate controls as necessary.

C. Any required maintenance for the above shall be performed and materials needed shall be furnished by the contractor. Not included in the materials to be furnished by the contractor are natural gas, electricity, water, and filters. Provide the Owner with four (4) copies of the inspection reports indicating all items checked and adjustment or repairs performed.

D. Water heaters shall be guaranteed for five years; parts.

E. All equipment compressors shall be guaranteed for five years; parts.

F. All aluminized steel gas-fired heat exchangers shall have 10-year warranty; parts. All stainless steel gas-fired heat exchangers shall have 15-year warranty; parts.

1.10 CUTTING AND PATCHING

A. Contractor shall set sleeves for pipes, ducts, and equipment accurately before the concrete walls and floors are poured.

B. Should the contractor neglect to perform this preliminary work and should cutting and patching be required in order to install the piping, ductwork, or equipment; the expense of the cutting and restoring of surfaces to their original condition shall be borne by the contractor.

1.11 BASIS OF DESIGN

A. When brand, trade, or manufacturer's names are used for Basis of Design; they are used in the interest of brevity to describe the style, type, size, quality, or arrangement of articles of

equipment, and are not intended to limit competition. If articles of equipment by manufacturers other than Basis of Design are submitted for installation, the Architect shall compare them with specified articles of equipment on basis of qualities mentioned. The size, weight, and arrangement of other equipment shall be checked by the contractor to ascertain it can be installed, connected, and serviced successfully; and that walking space and service space can be maintained without altering equipment space or enclosures or the work of other trades.

B. Items that are "standard" with the Basis of Design equipment shall be included as "standard" or provided as a factory or field installed "option" or "accessory" by manufacturers other than the Basis of Design submitted for approval. This includes items that may or may not be listed in the Specifications or on the Drawings as "standard" to be provided.

C. If any Division's contractor makes a change by submittal, by delivery, or by wiring rearrangement which results in increased costs; the contractor initiating the change shall bear all cost increases.

1.12 AS-BUILT DRAWINGS

A. Per the Georgia State Energy Code, the contractor shall produce and submit to the Architect, "As-Built" Drawings, four (4) copies, as described below.

B. As work progresses, neatly and clearly record on four (4) sets of mechanical plans (in red) all changes and deviations from the contract drawings in size, locations, etc., of all piping, ductwork terminal units and other equipment. Record (in red) final location of piping, ductwork, starters, valves, thermostats, etc., by dimensions to adjacent walls and floors. Make sufficient measurement to accurately locate all equipment. Locate underground lines by dimension from building walls.

1.13 OPERATION AND MAINTENANCE MANUALS

A. Operation and Maintenance manuals (4 sets) shall be provided to the Owner or the Owners designated representative. Manuals shall be in accordance with the Georgia State Energy Code for Buildings.

1. Manuals shall include as a minimum the following:
    a. Final, corrected submittal data with equipment sizes and selected options for each piece of equipment, including Engineer’s submittal review comments.
    b. Current manufacturer’s published operation and maintenance manuals for each piece of equipment.
    c. Name, address, email, and phone number of at least one LOCAL service agency for each type equipment.
    d. HVAC controls system maintenance and calibration information including wiring diagrams, schematics, and control drawings.
    e. Complete narrative of how each system is intended to operate, including suggested setpoints.
    f. Copy of the final Test & Balance report.
    g. Copy of the final As-Built Drawings.
    h. Controls certification letter. See Section 23 0900.
    i. Copy of Engineer’s final punch list items, with each item checked off when completed or an explanation of why the item was not completed.

1.14 INTERFACES WITH OTHER WORK

A. There are many interfaces between the work involved with Division 22 and 23 and the work involved with other Sections and Divisions, particularly with Division 26. Contractor shall be

aware of the requirements of these other Sections or Divisions and contractor's responsibilities at the interfaces.

B. Mechanical equipment, piping, or ductwork shall not be placed within 42" of switchboards and/or panel boards.

C. Water piping (domestic, storm, sanitary, etc., except sprinkler piping when required) shall not be located above electrical switchboards and/or panel boards. When sprinklers are required, shields shall be provided over the panels.

D. Mechanical equipment is shown on the Drawings in general locations. Contractor shall be responsible for field-coordination with other trades and installing equipment so as to maintain published service and operating clearances, and providing the design intent. If in doubt, direct clarifications to the Architect.

1.15 EQUIPMENT IDENTIFICATION

A. Equipment Identification:
   1. All items of equipment shall be identified with engraved tags. Tags shall be 1/8" thick plastic stock with adhesive backing, and shall be permanently secured to the equipment that they identify.
   2. All tags shall be of uniform 2" high x 4" wide with 1" high letters and numbers. Tags can be wider if required to accommodate the equipment number. All tags shall be black with white lettering.
   3. Equipment Identification numbers shall be the same as those scheduled on the Contract Drawings. Identification shall be located where it can be conveniently read, and shall be located in the same relative position on like equipment.
   4. In addition to the above ID tags, all scheduled equipment shall be provided with permanent factory-installed engraved nameplate labels listing complete model and serial numbers, unit voltage, motor sizes, etc.
   5. For equipment located in public spaces, identification shall be inside control boxes or covers, and not in public view.
   6. Identify all disconnect switches that are not directly attached to the equipment that they serve, with identical ID tags as specified above for the equipment.

1.16 PIPE IDENTIFICATION

A. All piping systems shall be identified.
   1. All piping systems within the building except as noted herein shall be identified with clear block letters and numbers stenciled on the outside surface of the pipe or insulation, indicating the system contents by abbreviated letters and direction of the flow. Pre-printed label/wraps shall be acceptable.
   2. This identification marking shall be applied to the pipe systems where pipe enters or leaves a wall or floor, and item of equipment such as pumps, fan coil units and tanks, and at tees. Identification shall be applied no less than 50 feet apart on horizontal pipe; and one identification per floor on vertical pipe.
   3. Letters and numbers shall be 3/4" high on pipe 2" and smaller.
   4. Letters and numbers shall be 1-1/2" high on pipe 3" and larger.
   5. Directional arrows shall be 4" long and 1/2" wide.
   6. Letters and numbers shall be black on white pipe or insulation.
   7. Letters and numbers shall be white on dark pipe or insulation.
   8. Pipe identification symbols shall be the same as shown on the drawings.
   9. Soil, vent, and refrigerant piping shall not be identified.

10. Per Mechanical Code; each length of pipe and tubing and each pipe fitting utilized in a mechanical system shall bear the identification of the manufacturer.

1.17 PERMITS AND INSPECTIONS

A. Contractor shall secure and pay for all permits, fees, inspections, and utility connection costs.

1.18 EQUIPMENT & MATERIAL PROTECTION

A. All equipment and material shall be kept clean and free of debris as construction progresses. Closures shall be provided over duct, piping, and major equipment openings during storage, erection, and prior to connection. Material finishes shall be protected by covers to prevent impingement of corrosive, abrasive, and disfiguring foreign matter. Accidental finish damage shall be repaired equivalent to original finish.

1.19 TEST, BALANCE, AND REPORT

A. Systems shall be tested, balanced, and adjusted by an independent firm certified by either AABC or NEBB, and results reported, six copies. Pipe pressure/leak testing shall be performed by the contractor; see section 22 1000. Duct and pipe systems may be tested in sections in order to permit construction to proceed. Report shall include a diagram of each system showing all devices in the system. Architect shall be furnished preliminary deficiency punch list. All systems shall be adjusted to deliver or remove to within plus or minus 10% of design airflow rates, as described herein.

B. Air Systems:
   1. Contractor shall clean the inside of all the ductwork with a vacuum cleaning system immediately prior to test and balance.
   2. Examine the air handling systems to see they are free from obstructions. Determine that all dampers and registers are open, or in normal positions; that moving equipment is lubricated; that filters are installed and clean; and perform other inspection and maintenance activities to insure that the operation of the systems is as specified.
   3. Demonstrate the air handling systems perform as specified. Record entering and leaving temperatures of medium in cooling and/or heating modes. Adjust variable type pulleys, or motor speeds, and/or volume and control dampers for all scheduled air moving equipment.
   4. Adjust dampers at the take-off fitting to distribute or exhaust the design air quantity. Do not balance with the damper at diffuser or register neck (where take-off dampers are provided), leave fully-open for Owner seasonal adjustment only. Each grille, register, and diffuser shall deliver or remove the designed CFM in the proper pattern.
   5. Perform this work in accordance with the procedures and standards described in the SMACNA Balancing and Adjusting Manual. Reports are to made on SMACNA forms or facsimiles thereof.
   6. Reports shall include, but not be limited to, the following:
      a. Recorded and design air flow CFM at each piece of scheduled mechanical equipment: supply air CFM, return air CFM, outside air minimum CFM as scheduled, relief air CFM, exhaust air CFM. Mechanical equipment airflow shall be measured and recorded at the inlet/outlet duct directly upstream/downstream (at non-turbulent location) of the fan utilizing a duct traverse, not by just summing all air distribution devices. Provide a duct traverse report for each system in the final TAB report. Test and record outside airflow through all packaged rooftop equipment intake hoods. Provide engraved tag on intake hood as specified in Section 23 3000.

C. Piping Systems:

1. Pipes shall be cleaned prior to testing.
2. When pressurized systems have been completed, but before pipe covering has been applied, a cold hydrostatic test shall be applied at 150% working pressure. All leaks must be corrected and the test re-applied until no leakage occurs. Systems tested shall include domestic hot and cold water systems.
3. Soil, waste and vent, and rainwater systems shall be tested as required by Code.
4. All tests shall be made to the satisfaction of the Architect, Plumbing, and other Inspectors of the County/City.

1.20 PROHIBITED MATERIALS

A. All products, materials, or assemblies which contain asbestos or polychlorinated Biphenyl (PCB) in any form or in any concentration whatsoever, are expressly forbidden from being used on this project. Products that off-gas formaldehyde (HCHO) shall be forbidden.

1.21 SITE VISIT AND FAMILIARIZATION

A. Contractors proposing to undertake work under this Division shall visit the site of the work and fully inform themselves of all conditions that effect the work or cost thereof; examine the Drawings and Specifications as related to the site conditions; acquaint themselves with the utility companies from whom services will be supplied; and verify locations of utility services and determine requirements for connections.

B. Consideration shall not be granted for any alleged misunderstanding of the amount of work to be performed. Tender of proposal shall convey full agreement to all items and conditions specified, indicated on the Drawings, and/or required by nature of the site.

1.22 DISINFECTION AND TESTING OF WATER SYSTEM

A. Sanitize plumbing potable water systems after cleaning and pressure tests, with chlorinated potable water solution to 200 ppm chlorine residual after 24-hours minimum, then flushed with fresh potable water until effluent chlorine content does not exceed make-up. Water samples shall be sent to Local Health Department (LHD) for testing. A letter of approval must be obtained from the LHD before the system is put into service.

B. All domestic water piping shall be disinfected with chlorine before it is placed into operation. The chlorinating material shall be liquid chlorine conforming to Federal Specification BB-C-120 and shall be introduced to the system by experienced operators only. The chlorine solution applied to the piping sections or system shall contain at least fifty (50) parts per million of available chlorine and shall remain in the sections or system for a period of not less than sixteen (16) hours. During the disinfection period all valves shall be opened and closed at least four (4) times. After the disinfection period, the chlorinated water shall be flushed from the system with clear water until the residual chlorine content is not greater than two-tenths parts per million (0.2PPM). Submit certification to the Architect and Owner that the system was disinfected.

END OF SECTION

SECTION 23 0520

SUPPORTS AND FOUNDATIONS

PART 1 - GENERAL

1.1 MECHANICAL GENERAL

A. Section 23 0010 is applicable.

1.2 REFERENCE STANDARDS

A. MSS Standard Practice, SP-58, 2009 Edition, "Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation" by Manufacturer's Standardization Society - called "MSS SP-58," herein, or local code requirements.

B. HVAC Duct Construction Standards, SMACNA, 2005.

1.3 PURPOSE

A. The purpose of supports and foundations in this Section is to position permanently the pipe, ducts, and equipment.

PART 2 - PRODUCTS

2.1 PIPE HANGER AND SUPPORT COMPONENTS

A. Hangers, supports, and pipe saddles shall be in accordance with MSS SP-58.

B. Hanger Spacing and Rod Sizes shall be in accordance with MSS SP-58. Exception: Hanger spacing for PVC and CPVC pipe shall be 4'-0" maximum. CPVC piping 1" and smaller hanger spacing shall be 3'-0" maximum. All PB pipe or tubing, all PEX tubing, and Polypropylene pipe or tubing 1" or smaller hanger spacing shall be 32" maximum. Polypropylene pipe or tubing 1 1/4" or larger hanger spacing shall be 4'-0" maximum.

C. Hanger Material shall be steel or cast iron as listed above except hangers in contact with copper pipe shall be copper, or have copper inserts, or be plastic coated steel to prevent pipe from touching hanger.

D. Trapeze Assemblies, or Unistrut type systems may be employed to support multiple parallel pipes.

E. Powder Drive Bolts or studs may be employed in concrete. The Architect must be consulted before using powder drive units in concrete.

F. Expansion Type Bolt anchors employing pre-drilled holes or self-drilled types may be employed in concrete. The Architect must be consulted before using anchors in concrete.

G. Pipe shields shall be provided to protect insulation on cold pipes at hangers in accordance with MSS SP-58.

H. Piping within 30 feet of isolated equipment shall be supported with Mason PC30N, 30° swing spring and double deflection neoprene hangers, 1.35” minimum static deflection. All hangers shall be supported only from structural framing which supports the roof assembly. Direct attachment to the roof deck shall not be permitted.

I. Basis of Design: Holdrite, Empire, or approved equivalent.

2.2 DUCT HANGERS AND OPENINGS

A. Shall be in accordance with HVAC Duct Construction Standards, SMACNA.

2.3 EQUIPMENT BASES AND SUPPORTS

A. All roof-mounted equipment shall be mounted on roof curbs or equipment supports under Division 23. Coordinate curb heights and flashing style with that required for roofing components. Roof curbs shall be as described herein.

B. Equipment mounting supports shall be prefabricated, welded 18 gauge galvanized steel with metric end sections, internal bulkhead reinforcement, wood nailer, removable counter flashing, 14" height, and sloped to fit roof pitch.

C. All suspended fans and air handlers shall be supported by all-thread rods with double deflection neoprene type vibration isolators, Mason Industries LDS HD or approved product; minimum four (4) supports. Neoprene isolators (at the factory mounting bracket) for in-line fans from the fan manufacturer are acceptable, if they meet the above requirements.

D. Air handling units, roof curbs, equipment weights, and duct openings shall be coordinated with Division 05 which is responsible for design required for accommodation of rooftop units.

2.4 VIBRATION ISOLATION

A. All vibration control devices shall be furnished by a single manufacturer who shall verify size and deflection to insure proper performance. Selection and location of vibration isolation equipment shall provide uniform loading and deflection according to weight distribution of equipment.

B. Vibration control devices shall be selected in accordance with the Vibration Isolator Selection Guide, Chapter 48, 2011 ASHRAE HVAC Applications Handbook.

C. Supports shall be selected to provide a 50% overload capacity before reaching a solid state and be fully adjustable.

D. Shop drawings shall be submitted for all equipment supports and shall include complete isolator data and manufacturer's operating weight, load distribution, and deflection at each loading point for each piece of isolated equipment.

E. Per Mechanical Code; where vibration isolation of equipment and appliances is employed, an approved means of supplemental restraint shall be used to accomplish the support and restraint.

F. Equipment by Mason Industries, Inc. is listed as the Basis of Design. Equipment by Amber/Booth, Kinetics, Vibro Acoustics, Vibrations Eliminator Co., and Vibration Mountings & Controls, Inc. shall be acceptable contingent upon full compliance with all criteria.

2.5 MISCELLANEOUS STEEL

A. Miscellaneous steel and rods required for suspension of equipment, pipe, and ductwork shall be furnished and installed under Division 23.

2.6 SLEEVES

A. Make sleeves through outside walls watertight. Pack with fiberglass and caulk, 1" deep at each face, with non-hardening sealant between pipe and sleeve.

2.7 SEISMIC RESTRAINTS

A. The Division 22 and 23 contractor shall be responsible for the design and installation of seismic restraints for the anchorage of all mechanical equipment and piping systems to the main structural system.

B. Installation for ductwork and piping shall comply with SMACNA Seismic Restraints Manual Guidelines for Mechanical Systems, Third Edition.

C. Contractor shall submit certification that seismic restraints have been provided as specified.

PART 3 - EXECUTION

3.1 ADJUSTMENT

A. All pipe hangers shall be capable of adjustment in height and this feature shall be used in final adjustment to take the weight of pipes uniformly on successive hangers and to obtain grade required.

B. Isolators shall be properly adjusted with springs perpendicular to bases or housing, adjustment bolts tightened on equipment mountings, and hangers not cocked.

3.2 LOAD SCHEDULES

A. Contractor shall submit load schedules for approval for all hangers and supports for large piping and heavy equipment.

3.3 NOTICE

A. Do not fasten a hanger or support to bridging or metal deck.

END OF SECTION

SECTION 23 0700

INSULATION

PART 1 - GENERAL

1.1 MECHANICAL GENERAL

A. Section 23 0010 is applicable.

1.2 HOT SURFACE INSULATION SYSTEM

A. Installed to prevent unwanted heat transfer. Installed on hot pipes and equipment.

B. Insulation need not be installed within wall or floor sleeves.

C. Pipe hangers may touch pipe if insulation encloses hanger.

1.3 COLD SURFACE INSULATION SYSTEM

A. Installed to prevent unwanted heat transfer, minimize sweating of pipes, ducts, and equipment, and provide a continuous high-quality vapor retarder on the outer surface of the insulation.

B. Insulation shall be continuous through wall and floor sleeves.

C. Pipe hangers shall be outside pipe insulation system.

D. Staples, screws, rivets, or any other securement device that punctures the vapor retarder shall not be used.

1.4 ITEMS NOT INSULATED

A. Insulation is not to be installed on domestic water plated fixtures & fixture supply piping, hot valve bonnets, valve stems, hot flanges, or hot unions; unless noted otherwise.

1.5 PIPES THAT SHALL BE INSULATED

A. Domestic Hot Water and Hot Water circulating lines.

B. Domestic Cold Water except where concealed within plumbing chases or within pipe riser shafts.

C. Condensate Drains: Where routed below roof lines.

PART 2 - PRODUCTS

2.1 ABBREVIATIONS FOR MANUFACTURER'S NAMES

A. O-CF - Owens-Corning Fiberglass Company

B. JM - Johns Manville

C. F - Foster Products Corporation

D. 3M - Minnesota Mining and Manufacturing Company

E. PC - Pittsburgh Corning

F. DM - Delta Maid

G. CT - CertainTeed

H. K - Knauf

I. AER - Aeroflex USA, Inc.

J. C - Childers

K. ARM - Armacell

L. K-F - K-Flex

M. ITW - ITW Insulation Systems

2.2 PIPE INSULATION

A. Domestic hot water: Molded glass fiber 4 to 8 pound density in 36" long sections, split lengthwise, with self-sealing laps and all service jacket; thermal conductance of 0.25 Btu-in/hr-ft2-F maximum at 100F mean temperature. Compliant with ASTM C547, Type I, Grade A. O-CF, JM, K.
   1. Pipes - 1/2" thru 1-1/4" = 1" thick
   2. 1-1/2" thru 2" = 1-1/2" thick
   3. Over 2" = 2" thick

B. Domestic cold water and interior condensate drains: Moulded glass fiber 4 to 8 pound density in 36" long sections split lengthwise, 1/2" thick. Compliant with ASTM C547, Type I, Grade A. O-CF, K, JM.

2.3 INSULATION FOR FITTINGS, VALVES, PRVS, STRAINERS, STEAM TRAPS, UNIONS, AND FLANGES

A. Hot Pipes (not including domestic water plated fixtures & fixture supply piping, unions & flanges): Shall be of same material and thickness as 2.02 above, and with insulation jacket as specified above. Finish any insulation terminations with white mastic. PVC fitting covers with low density batt insulation are not acceptable.

B. Cold Pipes (other than domestic cold water piping insulation and elastomeric condensate & refrigerant piping insulation): Shall be of same material and thickness as 2.02 above, seal any insulation terminations and exterior insulation surfaces with vapor retarder film, tape, or mastic/fabric/mastic system, such as F 85-60, C CP-82, or approved product; and wrapped with glass mesh tape and finished with vapor barrier coating, F 30-65 C CP-34, or approved product. Overall vapor retarder permeance shall not exceed 0.02 perms. PVC fitting covers are not an acceptable vapor retarder (but can used over specified vapor retarder, where wanted for aesthetic purposes.

2.4 ADHESIVES - GENERAL

A. Adhesives are packaged in cans and require stirring during application to result in firm bond. Adhesives applied to surfaces and to insulation require a time period to achieve a proper dry surface before final positioning in order to obtain a firm bond. Insulation which is not firmly bonded to surfaces, edges or joints shall be removed and replaced.

B. All adhesives shall be flame retardant U.L. approved.

C. Adhesive for flexible elastomeric insulation shall be an air drying contact adhesive applied per manufactures recommendations. Adhesive: Armacell Armaflex 520, or approved equivalent product.

D. All adhesives used shall be recommended by the insulation materials supplier and by the adhesive manufacturer for the intended application.

2.5 FLAME RETARDANT MATERIALS

A. All material shall be fire-retardant with an ASTM E84 flame spread rating not to exceed 25 without evidence of progressive combustion and a smoke developed rating not to exceed 50.

PART 3 - EXECUTION

3.1 CLEARANCES

A. Plan piping and ductwork layouts so that pipes and ducts are far enough apart and from adjacent surfaces to permit installation of insulation and air movement over surfaces.

3.2 **HOT PIPING**

A. Fiberglass insulation:
   1. Apply insulation over clean dry surfaces, with the pipe at approximately room temperature.
   2. Adjoining sections of insulation shall be butted firmly together and the longitudinal seam shall be located at about 3:00 or 9:00 o'clock pipe position.
   3. Any factory-applied vapor retarder shall be drawn tight and sealed at longitudinal joints with self-sealing lap tape under the overlap, in an effort to secure the insulation in place.
   4. Follow manufacturer's instructions for securement of insulation systems.
   5. Pipe insulation terminations such as at flanges shall be sealed-off with a breather mastic/fabric/mastic.
   6. Insulate fittings and other unusual shapes with preformed or mitered insulation pieces. Fitting insulation shall be same thickness and composition as that specified for pipe insulation. Hold insulation pieces in place with wire or filament tape. PVC jacketing stuffed with loose fiberglass batting shall not be acceptable.
   7. Indoors, if protective jacketing is not used, finish fittings with breather mastic/fabric/mastic system and cover butt joints with minimum 3" wide vapor retarder self-adhesive butt strips or tape of same composition as vapor retarder used on straight pipe.
   8. Supports can be internal or external to the insulation system.
   9. For protective jacketing, see Section 3.06.

3.3 **COLD PIPING (OTHER THAN ELASTOMERIC RUBBER PIPING INSULATION)**

A. Closed cell insulation materials (polyisocyanurate, cellular glass, and phenolic).
   1. Apply insulation over lean dry surfaces, with pipe at approximately room temperature.
   2. Adjoining sections of insulation shall be glued together at butt and longitudinal joints using a vapor retarding joint sealant suitable for the insulation type being used. Joint sealant shall be applied evenly across the entire joint face is as thin a layer as possible while still achieving good adhesion. Adjoining sections of insulation shall be butted firmly together after application of joint sealant.
   3. Longitudinal seam shall be located at about 3:00 or 9:00 o'clock pipe position.
   4. Factory-applied vapor retarder shall be used on all insulation types and shall be drawn tight and sealed at longitudinal joints with self-sealing lap tape under the overlap. Butt joints of the vapor retarder shall be sealed with minimum 3" wide vapor retarder self-adhesive butt strips or tape of same composition as vapor retarder used on straight pipe.
   5. Follow manufacturer's instructions for securement of insulation systems that do not have protective jacket. This typically involves the use of filament tape or metal banding to hold the system in place.
   6. Pipe insulation terminations such as at flanges shall be sealed-off with a vapor retarder mastic/fabric/mastic.
   7. Insulate fittings and other unusual shapes with preformed or mitered insulation pieces. Fitting insulation shall be same thickness and composition as that specified for pipe

insulation. Hold insulation pieces in place with filament tape. PVC jacketing stuffed with loose fiberglass batting shall not be acceptable.

8. Indoors, if protective jacketing is not used, finish fittings with vapor retarder mastic/fabric/mastic system, spiral-wrapped vapor retarder self-adhesive tape or other approved method that achieves a continuous vapor retarder. Vapor retarder applied to fittings shall interface with vapor retarder on neighboring straight pipe to assure vapor retarder continuity.
9. Supports shall be external to the insulation system and vapor retarder to assure insulation and vapor retarder continuity. Utilize high density insulation and verify the high density insulation is capable of resisting the forces exerted by the weight of the pipe, contents, and insulation system.
10. For protective jacketing, see Section 3.06.

B. Fiberglass insulation:

1. Apply insulation over clean dry surfaces, with the pipe at approximately room temperature.
2. Adjoining sections of insulation shall be glued together at butt and longitudinal joints using a vapor retarding joint sealant suitable for the insulation type being used. Joint sealant shall be applied evenly across the entire joint face is as thin a layer as possible while still achieving good adhesion. Adjoining sections of insulation shall be butted firmly together after application of joint sealant.
3. Adjoining sections of insulation shall be butted firmly together and the longitudinal seam shall be located at about 3:00 or 9:00 o'clock pipe position.
4. Factory-applied vapor retarder shall be drawn tight and sealed at longitudinal joints with self-sealing lap tape under the overlap. Butt joints of the vapor retarder shall be sealed with minimum 3" wide vapor retarder self-adhesive butt strips or tape of same composition as vapor retarder used on straight pipe.
5. Follow manufacturer's instructions for securement of insulation systems.
6. Pipe insulation terminations such as at flanges shall be sealed-off with a breather mastic/fabric/mastic.
7. Insulate fittings and other unusual shapes with preformed or mitered insulation pieces. Fitting insulation shall be same thickness and composition as that specified for pipe insulation. Hold insulation pieces in place with wire or filament tape. PVC jacketing stuffed with loose fiberglass batting shall not be acceptable.
8. Supports shall be external to the insulation system. Utilize high density insulation and verify the high density insulation is capable of resisting the forces exerted by the weight of the pipe, contents, and insulation system.
9. For protective jacketing, see Section 3.06.

3.4 ELASTOMERIC RUBBER INSULATION - PIPING

A. Elastomeric rubber insulation shall be installed in accordance with the manufacturer's recommendations. Protect condensate piping insulation routed on floors and across walkways with metal shroud across the exposed insulation. Permanently attach shroud to the floor. Elastomeric rubber piping insulation exposed to outdoor conditions shall have multiple recommended applications of vinyl lacquer-type coating, minimum 2 coats, allowing for drying between coats as recommended by the manufacturer. Coating shall be complete over all insulation surfaces. Armacell Armaflex WB Finish, or approved equivalent product by F 30-64, IMCOA or Dow Corning. Note to Owner, this weatherproofing coating should be reapplied every two years to protect insulation from UV damage.

END OF SECTION

SECTION 23 0900

HVAC AUTOMATIC CONTROLS

PART 1 - GENERAL

1.1 MECHANICAL GENERAL

A. Sections 23 0010 Mechanical General, 23 3000 Ductwork and 23 8000 HVAC Major Equipment shall apply.

1.2 CONTROLS

A. Shall be electronic/electric. Controls products shall be by Carrier, Trane, Siemens, Airlink, Johnson, Honeywell, Robertshaw, or Landis.

B. Installation: The complete control system shall be installed by trained mechanics in the employ of the contractor and who have a minimum of one year actual experience in the installation of these controls. A letter certifying this training and experience shall be a part of the control submittal.

1.3 ELECTRICAL WORK

A. The definition of "Path of Power"; the work included in Division 26; the work included in Division 23; and control wiring is described in Section 23 0010.

B. The electrical work installed under this section shall comply with the requirements of Division 26.

C. All exposed wiring, low and line voltage subject to mechanical damage, shall be run in conduit. Line and low voltage wiring shall be run in separate conduits. Concealed but accessible wiring, except in Mechanical Rooms and areas where other conduit and piping are exposed, shall be U.L. plenum-rated cable as approved by local codes unless expressly restricted by requirements in the Division 26 Specification. All control wiring not in conduit shall be supported from the building structure by products designed to support cables per NEC 800.24.

1.4 SERVICE AND WARRANTY

A. After completion of the installation, the contractor shall adjust all thermostats and other equipment provided under his contract. All control systems shall be tested and adjusted through all phases of operation and demonstrated to the Owner and architect or his representative to perform the functions as described for the control system. Contractor shall instruct the operating personnel in the operation of the entire control system.

B. Contractor shall provide certification (6 copies) that all controls have been installed, calibrated, and adjusted in accordance with the specifications and manufacturer's requirements.

C. The control system as shown on the Drawings and specified herein shall be guaranteed free from defects in workmanship and materials under normal use and service as herein specified. Any equipment herein described proven to be defective in workmanship or material during the guarantee period shall be adjusted repaired or replaced at no charge to the Owner.

1.5 SUBMITTALS

A. Contractor shall submit complete control shop drawings, sequence of control and component specification data for Architect's approval prior to installation or fabrication of any equipment.

B. Control diagrams shall show all external wiring between fans, panels, starters, controls, relays, and other wiring performed under this Section of the Specifications.

C. Deviations in details from the specified sequence of control shall be clearly noted on the sequence of control of the submittal.

D. Two sets of approved full-size, fade resistant, as-built schematic control diagrams shall be provided to the Owner.

1.6 IDENTIFICATION

A. All control devices shall have identification means attached to or painted on the front of most visible surfaces. Room thermostat having no special purpose other than to control local temperature shall not be identified.

B. Small devices - milled laminated plate secured with epoxy cement.

C. Devices large enough to have painted stenciled wording shall be painted.

D. Abbreviated words and numerals shall identify the system controlled, the function and the designator which appear on the control system.

1.7 SYSTEM ACCEPTANCE

A. After completion of the installation all control systems shall be tested and adjusted through all phases of operation. As part of the final site visit, the Contractor shall demonstrate to the Architect, the Engineer and the Owner's representatives that the controls for system(s) selected by the Engineer perform the sequences as described herein. The contractor shall provide written certification (6 copies) that all controls have been installed, calibrated, and adjusted in accordance with the specifications and manufacturer's requirements.

PART 2 - PRODUCTS

2.1 CONTROL WIRING

A. All control wiring installed by the Control Contractor shall comply with the material and installation requirements of Division 26.

B. All control wiring shall be run in conduct.

2.2 MISCELLANEOUS CONTROLS AND ACCESSORIES

A. Contractor shall furnish all two position relays, capacity relays transformers, plus all controls necessary to meet the specifications and to provide for properly operating automatic control system. All relays shall be U.L. Listed and of a type to meet current and voltage requirements of the particular application.

B. All relays, switches, transformers and other system controls and accessories required for the complete control system shall be of heavy duty type selected for the specific service, and shall be of the stand products of the control manufacturer.

C. Line voltage wiring to transformers and low voltage wiring from transformers to control devices shall be furnished and installed by Division 23. All line voltage wiring shall be run in conduit.

PART 3 - SEQUENCES OF OPERATION

3.1 GENERAL

A. Each piece of equipment energized by its control system shall function under control of its safety and operating controls.

3.2 FANS

A. Toilet exhaust fans shall be controlled by wall mounted motion detectors provided by the fan manufacturer.

3.3 ELECTRIC HEATERS

A. Electric ceiling heaters shall be energized by respective built-in thermostat subject to heater safety controls.

END OF SECTION

SECTION 23 3000

DUCTWORK

PART 1 - GENERAL

1.1 MECHANICAL GENERAL

A. Section 23 0010 is applicable.

1.2 PRESSURE

A. Exhaust ductwork is defined as STD, +/-1" static pressure, Class A seal, SMACNA.

1.3 GENERAL REQUIREMENTS

A. Construct ductwork to meet all functional criteria defined in Section 11 of the 2005 SMACNA "HVAC Duct Construction Standards, Metal and Flexible.", Third Edition, except as noted.

B. All ductwork shall comply with any applicable local, state, and federal Code requirements.

C. All ductwork shall meet or exceed the requirements listed in the 2012 International Mechanical Code, with 2014 & 2015 Georgia Amendments.

PART 2 - PRODUCTS

2.1 METAL DUCTWORK AND CONSTRUCTION

A. Ductwork shall be galvanized sheet steel, rectangular, flat oval, and round, except as noted below.

B. Metal thickness, reinforcement and joint construction for duct shall comply with SMACNA, 2005, Chapter 1. All duct shall have sealer applied for seal class as specified herein. Ductwork installed in any fire-rated roof/ceiling assembly shall comply with the requirements for that assembly.

C. All stiffeners shall be galvanized steel.

2.2 **PAINTING**

A. All metal visible through louvers, grilles, registers and diffusers (including dampers unless factory painted black): cover metal with two coats of flat black spray paint.

B. Route ductwork in return air plenums, where possible, so it does not pass over ceiling return grilles open to the plenum.

2.3 DUCTWORK SPECIALS

A. Furnish and install vanes at all square elbows and short radius ells. Long radius elbows without turning vanes and with a centerline radius of not less than 1.5 times the duct width may be used in lieu of elbows with turning vanes. Volume damper controls shall be securely fitted to square rod turning axles operated with locking type quadrants.

2.4 SEALANTS

A. Joint & seam sealant shall be a flexible, water-based, adhesive sealant designed for use in all pressure duct systems. After curing, it shall be resistant to ultraviolet light and shall prevent the entry of water, air, and moisture into the duct system. Sealer shall be UL 723 listed and meet NFPA requirements for Class 1 ductwork, Sealant shall not contain VOCs.

1. Shall be United McGill United Water Based Duct Sealant, Hard Cast Irongrip 601, Polymer Adhesives Airseal #11, Foster 32-19, Childers CP-146, or Ductmate Industries PROseal. Duct tape shall not be considered an acceptable sealant for duct joints.

B. "T" Type Flange Gasket: A butyl rubber gasket which complies with UL 723 and meets Mil-C 18969B and TTS-S-001657. This material, in addition to the above, shall not contain vegetable oils, fish oils, or any other type vehicle that will support fungal and/or bacterial growth. Basis of Design is Ductmate Industries 440 Butyl gasket tape, or approved equivalent product.

2.5 FITTINGS AND SPECIAL INSTALLATION

A. SMACNA Chapters 3, 4, 6 & 7

1.	Fittings	4-1 thru 4-9
2.	Duct Access Panels & Doors	7-2, 7-2M, & 7-3
3.	Grille & Register Connection	7-6
4.	Ceiling Diffuser Branch Ducts	7-7
5.	Flexible Ducts	Chapter 3
6.	Round Duct	Chapter 3
7.	Flexible Connection	7-8

2.6 INSPECTION PANELS

A. Shall be provided in plenums and ductwork for the purpose of visually inspecting fans, filters, coils and dampers. Panels into spaces large enough for a man to enter shall be 24" x 24" minimum. Panels into smaller spaces shall be 12" x 12" minimum. Fan section panel shall be 18" x 10" minimum. Panels in insulated metal shall be constructed of 22 gauge galvanized steel frame with 24 gauge galvanized steel door panel, and shall be neoprene-gasketed, double wall insulated with 1" thick fiberglass insulation. Panels shall be piano-style hinged (multiple screws on panels are not acceptable) on one side with galvanized steel cam latch on the other side. Finish shall be mill. Panels shall be by CESCO model HAD or approved equivalent product.

B. Inspection Panels shall not be installed to enter a space which has an access door.

2.7 FLEXIBLE EQUIPMENT DUCT CONNECTIONS

A. Flexible connections shall be used for connecting ductwork to all air conditioning units and fans for the purpose of vibration isolation. Flexible connections shall be per SMACNA, Section II and NFPA 701. Connector fabrics shall be mildew resistance per ASTM G21, and shall be minimum 24 gauge galvanized equivalent.

1. Flexible material for indoor installation shall be heavy commercial grade, woven nylon/polyester blend fabric, with a double vinyl coating. Minimum density 22 oz./sq. yd, rated for 180 deg F high temp, -40 deg F low temp. Basis of Design is Durodyne Excelon UL, color orange; approved equivalent product by Ductmate Industries, Flex-Weld Keflex, or Ventfabrics.
2. Flexible material for external installations shall be heavy commercial grade, woven fiberglass, with a Hypalon coating. Minimum density 26 oz./sq. yd., rated for 250 deg F high temp, -40 deg F low temp. Basis of Design is Durodyne Durolon UL, color white; approved equivalent product by Ductmate Industries, Flex-Weld Keflex, or Ventfabrics.

2.8 SLEEVES

A. Are defined as holes provided to permit passage of duct and insulation through floors and walls. Sleeves shall be installed during construction of floors and walls, before ducts are installed.

B. Masonry: Sleeves shall be formed with 10 gauge steel.

C. Where ducts pass through wood, drywall, plaster partitions, or suspended ceilings, sleeves shall be cut holes except at mechanical room walls which shall be framed with sheet metal.

D. Sealing of Annular Space: For sleeves in masonry and concrete, annular space shall be closed by packing with silicone RTV foam. Sleeves in mechanical room walls shall be packed with loose glass fiber and caulked on both sides. Sleeves in exterior walls shall have applied sealant material as called for under Architectural Section. The annular space shall be sealed flush with sleeve-end and shall be air-tight. Final finish shall have a neat and professional appearance.

E. Unused Holes in floors or walls made for duct penetration shall be plugged to match wall and finished.

PART 3 - EXECUTION

3.1 DUCTWORK

A. The recommendation of SMACNA for pressure and seal as specified, shall be followed in the installation of ducts and plenums.

3.2 FLEXIBLE EQUIPMENT CONNECTIONS

A. Flexible isolation shall be installed on inlet and outlet of unit connections prior to any duct hangers, and shall be provided by the unit manufacturer if available as an option.

END OF SECTION

SECTION 23 8000

HVAC - MAJOR EQUIPMENT

PART 1 - GENERAL

1.1 MECHANICAL GENERAL

A. Section 23 0010 is applicable.

PART 2 - PRODUCTS

2.1 FANS

A. General:
1. Fans are scheduled on the Drawings.
2. All units shall bear the AMCA Certified Performance Ratings Seal and U.L. Label. Sone ratings shall be in accordance with AMCA Bulletin 300. Fans shall have published ratings certified by Air Moving and Conditioning Associates, Inc., (AMCA), Standard 210 and Class established by AMCA 2408-69. Fan RPM and BHP shall be selected to produce specified capacity when installed in system with accessories as indicated. Fan wheels shall be statically and dynamically balanced.
3. Belt drive fan motors shall have bases which permit adjustment of belt tension, belt guards with tachometer hole for fan shaft, and all fan motors shall have variable pitch diameter sheaves.
4. Bearings for belt drive fans other than propeller type shall have an average service life of 100,000 hours, factory lubricated and equipped with standard hydraulic grease fittings and with lubricating lines extending to outside of casing.
5. A solid-state speed control on all direct drive fans, less the 3/4 HP, shall be provided (mounted at fan) and wired under this division to allow initial balancing of fan air quantity. EC motor with variable speed controller shall also be acceptable. Contractor shall coordinate with Electrical Division for additional neutral wire requirements.
6. Motors shall be as specified in Section 23 0010 and shall be readily accessible. Per 2007 Energy Independence & Securities ACT (EISA), 2010 DOE Small Motor Rule (10 CFR Part 31 Energy Conservation Program: Energy Standard for small Electric Motors), and ASHRAE/IES Standard 90.1; all motors over 1 HP shall be NEMA "Premium" efficiency. All motors over 1 HP shall be compatible for use with variable speed drives (VFDs).

B. Cabinet/Ceiling Type:
1. Housings shall be reinforced phosphatized steel. Wheels shall be true centrifugal, forward curbed design, statically and dynamically balanced. Fans shall be direct or belt drive as per schedule on drawing.
2. Where grilles are required, they shall be aluminum with white baked enamel symmetrically finished appearance. Interior surfaces of housings shall be lined with dark acoustical insulation permanently secured in place. Interior of installed unit shall not be visible when grille is in position.
3. Motors shall be shaded pole type with sleeve bearings, supported by one piece, die-formed steel suspension brackets with rubber isolation dampers.
4. Terminal box shall be mounted in the housing with receptacle, plug and cord inside of the cabinet. All motors shall be suitable grounded. Motor and fan assembly shall be removable from installed ceiling ventilator.
5. Where duct flanges are required on one or both ends of fan, they shall be pre-assembled to housings.

6. Backdraft dampers shall be of integral design with aluminum damper on steel spring and foam rubber seal to eliminate chatter.
7. A speed controller on direct drive fans, less than 3/4 HP, shall be mounted at the fan and factory wired or field wired under Division 23, between the fan and fan energizer. EC motor with variable speed controller shall be acceptable. Contractor shall coordinate with Electrical Division for additional neutral wire requirements.

C. Basis of Design for fans listed above is Greenheck; or approved equivalent product by PennBarry, Twin City, Accurex, or Loren Cook contingent upon full compliance with all criteria.

2.2 ELECTRIC UNIT HEATERS (EUH)

A. Electric unit heaters are scheduled on the Drawings.

B. Unit heaters shall be constructed of commercial grade heavy gauge steel, with die-formed steel housing. Unit shall be draw pull thru design assuring even distribution of air of heating elements.

C. Fan shall be propeller-type, with the fan motor completely enclosed. Electric heating element shall be resistance aluminum-finned, copper clad steel sheath heating element with integral thermal overload, controls, contactors, fused disconnects, and manual and automatic reset thermal overloads, fan delay, and integral adjustable thermostat.

D. Provide individually adjustable discharge louvers.

E. Provide all required mounting hardware for a complete installation.

F. Basis of Design is Q-Mark; or approved equivalent product by Markel, Modine, Indeeco, Redd-I, Chromalox, Berko, Trane, or Raywall.

PART 3 - EXECUTION

3.1 CONTROLS AND CONTROL WIRING

A. Control or safety devices furnished with equipment for field installation and wiring shall be installed and wired under Section 23 0900.

3.2 UNIT INSTALLATION

A. Do not operate any air distribution systems without filters in place. Construction filters shall be utilized prior to start of test and balance. Operating filters shall be installed for test and balance, and shall be checked and replaced as necessary prior to final inspection.

B. Provide manufacturers required service and/or operating clearances around all mechanical equipment.

3.3 HVAC EQUIPMENT KNOCKOUTS AND ACCESS PLATES

A. All unused holes in HVAC equipment shall be properly covered and sealed against the elements. Opening in outdoor equipment housing which are used for connection of electrical or mechanical lines shall have properly installed grommets, seals, strain clamps, or weather shields.

3.4 EQUIPMENT SUPPORTS AND PORTALS

A. Refer to Section 23 0520 for support specifications required for split system condensing units, and all special mechanical equipment on the roof, concrete pads, or suspended units.

B. Refer to Section 22 1000 for ducts, vents, and refrigerant piping which shall require roof portals.

END OF SECTION

SECTION 260500

ELECTRICAL GENERAL

PART 1 - GENERAL

1.01 SUMMARY:

A. Description:
   1. Provide all materials, tools, and labor for a complete electrical installation as shown on the contract documents and indicated in the specifications.
   2. Procure all permits and licences.
   3. Coordinate the electrical installation with the following:
      a. Architect
      b. Contractors of other trades.
      c. Local Electrical and Building Inspectors, or the authority having jurisdiction.
      d. Local Utility companies serving the project.

B. Related Documents:
   1. Electrical, "E-" , drawings
   2. All working drawings included in the contract documents.
   3. Specifications of the following divisions/sections:
      a. Division 1: General Requirements
      b. Division 3: Concrete
      c. Section 07200: Firestopping
      d. Division 11: Equipment
      e. Division 15: Mechanical

1.02 ABBREVIATIONS:

A. The following abbreviations are used throughout Division 16 specifications:
   1. AFF: Above Finished Floor
   2. ANSI: American National Standards Institute
   3. ASTM: American Society for Testing and Materials
   4. HVAC: Heating, Ventilating and Air Conditioning
   5. IEEE: Institute of Electrical and Electronic Engineers
   6. IES: Illuminating Engineering Society
   7. ITL: Independent Testing Laboratories
   8. NEC: National Electrical Code
   9. NECA: National Electrical Contractor Association
   10. NEMA: National Electrical Manufacturers Association
   11. NFPA: National Fire Protection Association
   12. NIC: Not in contract
   13. UL: Underwriters Laboratories, Inc.
   14. ADA: Americans with Disabilities Act.

1.03 DEFINITIONS:

A. "Provide" means to furnish and install.

1.04 CODES AND STANDARDS:

A. Comply with the following codes and published standards which are applicable to the electrical installation of this project:
   1. NFPA 70 - National Electrical Code, 2014 edition.
   2. NFPA 101 - Life Safety Code
   3. Standard Building Code
   4. Underwriters Laboratories Electrical Construction Directory ("green book")
   5. Underwriters Laboratories Electrical General Information ("white book")
   6. NFPA 72
   7. Americans with Disabilities Act, latest edition.

1.05 STANDARDS FOR MATERIALS AND WORKMANSHIP:

A. Use materials that are new and, where UL or ITL has established standards, listed and/or labeled.

B. Organize and execute work so that finished appearance is neat; mechanical, plumb when vertical and level when horizontal.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Provide equipment, products and materials shown on the drawings, as specified in the specifications or added by addendum.

2.02 SUBSTITUTION OF MATERIALS:

A. Refer to Contract Conditions.

2.03 CONCRETE:

A. Refer to Division 3 specifications.

2.04 PLYWOOD BACKBOARDS:

A. 3/4"x size indicated on the drawings, A/D grade, paint two coats gray enamel.

PART 3 - EXECUTION

3.01 VISIT TO SITE:

A. Prior to submitting bid, visit site and become familiar with the existing conditions relating to Division 16 work.

3.02 PROTECTION OF MATERIALS:

A. Cover fixtures, equipment and apparatus for protection against dirt, water, chemical or mechanical damage before and during construction.

B. Keep all conduit and other openings protected against entry of foreign matter.

C. Restore the original finish, including shop coat, of fixtures, apparatus or equipment that has been damaged prior to substantial completion.

3.03 COORDINATION:

A. Prior to rough-in of any materials, coordinate with subcontractors the physical clearances for and sequencing of Division 16 work as it interfaces with and relates to architectural, structural, plumbing and HVAC systems.

3.04 SHOP DRAWINGS AND PRODUCT DATA SUBMITTALS:

A. Submit as prescribed in section 01300 shop drawings and/or product data for the electrical equipment and materials listed below. Check for compliance with contract documents and certify compliance by affixing Electrical Contractor's "Approved" stamp and signature.
   1. Shop drawings and product data:
      a. Switchgear, Distribution Panelboards, Panelboards, and Loadcenters

   2. Product data only:
      a. Conduits, Couplings, Connectors, and Fittings
      b. Wiring Devices and Coverplates (receptacles, switches, wallbox dimmers)
      c. Fuses and Circuit Breakers
      d. Junction Boxes, Outlet Boxes, and Floor Boxes
      e. Lighting Fixtures and Lamps
      f. Disconnect Switches, Motor Starters, and Motor Switches
      g. Wire and Cable
      h. Time Clocks, Relays, Contactors, and Photocells

B. Refer to respective sections for submittal instructions where instructions have been prescribed.

C. Obtain shop drawing review by engineer before purchase of any equipment requiring shop drawing submittals.

D. Include with the electrical distribution equipment submittal a plan view of each electrical room. Use 1/2" = 1' scale and show the submitted equipment laid out in each room. Label each piece of equipment and indicate the required maintenance clearance by a dashed line. Also include an elevation of each of the walls in the room showing electrical equipment to scale.

3.05 CERTIFICATION AND TEST REPORTS:

A. Submit the following certifications and test reports to the Architect:
   1. Test Reports:
      a. Megger test for all feeders and Service Entrance conductors.

3.06 OPERATIONAL TEST

A. At the time of the substantial completion job observation, perform a test of all light fixtures, electrical systems, equipment, machinery and appliances, in the presence of the Architect or his representative, which demonstrates that all of Division 260 systems are operational.

3.07 JOB OBSERVATION ASSISTANCE:

A. During all job observations, provide an electrician with tools and volt/ammeter to accompany Architect and/or his representative.

B. Remove any covers, trims or wiring devices and open all cabinets, disconnect switches or other equipment served electrically and designated by the Architect or his representative.

C. Restore removed or opened equipment to its installed or closed position after the job observation.

3.08 OWNER INSTRUCTION AND ASSISTANCE:

A. At substantial job completion job observation, instruct the Owner's operating personnel in the operation, sequencing, maintenance and safety/emergency provisions of the electrical systems.

3.09 AS-BUILT DRAWINGS:

A. Record on one set of electrical drawings all changes, deviations and underground conduits. Transfer same to a reproducible sepia and deliver same to architect as per Section 01010.

END OF SECTION 260500

SECTION 260519

CONDUCTORS

PART 1 - GENERAL

1.01 SUMMARY:

A. Description:
1. Provide continuous color coded conductors beginning at service point to distribution equipment and to each outlet and each piece of electrical energy consuming equipment.

1.02 SUBMITTALS:

A. Manufacturers Product Data Sheets.

PART 2 - PRODUCTS

2.01 CONDUCTORS:

A. Copper Conductors:
1. Soft drawn annealed copper, 98 % conductivity, without weld, splice or joint throughout its length; uniform in cross section without flaws, scales, or other imperfections with THHN/THWN or XHHW insulation.

2. Acceptable Manufacturers:
a. Phelps Dodge
b. Pirelli Cable
c. Senator
e. Southwire
f. Triangle

B. Configuration:
1. No. 10 and smaller: Solid
2. No. 8 and larger: Stranded

C. Insulation - 600 Volts:
1. No. 6 and smaller: THHN, THWN
2. No. 4 and larger: XHHW

D. Jacket Color:
1. No. 8 and smaller: Uniform colored jacket
2. No. 6 and larger: Black

E. Jacket Markings:
1. Voltage
2. Insulation type
3. Conductor Size

4. Conductor type

2.02 COLOR CODING TAPE:

A. Vinyl 3/4" wide with uniform color and adhesive backing.

B. Acceptable Manufacturers:
   1. Brady
   2. 3M
   3. Plymouth
   4. Thomas & Betts

2.03 SPLICE AND TAP MATERIALS:

A. No. 10 and smaller:
   1. Crimp type: Cylindrically shaped conductor sleeve for crimping copper conductors. Insulated with nylon or plastic cover.
   2. Twist on: Inner spiral spring or threads for holding and making electrical contact between copper conductors and with outer long skirted insulated cover of nylon or plastic.

B. No. 8 and Larger:
   1. Set-screw or bolted type: Metal connectors for joining copper to copper, with bolts or set-screws to apply pressure to conductors. Insulate with nylon or plastic cover or with electrical tape.
   2. Pressure type: Metal connectors for joining copper to copper, copper to aluminum, or aluminum to aluminum with power operated crimping tool. Insulate with nylon or plastic cover or with electrical tape.

C. Acceptable Manufacturers:
   1. AMP
   2. Burndy
   3. Ideal
   4. Ilsco
   5. Panduit
   6. 3M
   7. Thomas & Betts

2.04 CONDUCTOR TERMINALS:

A. Copper conductors: High conductivity copper terminal designed to hold conductor and make electrical contact by bolt, setscrew or power crimp and with spade to match equipment receiving conductor.

B. Acceptable Manufacturers:
   1. Burndy
   2. Ideal
   3. Ilsco
   4. Panduit
   5. Thomas & Betts

2.05 CONDUCTOR HARNESS:

A. Plastic or nylon self-locking straps (commonly refered to as zip-ties or tie-wraps).

B. Acceptable Manufacturers:
   1. Panduit
   2. Thomas & Betts

2.06 WIRE PULLING LUBRICANT:

A. Lubricating, insulating and chemically neutral to conductors, conductor insulation and conduits.

B. Acceptable Manufacturers:
   1. Greenlee
   2. Ideal
   3. Polywater

2.07 ELECTRICAL TAPE:

A. Vinyl plastic; moisture tight, resistant to ultraviolet radiation, alkalies, acids and corrosion; chemically neutral to conductors and conductor insulation; fire retardant; and single thickness dielectric strength equal to or greater than 10,000V.

B. Acceptable Manufacturers:
   1. Scotch/3M
   2. Plymouth

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Install the number of conductors indicated with a minimum of two (2) conductors being installed in each conduit not prescribed to be empty.

B. Minimum Conductor Size: No. 12

C. Complete installation of raceway run prior to pulling conductors.

D. Install insulated bushings in conduit fittings prior to pulling conductors.

E. Use wire pulling lubricants to reduce stress on conductors. Pull all conductors of a run together. Use pulling methods which do not damage the raceway or conductors.

F. Color Coding:
   1. No. 8 and smaller: Uniform colored jacket with respective color below.
   2. No. 6 and larger: Two wraps of tape applied within 6" of each conductor end with respective color below.
   3. Conductor Color Code:

	208Y/120V	480Y/277V	
Phase A	Black	Brown	
Phase B	Red	Orange	
Phase C	Blue	Yellow	
Neutral	White	Gray	
Ground	Green		
Isolated Ground	Green w/ White Stripe		

4. For Different Voltages in Same Enclosure: Use a colored stripe (not green) on one neutral to differentiate between systems. Keep stripe color consistent throughout project.

G. At outlets leave a minimum of 12" of conductor ends at each fixture outlet, device outlet and equipment outlet box.

H. Conductor Terminals:
1. Single: Use terminals on conductors no. 8 and larger where equipment receiving conductors do not have conductor lugs with set-screw(s)
2. Multiple: Install terminals on conductors where more than one conductor is connected to a single lug.

I. Route conductors in all switchboards, panelboards, motor control centers and terminal cabinets parallel to or at right angle to the enclosure's sides and tops. Group and harness conductors in those enclosures using conductor harness straps.

J. Prior to energizing conductor, megger test conductors for continuity and shorts. Correct deficiencies prior to energizing.

K. Tighten all bolted connections in and to mechanical lugs to torque rating specified per manufacturers recommendations.

L. Tighten all conductors with mechanical connections, torqued in accordance with the conductor and/or connector manufacturers markings as well as the values referenced in the following publications:
1. Underwriters Laboratories Electrical Construction Directory (Green Book).
2. Underwriters Laboratories Electrical General Information (White Book).

END OF SECTION 260519

SECTION 260526
GROUNDING

PART 1 - GENERAL

1.01 SUMMARY:

A. Description:
   1. Provide a grounding system for the main building service and each separately derived system originating at the respective grounding electrode(s) and radiating to every electrical power controlling and consuming device in the system.

B. Related Sections:
   1. Section 16050: Electrical General
   2. Section 16110: Raceways
   3. Section 16120: Conductors

1.02 SUBMITTALS:

A. Manufacturers Product Data Sheets

PART 2 - PRODUCTS

2.01 DRIVEN GROUND RODS:

A. Provide ten (10) feet long, 3/4 inch diameter copperclad steel ground rods.

2.02 GROUND CLAMPS:

A. Bronze, U.L. listed, with configuration to match application.

B. Acceptable Manufacturers:
   1. Burndy
   2. Ilsco
   3. Thomas & Betts
   4. O.Z. Gedney

PART 3 - EXECUTION

3.01 SERVICE ENTRANCE GROUNDING ELECTRODES:

A. Driven Ground Rods: Install two driven ground rods minimum 12 feet apart, located outside of building, and as close as possible to the service entrance but a minimum of 36" from the building foundation. Locate in non-paved area where feasible. Install so as to maintain accessibility to top of rod. Provide each with box with removable cover for inspecting ground rod connection. Install box so that top is flush with finished grade.

B. Building Steel: Select a connection point on the building steel as close as possible to the domestic water service entrance that will also remain exposed.

C. Domestic Water Pipe: Select a connection point on the domestic water pipe inside of the building as close as possible to the point it enters the building and that will also remain exposed.

D. In-Slab Reinforcing Bar: Bond to reinforcing bar prior to concrete pour. Length of re-bar per NEC.

E. Gas Pipe: Select a connection point inside of the building near the point where it enters the building and that will remain exposed.

3.02 MAIN SERVICE GROUNDING ELECTRODES BONDING CONDUCTORS:

A. Install a 3/0 bare stranded copper conductor between each grounding electrode and its closest grounding electrode neighbor so that all electrodes are bonded together.

B. Clamp each bonding connection both cable to cable and cable to grounding electrode.

3.03 MAIN SERVICE GROUNDING ELECTRODE CONDUCTOR:

A. Install a 3/0 bare stranded copper conductor from the closest driven ground rod to the service switchboard ground bus.

B. Clamp the connection to the ground rod and ground bus.

3.04 ADDITIONAL BONDS:

A. Gas Service Pipe: Bond gas service pipe at the first accessible point nearest its entry to the building to the nearest main service grounding electrode with a 3/0 bare stranded copper conductor. Exothermic weld the connection at grounding electrode and to a ground clamp at the gas pipe.

B. Roof Structure: Bond roof structure steel at its nearest accessible point to the building steel connection point with a 3/0 bare stranded copper conductor. Exothermic weld both connections.

C. Domestic Water Meter: Install bond across water meter with 3/0 stranded bare copper conductors of sufficient length to accommodate removal of meter. Exothermic weld both connections to water pipe.

D. Non-metallic Domestic Water Insulated Coupling: Install bond across insulated coupling with 3/0 stranded bare copper of sufficient length to accommodate removal of coupling. Exothermic weld both connections to water pipe.

E. Gas Meter: Install bond across gas meter with a 3/0 stranded bare copper conductor of sufficient length to accommodate removal of meter. Use ground clamps on pipes and exothermic weld cable to clamps.

3.05 EQUIPMENT GROUNDING CONDUCTOR:

A. Provide a seperate ground conductor in every conduit.

3.06 EQUIPMENT GROUNDING CONDUCTOR ROUTING:

A. Route equipment grounding conductor with respective feeder, power wiring and branch circuit conductors.

3.07 CONDUITS:

A. All grounding electrode conductors, equipment grounding conductors and bonds where not internal to equipment enclosures shall be installed in conduit to within 6" of terminating clamp.

END OF SECTION 260526

SECTION 260533

RACEWAY

PART 1 - GENERAL

1.01 SUMMARY:

A. Description:
1. Provide continuous conduit systems - beginning at the service point, to all distribution equipment and to every outlet and piece of electrical equipment with conduits, couplers, supports, hangers, fittings, bushings and accessories.

B. Related Sections:
1. Section 16050: Electrical General

1.02 SUBMITTALS:

A. Manufacturers Product Data Sheets

PART 2 - PRODUCTS

2.01 RIGID STEEL AND INTERMEDIATE METALLIC CONDUIT:

A. Conduit:
1. Rigid ferrous steel pipe, hot-dipped galvanized or sherardized with smooth interior.
2. Acceptable Manufacturers:
a. Allied
b. Triangle
c. Wheatland

B. Couplings and Connectors:
1. Couplings:
a. Hot-dipped galvanized or sherardized ferrous steel, threaded
2. Connectors:
a. Steel or malleable iron, threaded with throat bushing, lock nuts and, where prescribed, grounding lugs.
3. Erickson:
a. Malleable iron, concrete tight
4. Acceptable Manufacturers:
a. Appleton
b. Crouse Hinds
c. Steel City
d. Thomas & Betts

C: Joint Compound:
1. Anti-seize lubricant with rust and corrosion inhibitors and colloidal copper
2. Acceptable Manufacturers:
a. Thomas & Betts

D. Expansion Fittings:
   1. Steel with three cap nuts, phenolic bushing, packing ring, metallic copper grounding ring and copper bonding jumper.
   2. Acceptable Products:
      a. Crouse Hinds "XJ"
      b. O.Z. Gedney "AX" or "DX"
      c. Appleton "XJ"

2.02 ELECTRICAL METALLIC TUBING

A. Conduit:
   1. Thin wall ferrous steel tubing, hot-dipped galvanized, smooth interior, square and reamed ends
   2. Acceptable Manufacturers:
      a. Allied
      b. Wheatland
      c. Triangle

B. Couplings and Connectors:
   1. Couplings:
      a. Steel, compression type.
   2. Connectors:
      a. Steel, compression type with nylon insulated bushings, locknuts, and where indicated, grounding lugs.

C. Expansion Fittings:
   1. Steel with three cap nuts, phenolic bushing, packing ring, metallic copper grounding ring and copper bonding jumper.
   2. Acceptable Products:
      a. Crouse Hinds "XJ"
      b. O.Z. Gedney "AX" or "DX"
      c. Appleton "XJ"

2.03 RIDGID NONMETALLIC CONDUIT:

A. Conduit:
   1. Schedule 40 Polyvinyl chloride (PVC), resistant to crushing, moisture, low temprature, and corrosive agents in standard trade sizes.

B. Couplings and Connectors:
   1. Couplings: Schedule 40 PVC
   2. Connectors: Schedule 40 PVC with lock nuts

C. Expansion Fittings:
   1. Schedule 40 PVC with grommeted inner cylinder and outer sleeve

D. Joint Cement:
   1. PVC solvent

E. Acceptable Manufacturers:
   1. Carlon
   2. Cantex
   3. Wheatland

2.04 LIQUIDTIGHT FLEXIBLE METAL CONDUIT:

A. Conduit:
   1. Galvanized steel single strip, interlocked, smooth inside and out, with liquid-tight flexible polyvinyl chloride outer jacket.
   2. Acceptable Manufacturers:
      a. American Flexible Conduit
      b. Wheatland
      c. Allied

B. Fittings:
   1. Threaded corrosion-resistant steel or malleable iron with insulated throat bushing, liquid tight, locknuts and external ground lugs.
   2. Acceptable Manufacturers:
      a. Appleton
      b. O.Z. Gedney
      c. Thomas & Betts

2.05 FLEXIBLE METAL CONDUIT:

A. Conduit:
   1. Galvanized steel single strip, interlocked, smooth inside and out.
   2. Acceptable Manufacturers:
      a. AFC
      b. Alflex
      c. General Cable

B. Fittings:
   1. Threaded corrosion-resistant steel or malleable iron with insulated throat bushing and lock nuts.
   2. Acceptable Manufacturers:
      a. Appleton
      b. O.Z. Gedney
      c. Thomas & Betts

2.06 SEALS:

A. Fire Rated Seals:
   1. Flanged three hour fire and smoke stop.
   2. Acceptable Products:
      a. O.Z. Gedney "CFSF"

B. Thruwall Seals:
   1. Malleable iron, hot-dipped galvanized sleeve and sealing ring with pressure rings and sealing grommets
   2. Acceptable Products:
      a. O.Z. Gedney "FSK" and "WSK"
      b. Spring City "WEP" or "WDP"
      c. Thunderline Link Seal

PART 3 - EXECUTION

3.01 APPLICATIONS:

A. Provide Rigid Metal Conduit or Intermediate Metallic Conduit for service entrance, feeders, in areas where exposed to moisture, exposed on exterior surfaces, and exposed interior from floor to 10'-0" or where exposed to physical abuse.

B. Provide Electrical Metallic Tubing (EMT) for interior power circuits, branch circuits and system circuits in walls,in plenums (above ceilings), attics or exposed above 10'-0", where not exposed to moisture.

C. Provide Rigid Nonmetallic Conduit for service ground, in direct contact with earth, exposed in corrosive environments above 10'-0" above floor, or service entrance when encased in concrete.

D. Provide Liquid-tight Flexible Metal Conduit for final connecting link (minimum of 18", maximum of 72") to the following:
   1. Plumbing equipment
   2. Kitchen equipment
   3. Exterior Mechanical equipment

E. Provide Flexible Metal Conduit for:
   1. Final connection link (minimum of 18", maximum of 72") to:
      a. Motors
      b. Mechanical equipment
      c. Dry type transformers
   2. Connections between junction boxes and accessible recessed lighting fixtures.

3.02 CONDUIT SUPPORT

A. Intervals: Maximum 8 feet on center and within 3 feet of each outlet box, junction box, cabinet or fitting.

B. Conduits 3/4" and smaller:
   1. Method
      a. When single conduit: Attach directly to building structure or suspend with 1/4" rod.
      b. When multiple parallel and adjacent conduits and:
         1) When horizontal at structure: Attach directly to structure or to support framing attached to structure.
         2) When horizontally suspended: Attach to support framing, suspended from building structure.
         3) When vertical: Attach to support framing attached to building structure, wall structure or suspended from building structure.
   2. Conduit attachment:
      a. When direct to structure or single conduit suspended: steel conduit hangers, clamped with bolts or screws.
      b. When on support framing: Two section bolted conduit clamp.
   3. Structural steel attachment
      a. When single conduit: steel conduit clamp with bolt or bolted
      b. When hanger rod: Clamp with bolt or bolted
   4. Concrete attachment: Steel preformed conduit clamp. Attach clamp with expansion anchor installed in drilled hole or with power fastening anchor designed to meet concrete specification. In either case, maintain design support of 300% or greater of load.
   5. Wood attachment: Wood screws or bolted with design support of 300% or greater of load.

C. For 1" or larger:
   1. Method:
      a. When single conduit: Attach directly to building structure or suspend with threaded rod.
      b. When multiple parallel and adjacent conduits: Attach to support framing attached to building structure, wall structure or suspended from building structure.
   2. Conduit attachment:
      a. When single conduit: Bolted clamp
      b. When on support framing: Two section bolted conduit clamp
   3. Structural steel attachment: Beam clamps with bolts or bolted directly to steel.
   4. Concrete attachment: Provide preset insert prior to concrete pour or coordinate drill locations with Architect. When drilling provide expansion anchors. In either case, maintain design support of 300% or greater of load.
   5. Wood attachment: Wood screws or bolted with design support of 300% or greater of load.

D. Framing:
   1. Attachment, suspension and bearing members capable of supporting 300% of load.

3.03 INSTALLATION:

A. For conduit layout follow, generally, the diagrammatic layout shown on plans. Provide offsets and routing changes to avoid structural, architectural or equipment elements.

B. Provide 1/2" minimum size conduit.

C. Conceal all conduit except where shown to be exposed. Install conduit concealed above a lay-in ceiling with clearance to allow easy removal of ceiling panels.

D. Install exposed conduit parallel with or perpendicular to building walls at greatest height possible. Paint exposed conduit two coats of color directed by Architect.

E. Extend homeruns from outlets shown to panel designated. Do not combine homeruns.

F. Use benders designed for the size and type of conduit. Limit each bend to 90 degrees or less with a radius 10 times conduit diameter or greater for telephone system and 6 times conduit diameter or greater for all other systems.

G. Provide insulated bushings at each end of every conduit run.

H. Provide joint compound on rigid steel conduit and intermediate metallic conduit joints.

I. Provide an Erickson type coupling where two segments of a conduit run must be joined and neither can be rotated.

J. Close all conduit ends during construction with plastic conduit plugs.

K. Install conduit above water and steam piping where possible.

L. Maintain grounding of metallic raceways with clean and tight connections. Provide grounding conductor in plastic and flexible conduit.

M. Provide ground lugs on all conduit connectors to service equipment enclosures.

N. Provide grounding wedge lugs or locknuts designed to bite metal on conduit connectors to panel cabinet or pullboxes.

O. Seal all conduits which extend from the interior to the exterior of the building to prevent the circulation of air.

P. Provide a thruwall waterproof seal on each conduit that penetrates a wall at or below grade level.

Q. Provide an expansion fitting in each conduit crossing a building expansion joint and locate the fitting at the joint. Also provide expansion fittings in building conduits exceeding 100 feet at intervals of 100 feet.

R. Provide a fire rated seal on each conduit that penetrates any floor or fire rated partition. Match seal rating to floor or partition rating.

S. Provide an explosion-proof seal in each conduit run where it enters and leaves a hazardous location.

T. Where liquids are present, form drip loops in liquid-tight flexible metal conduit to prevent liquid from running into connections.

U. Blow out and swab all conduits clear of trash and water prior to pulling wire.

V. Provide a nylon pullcord in all empty conduits.

W. In mechanical equipment rooms where a piece of equipment is located more than 2 feet away from walls or columns, serve equipment from underfloor or provide a vertical conduit, minimum 1", attached to floor and ceiling with conductors entering and exiting conduit through conduit bodies.

X. Coordinate conduit supports in precast or cast-in-place concrete prior to pour.

3.04 UNDERGROUND INSTALLATION

A. Where exterior of building bury conduit a minimum of 36" below finished grade. Install Caution tape 6”-12” above all underground conduit before backfilling.

B. Encase conduit in 3" concrete envelope where it passes under driveways, roadways or entrances to parking lots.

C. When under interior slab on grade seal vapor barrier around conduit penetration.

END OF SECTION OF 260533

SECTION 260534

BOXES

PART 1 - GENERAL

1.01 SUMMARY

A. Description:
   1. Provide electrical boxes or, where prescribed, conduit bodies for devices, outlets, splice connection points, raceway junction and conductor pulling points complete with supports, covers and accessories.

B. Related Sections:
   1. Section 16050: Electrical General.

C. Standards:
   1. Underwriters Labratories labeled and listed for application specified.

1.02 SUBMITTALS

A. Manufacturers Product Data Sheets.

PART 2 - PRODUCTS

2.01 INTERIOR OUTLET BOXES AND EXTENSIONS:

A. Galvanized steel, UL listed for application with conduit knockouts and threaded holes for mounting devices and/or coverplates.

B. Minimum Sizes:
   1. Single Device: 3"H x 2"W x 2"D
   2. Gang Device: 3"H x 2"W (per gang) x 2"D
   3. Octagonal: 4"W x 1-1/2"D
   4. Square: 4" Square x 1-1/2"D

C. Acceptable Manufacturers:
   1. Appleton
   2. Raco
   3. Steel City
   4. American Electric

2.02 CONCRETE BOXES:

A. Galvanized steel for encasing in concrete with conduit knockouts and threaded holes for mounding devices and/or coverplates.

B. Acceptable Manufacturers:
   1. Appleton

2. Crouse Hinds
3. Raco
4. Steel City

2.03 MASONRY BOXES:

A. Galvanized steel for mounting in masonry walls with conduit knockouts and threaded holes for mounding devices and/or coverplates.

B. Acceptable Manufacturers:
1. Appleton
2. Raco
3. Steel City
4. Crouse Hinds

2.04 CAST BOXES:

A. Cast malleable iron, cadmium/zinc plated finish, NEMA 3R, threaded conduit entries, neoprene coverplates gasket and threaded holes for mounting devices and/or coverplates.

B. Acceptable Manufacturers:
1. Appleton
2. Crouse Hinds
3. Raco
4. Steel City

2.05 JUNCTION AND PULL BOXES:

A. Dry Locations: Galvanized sheet steel, NEMA 1, welded seams and cover held by stainless steel screws or bolts.

B. Damp or Wet Locations: Cast malleable iron with corrosion-resistant finish, NEMA 3R, threaded conduit entries, neoprene coverplate gasket, and coverplate held by stainless steel bolts.

C. Acceptable Manufacturers:
1. Appleton
2. Crouse Hinds
3. Hoffman
4. Killark

2.06 FLOOR BOXES:

A. As specified on the drawings for particular application.

2.07 PLASTIC BOXES

A. Schedule 40 Polyvinyl cloride

B. Acceptable Manufacturers:
   1. Carlon
   2. Queen City
   3. Raco

PART 3 - EXECUTION

3.01 DEVICE APPLICATIONS

A. Boxes for switches, receptacles, dimmers (designed for device box mounting) and future devices:
   1. For dry Locations:
      a. When recessed:
         1) For construction other than concrete or masonry, use interior outlet box.
         2) For concrete: Concrete box
         3) For masonry: Masonry box or square interior outlet box with masonry extension.
      b. When surface: Cast box
   2. For Damp or Wet Locations:
      a. When recessed:
         1) For concrete: Concrete box
         2) For masonry: Masonry box or square interior outlet box with masonry extension.
      b. When surface: Cast box
   3. For hazardous Areas: Hazardous area boxes

3.02 GENERAL APPLICATIONS

A. For lighting fixtures, equipment connections, pullboxes for conduit 1" and smaller, and junction boxes for conduits 1" and smaller.
   1. Recessed Interior Box:
      a. For construction other than concrete or masonry, use octagonal or square interior outlet box.
      b. For concrete: Concrete box
      c. For masonry: Concrete box or square interior box with masonry extension.
   2. Box Above an Accessible Ceiling: Octagonal or square interior outlet box.
   3. Exposed Interior Box:
      a. Above 7'-0": Octagonal or square interior outlet box or conduit body.
      b. 7'-0" and below: Cast box or conduit body..
   4. Exterior Box:
      a. When recessed in vertical element or ceiling:
         1) For concrete: Concrete box
         2) For masonry: Concrete box or square interior box with masonry extension.
         3) For construction other than concrete or masonry, provide square interior box.

b. Flush mounted in ground: Cast junction box
c. Exposed: Cast box or conduit body.

B. Integrally Mounted Boxes: Boxes which are an integral part of an equipment assembly from the manufacturer and are UL listed for the application may be used in lieu of the boxes prescribed above.

3.03 JUNCTION BOXES AND PULL BOXES (conduits larger than 1"):

A. Junction boxes or conduit bodies where junction is exposed

3.04 SUPPORT:

A. General: Support each box from the building structure independently of conduit as follows, utilizing a support system capable of carrying 300% of load.
1. Surface:
a. Structural Steel: Bolted directly to steel member.
b. Concrete: Power driven fastener or bolt to expansion anchor set in drilled hole.
c. Wood: Screw or bolt to wood.
2. Suspended: Bolted to engineered support clip which is bolted to suspended ceiling system.
3. Recessed:
a. Concrete: Set in concrete prior to pour.
b. Masonry: Set or cut into masonry during masonry errection. Grout in around box.
c. Drywall: Attach directly to stud or joist by screw or bolt; or directly to a galvanized steel support which is attached directly at each end to stud or joist by screw or bolt.
d. Earth: Compact earth around box

3.05 INSTALLATION:

A. Outlet locations indicated on the plans are approximate. Coordinate and determine the exact location at the building. The architect reserves the right to shift the exact location of any outlet 10 feet before it is permanently installed.

B. Install boxes plumb when vertical, level when horizontal and flush adjacent surface when recessed.

C. Where an outlet occurs in an architectural feature, center the outlet in same.

D. Where the mounting height of a wall outlet is not shown, mount at height directed by Architect. Mounting heights are from finished floor to bottom of device.

E. The contractor may, with Architect's approval, slightly vary an outlet's mounting height so that the box's top or bottom occurs at a masonry joint.

F. Where outlets at different levels are shown adjacent, install them on the same vertical line.

G. Space wall switch outlets with first gang box 4" from door trim on the installed strike side.

H. Locate boxes and conduit bodies so that covers are accessible and removable.

I. Limit masonry cuts from outlet boxes so that coverplate covers the cut.

J. Provide plaster rings for all boxes set in plaster walls or ceilings.

K. Match configuration to application.

L. Utilize box size (capacity) based upon NEC.

M. For devices, utilize boxes designed to support the device independently of coverplate and so install.

N. Cover unused conduit openings with plastic covers for sheet steel boxes and threaded plugs for cast boxes.

O. Prior to pulling conductors or installing devices, clean boxes of dirt, debris and water.

P. Cover all boxes and secure with screws or bolts.

Q. Install pullboxes to limit pulling distance and/or pulling bends.

R. Do not install boxes back to back in any wall. Provide at least one cell seperation of back to back boxes in CMU wall.

END OF SECTION 260534

SECTION 262416

PANELBOARDS

PART 1 - GENERAL

1.01 Summary:

A. Description:
1. Provide panelboards complete with enclosure, circuit breakers, spaces, trims, covers, locks and accessories in configurations as indicated on the drawings.

B. Standards:
1. Underwriters Laboratories #67
2. Underwriters Laboratories #489
3. Underwriters Laboratories #50
4. NFPA 70 (National Electrical Code)

1.02 Submittals:

A. Manufacturers Product Data Sheets

B. Shop Drawings
1. Dimensional Data
a. Enclosure Size
b. Gutter Space
c. Cover and Trim
2. Bussing Size
3. Lug Configuration and Ratings
4. Branch Breakers
5. Main Breakers

PART 2 - PRODUCTS

2.01 Manufacturer:

A. Acceptable Manufacturers
1. Products specified as standard of quality are manufactured by Square D Company referred to as Square D.
2. Products of manufacturers listed below meeting indicated standards and specified manufacturer's product data characteristics, except as modified below, are acceptable for use, subject to prior approval of proposed product list.
a. General Electric
b. Siemens/ITE
c. Cutler Hammer
d. Or approved equivalent.

2.02 General:

A. Panelboards shall be of dead front construction, equipped with thermal magnetic molded case circuit breakers of frame size and trip ratings as shown on the schedule.

2.03 Panelboards:

A. Circuit Breakers:
   1. Circuit breakers shall be Square D type QO (plug-on) or QOB (bolt-on) thermal-magnetic, molder case circuit breakers. Breakers shall be 1, 2, or 3-pole with an integral crossbar to assure simultaneous opening of all poles in multipole circuit breakers. Breakers shall have an overcenter, trip-free, toggle-type operating mechanism with quick-make, quick-break action and positive handle indication. Handles shall have "ON", "OFF" and "TRIPPED" positions. Plug-on (QO) and bolt-on (QOB) circuit breakers shall be able to be installed in the panelboard without requiring additional mountinghardware.
   2. Circuit breakers shall be UL listed in accordance with UL Standard 489 and shall be rated 240 volts ac maximum with continuous current ratings as noted on the plans. Interrupting ratings shall be as schedule with a maximum of 65,000 rms symmetrical amperes at 240 volts ac. Single pole, 15 and 20 ampere circuit breakers intended to switch fluorescent lighting loads on a regular basis shall carry the SWD marking.

B. Bussing Assembly and Temperature Rise
   1. Panelboard bus structure and main lugs or main circuit breaker shall have current ratings as shown on the panelboard schedule. Such ratings shall be established by heat rise tests, conducted in accordance with UL Standard 67. Bus structure shall be insulated. Bus bar connections to the branch circuit breakers shall be the "distributed phase" or phase sequence type and shall accept either plug-on (QO) or bolt-on (QOB) circuit breakers. All current carrying parts of the bus structure shall be plated.
   2. Panelboard bussing shall be copper.

2.04 Cabinets and Fronts:

A. The panelboard bus assembly shall be enclosed in a steel cabinet. The rigidity and gauge of steel to be as specified in UL Standard 67 for panelboards. The box shall be fabricated from galvanized steel or equivalent rust resistant steel. Each front shall include a door and have a flush, cylinder tumbler-type lock with catch and spring-loaded stainless steel door pull. All panelboard locks shall be keyed alike. Fronts shall have adjustable indicating trim clamps which shall be completely concealed when the doors are closed. Doors shall be mounted with completely concealed steel hinges. Fronts shall not be removable with door in the locked position. 600A panelboard fronts shall have exposed trim clamps. Column width fronts shall have exposed hinges and be screw cover type. A circuit directory frame and card with a clear plastic covering shall be provided on the inside of the door.

2.05 Integrated Equipment Short Circuit Rating

A. Each panelboard, as a complete unit, shall have a short current rating equal to or greater than the integrated equipment rating shown on the panelboard schedule or on the plans. This rating shall be established by testing with the overcurrent devices mounted in the panelboard. The short circuit tests on the overcurrent devices and on the panelboard structure shall be made simultaneously by connecting the fault to each overcurrent device the panelboard connected to its rated voltage source. Method of testing shall be per Underwriters Laboratories Standard UL 67. The source shall be capable of supplying the specified panelboard short circuit or greater. Testing of panelboard overcurrent devices for short circuit rating only while individually mounted is not acceptable. Also, testing of the bus structure by applying a fixed fault to the bus structure alone is not acceptable. Panelboards shall be marked with their maximum short circuit current rating at the supply voltage and shall be UL listed.

2.06 UL Listing

A. Panelboards shall be listed by Underwriters Laboratories and shall bear the UL label. When used as service entrance device, panelboards shall be listed for use as service equipment.

PART 3 - EXECUTION

3.01 Installation:

A. Mount panelboard flush or surface as prescribed with top 6'-6" A.F.F.

B. Key all locks alike and give owner two keys per panelboard.

C. For flush mounted panelboards, provide a minimum of three spare 3/4" conduits stubbed out into ceiling space.

D. Anchor enclosures firmly to walls and/or structural surfaces.

E. Where panelboards exceed 42 poles, provide multiple sections with equal size enclosures with 4" diameter openings with bushings between abutting enclosures.

3.02 Warranty Service:

A. Thermoscan all connections in each panelboard during the last month of the warranty period. Provide a report of findings to the county maintenance office. Retorque all feeder connections and any loose branch circuit connections.

END OF SECTION 262416

SECTION 262419

MOTOR AND EQUIPMENT CONNECTIONS

PART 1 - GENERAL

1.01 SUMMARY:

A. Description:

1. Provide power wiring to each motor, all mechanical equipment, all kitchen equipment, and all miscellaneous equipment included in the contract documents. Power wiring is the system of conductors from the energy source to the equipment that conducts the electrical energy which does work or provides heat.

2. Provide a disconnect switch, fused where prescribed, for each motor or piece of equipment.

PART 2 - PRODUCTS

2.01 STARTERS:

A. Provided under other divisions except where specifically prescribed in Division 16 documents.

2.02 MOTORS AND EQUIPMENT:

A. Motors, mechanical equipment, kitchen equipment, etc., provided under other divisions.

2.03 CONTROL AND INTERLOCK WIRING:

A. Control wiring, (i.e., HVAC controls, remote pushbutton stations, thermostats, etc.), is excluded except where specifically prescribed in Division 16 documents. Raceways and junction boxes for control wiring IS INCLUDED UNDER THIS DIVISION.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Coordinate all rough-in and final power wiring and equipment connection with other subcontractors.

B. Install and connect individually mounted starters provided by other subcontractors.

C. Label each disconnect switch and starter with name of equipment it serves.

D. Coordinate overcurrent device rating with nameplate of motor or equipment which it protects.

END OF SECTION 262419

SECTION 262726

WIRING DEVICES

PART 1 - GENERAL

1.01 SUMMARY

A. Description:
1. Provide switches, receptacles, dimmers and other strap mounted wiring devices as shown on the drawings.

B. Standards:
1. Underwriters Laboratories listed and labeled.
2. NEMA (configurations as listed)

1.02 SUBMITTALS

A. Manufacturers Product Data Sheets.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Acceptable Manufacturers of Switches, Receptacles, and Coverplates:
1. Products specified as standard of quality are manufactured by Hubbell Incorporated, Wiring Device Division; referred to as Hubbell.
2. Products of manufacturers listed below meeting indicated standards and specified manufacturer's product data characteristics, except as modified below, are acceptable for use, subject to prior approval of proposed product list.
a. Arrow-Hart
b. Bryant
c. Leviton
d. Pass and Seymor/Legrand
3. Manufacturers product numbers listed below do not include color selection. Refer to Section 16140, 2.06 for device colors

B. Acceptable Manufacturers of Wallbox Dimmer Switches:
1. Lutron, Nova Series.
2. Lightolier, Neptune Momentium Series.

2.01 RECEPTACLES:

A. Duplex - 20A: 2-pole, 3-wire, 125 Volts, side/back wiring with ground screw, NEMA 5-20R.
1. Hubbell # 5362.

B. Single - 20A: 2-pole, 3-wire, 125 Volts, side/back wiring with ground screw, NEMA 5-20R.
1. Hubbell # 5361.

C. Duplex Isolated Ground - 20A: 2-pole, 3-wire, 125 Volts, side/back wiring with insulated/ isolated ground screw, NEMA 5-20R.
1. Hubbell # IG5362.

D. Duplex Ground Fault Circuit Interrupter - 20A: 2-pole, 3-wire, 125 Volts, pigtail wiring, thru wiring to protect 4 receptacles downstream, test and reset buttons, NEMA 5-20R.
1. Hubbell # GF5362.

E. Single Isolated Ground Twist Lock - 20A: 2-pole, 3-wire, 125 Volts, side/back wiring with insulated/isolated ground screw, NEMA L5-20R.
1. Hubbell # IG2301A.

2.03 SWITCHES

A. Single Pole Single Throw Toggle: 20 Ampere, 277 Volt AC, maintained contacts, quiet operating toggle, side/back wiring and ground screw.
1. Hubbell # 1221.

B. Double Pole Single Throw Toggle: 20 Ampere, 277 Volt AC, maintained contacts, quiet operating toggle, side/back wiring and ground screw.
1. Hubbell # 1222.

C. Three Way Single Throw Toggle: 20 Ampere, 277 Volt AC, maintained contacts, quiet operating toggle, side/back wiring and ground screw.
1. Hubbell # 1223.

D. Four Way Single Throw Toggle: 20 Ampere, 277 Volt AC, maintained contacts, quiet operating toggle, side/back wiring and ground screw.
1. Hubbell # 1224.

E. Key Operated Single Pole Single Throw: 20 Ampere, 277 Volt AC , maintained contacts, side/back wiring and ground screw.
1. Hubbell # 1221LCN w/# 1209 Key.

F. Key Operated Double Pole Single Throw: 20 Ampere, 277 Volt AC , maintained contacts, side/back wiring and ground screw.
1. Hubbell # 1222LCN w/# 1209 Key.

G. Key Operated Three Way Pole Single Throw: 20 Ampere, 277 Volt AC , maintained contacts, side/back wiring and ground screw.
1. Hubbell # 1223LCN w/#1209 Key.

H. Key Operated Four Way Pole Single Throw: 20 Ampere, 277 Volt AC , maintained contacts, side/back wiring and ground screw.
1. Hubbell # 1224LCN.

I. 120/277 Volt Pilot Light Switch: 20 Ampere, 120 Volt, maintained contacts, single pole single throw, side/back wiring, red handle illuminated when circuit is energized.
1. Hubbell # 1221PL

2.04 COVERPLATES:

A. Stainless Steel Coverplates:
   1. Smooth stainless steel, brushed finish, JUMBO (3-1/2" x 5-1/4" , single gang), in configurations up to six (6) gang as indicated on the drawings, screws to match finish, and openings to match device.

B. Surface Mounted:
   1. Corrosion-resistant steel, rounded corners and edges, stainless steel screws, single or multiple gang as indicated on the drawings. Openings to match device(s) and construction to match box.

C. Weatherproof:
   1. Gasketed, hinged with spring loaded closers, secured with corrosion-resistant screws and UL listed for wet location.

2.06 DEVICE AND COVERPLATE COLOR/FINISH

A. All devices other than isolated ground type shall be IVORY.

B. Isolated ground devices shall be orange with stainless steel coverplates.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Install the type device indicated by symbol or legend at the location shown on the plans.

B. Install devices after conductors are pulled and painting is completed.

C. Install devices vertically, unless otherwise noted, with SPST switches having up as "ON" and receptacles having ground pin at bottom.

D. Where more than one device is indicated at a location, the devices shall be mounted in combined sectional gang boxes and covered with a single plate.

E. Coordinate location of devices with other trades and architectural features. Do not locate devices on two different finishes such as half on wall tile and half on painted surface.

END OF SECTION 262726

SECTION 262816

DISCONNECT SWITCHES

PART 1 - GENERAL

1.01 SUMMARY

A. Description

1. Provide disconnect switches in configurations as indicated on the drawings complete with enclosures and accessories.

1.02 SUBMITTALS

A. Manufacturers Product Data Sheets.

PART 2 - PRODUCTS

1.01 MANUFACTURERS

A. Acceptable Manufacturers as Follows:
   1. General Electric
   2. Siemens/ITE
   3. Square D
   4. Cutler Hammer

1.02 DISCONNECT SWITCHES:

A. Disconnect switches shall be heavy duty (NEMA Type HD) and Underwriters Laboratories Listed.

B. All switches shall have blades which are fully visible in the "OFF" position when the switch door is open. All current carrying parts shall be plated to resist corrosion and promote cool operation. Switches shall have removable arc suppressors where necessary to permit easy access to line side lugs. Lugs shall be front removable and UL listed for 60 degrees C or 75 degrees C, aluminum or copper wires.

C. Switches shall be quick-make, quick-break such that, during normal operation of the switch, the operation of the contacts shall not be capable of being restrained by the operating handle after the closing or opening action of the contacts has started. The operating handle shall be an integral part of the box, not the cover. Provisions for padlocking the switch in the "OFF" position with at least three locks shall be provided. Switches shall have a dual cover interlock to prevent unauthorized opening of the switch door when the handle is in the "ON" position, and to prevent closing of the switch mechanism with the door open. The handle position shall indicate whether the switch is "ON" or "OFF".

D. Switches shall be furnished in NEMA 1 general purpose enclosures unless specified as

NEMA 3R on the plans. Covers on NEMA 1 enclosures shall be attached with pin type hinges, NEMA 3R covers shall be securable in the open position. NEMA 3R enclosures for switches thru 200 amperes shall have provisions for interchangeable bolt-on hubs. Hubs shall be as indicated on the plans. NEMA 3R enclosures shall be manufactured from galvanized steel. Enclosures shall have a gray baked enamel finish, electrodeposited on cleaned, phosphatized steel.

E. Switches shall be horsepower rated for ac and/or dc as indicated by the plans. All fusible switches rated 100 thru 600 amperes at 240 volts and 30 thru 600 amperes at 600 volts shall have a UL approved method of field conversion from standard Class H fuse spacing to Class J fuse spacing. The switch also must accept Class R fuses and have provisions for field installation of a UL listed rejection feature to reject all fuses except Class R. The UL listed short circuit rating of the switches shall be 200,000 rms symmetrical amperes when Class R or Class J fuses are used with the appropriate rejection scheme. The UL listed short circuit rating of the switch, when equipped with Class H fuses, shall be 100,000 rms symmetrical amperes. 800 and 1200 ampere switches shall have provisions for Class L fuses and shall have a UL listed short circuit rating of 200,000 rms symmetrical amperes.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install disconnect switch adjacent to equipment it serves or as located on the plans.

B. Anchor enclosures firmly to walls and/or structural surfaces. Coordinate mounting of disconnects to roof top mechanical equipment with supplier/installer.

C. Provide engraved nameplate.

END OF SECTION 262816

SECTION 264313

SERVICE ENTRANCE

PART 1 - GENERAL

1.01 Summary

A. Description

1. Provide electrical service entrance as shown on the drawings and specifications.
2. Provide transient voltage surge suppression for the service entrance.
3. Electrical service shall be as shown on the riser diagram.

PART 2 - PRODUCTS

2.01 Transient Voltage Surge Suppressor

A. Provide Transient Voltage Surge Suppression (TVSS) on Service Entrance conductors.

1. Single stage parallel hybrid design transient voltage source suppressor.
   a. Line to ground protection
   b. U.L. Listed and tested to U.L. 1499, ANSI/IEEE C62.41 and C62.45
   c. Maximum surge current per phase (8 x 20us) 50,000 amps/phase
   d. Withstand 1,000 sequential category C, B1-wave impulses
   e. Status alarm monitor

PART 3 - EXECUTION

3.01 Installation

A. Provide service entrance conductors and conduit duct bank as indicated on the drawings.

B. Where service entrance crosses a driveway, concrete encase duct bank per NFPA 70, Article 310.

3.02 Utility Company Coordination

A. Obtain electrical service from Power Company and verify available fault current at transformer(s). Contact engineer if specified equipment fault duty ratings are insufficient.

B. Provide metering as indicated on the drawings. Obtain and comply with utility company metering requirements.

C. Obtain requirements for installation of utility company's transformers and primary cabling. Provide conduits, concrete pads, elbows, Etc. as required by utility company. Coordinate connection requirements of service entrance conductors to utility company transformer.

END OF SECTION 264313

SECTION 265100

LIGHTING

PART 1 - GENERAL

1.01 SUMMARY

A. Description:
1. Provide lighting fixtures as prescribed in the lighting fixture schedule complete with housing, junction boxes, ballasts, lamp sockets, lamps, lenses, baffles and trims installed with support from building structure. Verbal description of fixture in schedule will take precedence over manufacturer number.

B. Standards:
1. Underwriters Laboratories labeled and listed.
2. CBM Approved
3. ANSI C82.2

1.02 SUBMITTALS:

A. Manufacturers Product Data Sheets.

B. Shop Drawings for Custom Fixtures.

C. ITL certified photometric reports.

PART 2 - PRODUCTS

2.01 LIGHT FIXTURES: As prescribed in lighting fixture schedule.

2.02 FLUORESCENT BALLAST:

A. Electronic: Solid state electronic, Class P, Class A sound rating, CBM certified ,90 degree Celsius, capable of operating one to four lamps.

2.03 HIGH INTENSITY DISCHARGE BALLAST:

A. High Pressure Sodium: Core and coil or constant power autotransformer, high power factor (92% minimum) starting current less than operating, 5% lamp power variation on 10% line potential variation, 180 degree Celsius Class H insulation, -20 degree Fahrenheit starting temperature.

B. Metal Halide Lamp: Core and coil or constant autotransformer lead-peaked, high power factor (90% minimum), starting current less than operating, 10% lamp power variation on 10% line potential variation, 180 degree Celsius Class H insulation, -20 degree Fahrenheit starting temperature.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Support:
1. Support each fixture from the building structure.
2. Support in a manner that ensures the fixture weight being equally distributed from each support and the fixture remaining in a level position.
3. Provide support systems capable of carrying 300% of load imposed.

B. For HID pendant or suspended fixtures mounted to suspended ceilings, provide 1/4" steel rods or # 12 steel jack chain above the suspended ceiling from building structure to fixture. Provide a minimum of two supports for each chassis and spaced a maximum of 4 feet on center.

C. For recessed H.I.D. and fluorescent fixtures recessed in a suspended ceiling, provide 2 #10 awg. wire supports from building structure to fixture. Provide a minimum of two supports for each chassis spaced a maximum of 4 feet on center and located on diagional corners of the fixture. Provide tie down clips to secure fixture to the ceiling grid.

D. For recessed single incandescent, provide #10 AWG steel hanging wire from building structure to fixture; minimum of 2 separate supports per fixture.

E. For each recessed fixture, provide a trim to match the type ceiling (plaster, grid, exposed panel, etc.) in which it is being installed.

F. Aim and adjust all fixtures with lamp position, tilt, shutters, rotation or other types of adjustment during installation. The Architect or his representative will determine the final aiming and adjustment of such fixtures during the substantial completion job visit. Fixtures serving areas where daylighting dominates will be adjusted after sunset.

G. Provide electrician with equipment and tools to execute aiming and adjustment instruction.

END OF SECTION 265100

SECTION 31 1000

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 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.

1.3 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. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.

C. Do not commence site clearing operations until temporary erosion- and sedimentation-control and plant-protection measures are in place.

D. Tree- and Plant-Protection Zones: Protect according to requirements in Section 01 5639 "Temporary Tree and Plant Protection."

PART 2 - PRODUCTS

2.1 MATERIALS

A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 31 2000 "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 according to requirements in Section 01 5639 "Temporary Tree and Plant Protection."

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 according to requirements in Section 01 5639 "Temporary Tree and Plant Protection."

B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations according to requirements in Section 01 5639 "Temporary Tree and Plant Protection."

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 Architect not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Architect's 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 02 4116 "Structure Demolition" and Section 02 4119 "Selective Demolition."

3.5 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.

1. Grind down stumps and remove roots larger than 3 inches in diameter, obstructions, and debris to a depth of 18 inches below exposed subgrade.
2. 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.

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 31 1000

SECTION 31 2000

EARTH MOVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Excavating and filling for rough grading the Site.
2. Preparing subgrades for slabs-on-grade, walks, pavements, turf and grasses, and plants.
3. Excavating and backfilling for buildings and structures.
4. Drainage course for concrete slabs-on-grade.
5. Subbase course for concrete walks pavements.
6. Subbase course and base course for asphalt paving.
7. Excavating and backfilling trenches for utilities and pits for buried utility structures.

1.2 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. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.

C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

F. 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. 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. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

G. Fill: Soil materials used to raise existing grades.

H. 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.

I. 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.

J. 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.

K. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

1.3 INFORMATIONAL SUBMITTALS

A. Material test reports.

1.4 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 specified in Section 01 5639 "Temporary Tree and Plant Protection" 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 4 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.

1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

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 294**/**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. Engineered Fill: 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.

G. 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 sieve and not more than 8 percent passing a No. 200 sieve.

H. Drainage Course: Narrowly graded mixture of washed, crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and zero to 5 percent passing a No. 8 sieve.

2.2 ACCESSORIES

A. Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility; colored to comply with local practice or requirements of authorities having jurisdiction.

B. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored to comply with local practice or requirements of authorities having jurisdiction.

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.
2. Cut and protect roots according to requirements in Section 01 5639 "Temporary Tree and Plant Protection."

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. Cut and protect roots according to requirements in Section 01 5639 "Temporary Tree and Plant Protection."

3.6 SUBGRADE INSPECTION

A. Proof-roll subgrade below the building slabs and pavements with a pneumatic-tired dump truck to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. All areas to remain at grade or to receive fill should be proof-rolled with a loaded tandem-axle dump truck in the presence of the Geotechnical Engineer.

2. Cut areas should be proof-rolled once rough subgrade has been reached.

B. Any soft soils encountered during proof-rolling should be stabilized by compaction or undercut and replaced with suitable compacted materials.

C. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, 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.

1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Architect.

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.

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. Concrete is specified in Section 03 3000 "Cast-in-Place Concrete."

D. Trenches under Roadways: Provide 4-inch- thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase course. Concrete is specified in Section 03 3000 "Cast-in-Place Concrete."

E. Initial Backfill: Place and compact initial backfill of satisfactory soil, 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.

G. Warning Tape: Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

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 3 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 3 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 6 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 and pavements, compact to minimum 95% of maximum dry density. The top 24 inches under pavements and structures shall be compacted to 98% of its standard proctor value.
2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 95 percent.
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 95 percent.
4. For utility trenches, compact each layer of initial and final backfill soil material at 95 percent.

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 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 100 percent of maximum dry unit weight according to ASTM D 698.

3.15 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

A. Place drainage course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:

1. Place drainage 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.
2. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.16 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. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.

E. 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.

3.17 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.

3.18 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 31 2000

SECTION 32 1216

ASPHALT PAVING

1.1 SUMMARY

A. Section Includes:
1. Cold milling of existing asphalt pavement.
2. Hot-mix asphalt patching.
3. Hot-mix asphalt paving.
4. Hot-mix asphalt overlay.

B. Related Requirements:
1. Section 31 2000 "Earth Moving" for subgrade preparation, fill material, unbound-aggregate subbase and base courses, and aggregate pavement shoulders.
2. Section 32 1373 "Concrete Paving Joint Sealants" for joint sealants and fillers at pavement terminations.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each paving material from manufacturer.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by authorities having jurisdiction or the Georgia DOT.

B. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of Georgia DOT for asphalt paving work.
1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

PART 2 - PRODUCTS

2.1 AGGREGATES

A. Coarse Aggregate: ASTM D 692/D 692M, sound; angular crushed stone, crushed gravel, or cured, crushed blast-furnace slag.

B. Fine Aggregate: ASTM D 1073, sharp-edged natural sand or sand prepared from stone, gravel, cured blast-furnace slag, or combinations thereof.

C. Mineral Filler: ASTM D 242/D 242M, rock or slag dust, hydraulic cement, or other inert material.

2.2 ASPHALT MATERIALS

A. Asphalt Binder: Comply with Georgia DOT Standard specification in sections 20.2 and 828.

B. Tack Coat: Comply with Georgia DOT section 413.

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 approved by authorities having jurisdiction and complying with the following requirements:
   1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.

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 0.05 to 0.15 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. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.

D. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 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 not less than 10 feet wide unless infill edge strips of a lesser width are required.

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 JOINTS

A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.
   1. Clean contact surfaces and apply tack coat to joints.
   2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
   3. Offset transverse joints, in successive courses, a minimum of 24 inches.
   4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints using either "bulkhead" or "papered" method according to AI MS-22, for both "Ending a Lane" and "Resumption of Paving Operations."

3.5 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.

3.6 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. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

3.7 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.

3.8 WASTE HANDLING

A. General: Handle asphalt-paving waste according to approved waste management plan required in Section 01 7419 "Construction Waste Management and Disposal."

END OF SECTION 32 1216

SECTION 32 1313

CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Driveways.
2. Roadways.
3. Curbs and gutters.
4. Walks.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. 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.

1.3 QUALITY ASSURANCE

A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").

1.4 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 CONCRETE MATERIALS

A. Cementitious Materials: Use the following cementitious materials, of same type, brand, and source throughout Project:

1. Portland Cement: ASTM C 150/C 150M, white portland cement Type I, Type II, Type I/II, Type III, Type V.
2. Fly Ash: ASTM C 618, Class C or Class F.
3. Slag Cement: ASTM C 989/C 989M, Grade 100 or 120.

B. Normal-Weight Aggregates: ASTM C 33/C 33M, Class 4S Class 4M Class 1N, uniformly graded. Provide aggregates from a single source.

C. Air-Entraining Admixture: ASTM C 260/C 260M.

D. 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.

E. Water: Potable and complying with ASTM C 94/C 94M.

2.3 STEEL REINFORCEMENT

A. Plain-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, fabricated from as-drawn steel wire into flat sheets.

B. Deformed-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, flat sheet.

C. Reinforcing Bars: ASTM A 615/A 615M, Grade 60; deformed.

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.

2.4 FIBER REINFORCEMENT

A. Synthetic Fiber: Monofilament/fibrillated polypropylene fibers engineered and designed for use in decorative concrete paving, complying with ASTM C 1116/C 1116M, Type III, 1/2 to 1-1/2 inches long.

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

a. Euclid Chemical Company (The); an RPM company.
b. FORTA Corporation.
c. GCP Applied Technologies Inc. (formerly Grace Construction Products).
d. Nycon, Inc.

e. Engineer's approved equivalent.

2.5 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry.

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

C. Water: Potable.

D. Evaporation Retarder: Waterborne, monomolecular, film forming, manufactured for application to fresh concrete.

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

a. BASF Corporation; Construction Systems.
b. Bon Tool Co.
c. Brickform; a division of Solomon Colors.
d. ChemMasters, Inc.
e. Dayton Superior.
f. Euclid Chemical Company (The); an RPM company.
g. Kaufman Products, Inc.
h. L&M Construction Chemicals, Inc.
i. Lambert Corporation.
j. Metalcrete Industries.
k. Nox-Crete Products Group.
l. Sika Corporation.
m. SpecChem, LLC.
n. TK Products.
o. Vexcon Chemicals Inc.
p. W. R. Meadows, Inc.
q. Engineer's approved equivalent.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.

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

a. Anti-Hydro International, Inc.
b. ChemMasters, Inc.
c. Dayton Superior.
d. Euclid Chemical Company (The); an RPM company.
e. Kaufman Products, Inc.
f. L&M Construction Chemicals, Inc.
g. Lambert Corporation.
h. Nox-Crete Products Group.

i. Right Pointe.
j. SpecChem, LLC.
k. TK Products.
l. Unitex by Dayton Superior.
m. Vexcon Chemicals Inc.
n. W. R. Meadows, Inc.
o. Engineer's approved equivalent.

F. White, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 2, Class B, dissipating.

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

a. Anti-Hydro International, Inc.
b. ChemMasters, Inc.
c. Dayton Superior.
d. Euclid Chemical Company (The); an RPM company.
e. Kaufman Products, Inc.
f. L&M Construction Chemicals, Inc.
g. Lambert Corporation.
h. SpecChem, LLC.
i. Vexcon Chemicals Inc.
j. W. R. Meadows, Inc.
k. Engineer's approved equivalent.

2.6 RELATED MATERIALS

A. Joint Fillers: ASTM D 1751, asphalt-saturated cellulosic fiber in 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.

2.7 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. Proportion mixtures to provide normal-weight concrete with the following properties or as shown on the drawings:
1. Maintain Compressive Strength (28 Days) as follows:
a. Manholes: 4000 psi
b. Septic tank: 4000 psi
c. Drainage Structures: Per GDOT Standard
d. Standard Sidewalk: 3000 psi
e. Concrete wheel stop: 3000 psi

2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.45.
3. Slump Limit: 4 inches plus or minus 1 inch

C. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash or Pozzolan: 25 percent.
2. Slag Cement: 50 percent.
3. Combined Fly Ash or Pozzolan, and Slag Cement: 50 percent, with fly ash or pozzolan not exceeding 25 percent.

D. Add air-entraining admixture at 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.

E. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.

F. Synthetic Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than 1.0 lb/cu. yd..

G. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

2.8 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. 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 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, to match jointing of existing adjacent concrete paving:

E. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate edging-tool marks on concrete surfaces.

3.5 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.

3.6 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.
2. Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface, perpendicular to line of traffic, to provide a uniform, fine-line texture.
3. 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.

3.7 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 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.

3.8 PAVING TOLERANCES

A. Comply with tolerances in ACI 117 and as follows:

1. Elevation: 3/4 inch.
2. Thickness: Plus 3/8 inch, minus 1/4 inch.
3. Surface: Gap below 10-feet-long; unleveled straightedge not to exceed 1/2 inch.
4. Joint Spacing: 3 inches.
5. Contraction Joint Depth: Plus 1/4 inch, no minus.
6. Joint Width: Plus 1/8 inch, no minus.

3.9 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 32 1313

SECTION 33 4100

STORM UTILITY DRAINAGE PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Pipe and fittings.
   2. Encasement for piping.
   3. Manholes.
   4. Cleanouts.
   5. Nonpressure transition couplings.
   6. Expansion joints.
   7. Stormwater inlets.
   8. Pipe outlets.

1.2 ACTION SUBMITTALS

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

B. Shop Drawings:
   1. Manholes: Include plans, elevations, sections, details, frames, and covers.
   2. Catch basins and stormwater inlets. Include plans, elevations, sections, details, frames, covers, and grates.
   3. Stormwater Detention Structures: Include plans, elevations, sections, details, frames, covers, design calculations, and concrete design-mix reports.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from storm drainage system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.

B. Profile Drawings: Show system piping in elevation. Draw profiles at horizontal scale of not less than 1 inch equals 50 feet and vertical scale of not less than 1 inch equals 5 feet. Indicate manholes and piping. Show types, sizes, materials, and elevations of other utilities crossing system piping.

C. Product Certificates: For each type of cast-iron soil pipe and fitting, from manufacturer.

D. Field quality-control reports.

PART 2 - PRODUCTS

2.1 PE PIPE AND FITTINGS

A. Corrugated PE Drainage Pipe and Fittings NPS 3 to NPS 10: AASHTO M 252M, Type S, with smooth waterway for coupling joints.
   1. Silttight Couplings: PE sleeve with ASTM D 1056, Type 2, Class A, Grade 2 gasket material that mates with tube and fittings.
   2. Soiltight Couplings: AASHTO M 252M, corrugated, matching tube and fittings.

B. Corrugated PE Pipe and Fittings NPS 12 to NPS 60: AASHTO M 294M, Type S, with smooth waterway for coupling joints.
   1. Silttight Couplings: PE sleeve with ASTM D 1056, Type 2, Class A, Grade 2 gasket material that mates with pipe and fittings.
   2. Soiltight Couplings: AASHTO M 294M, corrugated, matching pipe and fittings.

2.2 PVC PIPE AND FITTINGS

A. PVC Corrugated Sewer Piping:
   1. Pipe: ASTM F 949, PVC, corrugated pipe with bell-and-spigot ends for gasketed joints.
   2. Fittings: ASTM F 949, PVC molded or fabricated, socket type.
   3. Gaskets: ASTM F 477, elastomeric seals.

2.3 NONPRESSURE 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 corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Sleeve Materials:
   1. For Concrete Pipes: ASTM C 443, rubber.
   2. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
   3. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
   4. 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. Shielded, Flexible Couplings:
   1. Description: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

E. 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.

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.
   2. Top-Loading Classification(s): Heavy Duty.
   3. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

B. Plastic Cleanouts:
   1. Description: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

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, and separate base slab or base section with integral floor.
   5. Riser Sections: 4-inch minimum thickness, and lengths to provide depth indicated.
   6. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated, and top of cone of size that matches grade rings.
   7. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
   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 36 inches..

10. Adjusting Rings: Interlocking HDPE rings with level or sloped edge in thickness and diameter matching manhole frame and cover, and of height required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.
11. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover, and height as required to adjust manhole frame and cover to indicated elevation and slope.

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 "STORM SEWER."
2. Material: ASTM A 536, Grade 60-40-18 ductile iron unless otherwise indicated.

2.6 CONCRETE

A. General: Cast-in-place concrete according to ACI 318, ACI 350/350R, and the following:

1. Cement: ASTM C 150, Type II.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.

B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio.

1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) 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: As shown on drawings percent through manhole.

D. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 maximum water/cementitious materials ratio.

1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.

2.7 STORMWATER INLETS

A. Curb Inlets: Made with vertical curb opening, of materials and dimensions according to utility standards.

B. Gutter Inlets: Made with horizontal gutter opening, of materials and dimensions according to utility standards. Include heavy-duty frames and grates.

C. Combination Inlets: Made with vertical curb and horizontal gutter openings, of materials and dimensions according to utility standards. Include heavy-duty frames and grates.

D. Frames and Grates: Heavy duty, according to utility standards.

2.8 PIPE OUTLETS

A. Head Walls: Cast-in-place reinforced concrete, with apron and tapered sides.

B. Riprap Basins: Broken, irregularly sized and shaped, graded stone according to NSSGA's "Quarried Stone for Erosion and Sediment Control."
   1. Average Size: NSSGA No. R-3, screen opening 2 inches.
   2. Average Size: NSSGA No. R-4, screen opening 3 inches.
   3. Average Size: NSSGA No. R-5, screen opening 5 inches.

C. Filter Stone: According to NSSGA's "Quarried Stone for Erosion and Sediment Control," No. FS-2, No. 4 screen opening, average-size graded stone.

D. Energy Dissipaters: According to NSSGA's "Quarried Stone for Erosion and Sediment Control," No. A-1, 3-ton average weight armor stone, unless otherwise indicated.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Section 31 2000 "Earth Moving."

3.2 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, 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 use of lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.

F. Install corrosion-protection piping encasement over the following underground metal piping according to ASTM A 674 or AWWA C105:
   1. Hub-and-spigot, cast-iron soil pipe and fittings.
   2. Hubless cast-iron soil pipe and fittings.
   3. Ductile-iron pipe and fittings.
   4. Expansion joints.

3.3 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, nonpressure drainage piping according to the following:
   1. Join hub-and-spigot, cast-iron soil piping with gasketed joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
   2. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.
   3. Join hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.
   4. Join ductile-iron culvert piping according to AWWA C600 for push-on joints.
   5. Join ductile-iron piping and special fittings according to AWWA C600 or AWWA M41.
   6. Join corrugated PE piping according to ASTM D 3212 for push-on joints.
   7. Join PVC corrugated sewer piping according to ASTM D 2321 for elastomeric-seal joints.
   8. Join nonreinforced-concrete sewer piping according to ASTM C 14 and ACPA's "Concrete Pipe Installation Manual" for rubber-gasketed joints.
   9. Join reinforced-concrete sewer piping according to ACPA's "Concrete Pipe Installation Manual" for rubber-gasketed joints.
   10. Join dissimilar pipe materials with nonpressure-type flexible couplings.

3.4 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.
   1. Use Light-Duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.
   2. Use Medium-Duty, top-loading classification cleanouts in paved foot-traffic areas.
   3. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic service areas.
   4. Use Extra-Heavy-Duty, top-loading classification cleanouts in roads.

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 earth grade.

C. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.5 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. Where specific manhole construction is not indicated, follow manhole manufacturer's written instructions.

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.

3.6 STORMWATER INLET AND OUTLET INSTALLATION

A. Construct inlet head walls, aprons, and sides of reinforced concrete, as indicated.

B. Construct riprap of broken stone, as indicated.

C. Install outlets that spill onto grade, anchored with concrete, where indicated.

D. Install outlets that spill onto grade, with flared end sections that match pipe, where indicated.

E. Construct energy dissipaters at outlets, as indicated.

3.7 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318.

3.8 CONNECTIONS

A. Connect nonpressure, gravity-flow drainage piping in building's storm building drains specified in Section 22 1413 "Facility Storm Drainage 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 and structures by cutting into existing unit and creating an opening 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, manhole, or structure wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.
    a. Use concrete that will attain a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.
    b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.
4. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

C. Connect to sediment interceptors specified in Section 22 1323 "Sanitary Waste Interceptors."

D. Pipe couplings and expansion joints with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

1. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping unless otherwise indicated.
    a. Shielded flexible couplings for same or minor difference OD pipes.
    b. Unshielded, increaser/reducer-pattern, flexible 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.

3.9 IDENTIFICATION

A. Materials and their installation are specified in Section 31 2000 "Earth Moving." Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.
   1. Use detectable warning tape over ferrous piping.
   2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

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 reports for each system inspection.
   2. Defects requiring correction include the following:
      a. Alignment: Less than full diameter of inside of pipe is visible between structures.
      b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder 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. Submit separate report for each test.
   5. Gravity-Flow Storm Drainage Piping: Test according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
      a. Exception: Piping with soiltight joints unless required by authorities having jurisdiction.
      b. Option: Test plastic piping according to ASTM F 1417.
      c. Option: Test concrete piping according to ASTM C 924.

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 33 4100