

CHAIN LINK FENCING - SECTION 02441

1.0 GENERAL

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

1.2 SUMMARY:

- A. Provide chain link fencing and chain link gates in accord with the requirements of this Section and as shown on the Drawings.
- B. Related Work includes:
  - 1. Section 03300 - Cast In-Place Concrete

1.3 QUALITY ASSURANCE:

Comply with applicable provisions of the following standards:

- A. Specifications and Standards of the Chain Link Fence Manufacturers Institute (CLFMI).
- B. American Society for Testing and Materials (ASTM) Specifications for Chain Link Fencing Materials.

1.4 SUBMITTALS:

- A. Manufacturers' Data: Within 15 calendar days after Notice to Proceed, submit complete manufacturer's and/or supplier's data and instructions for all chain link fencing and gate materials.

2.0 MATERIALS

2.1 GENERAL:

- A. Posts, Frames, Rails, Stretcher Bars, Truss Rods: Galvanized steel/PVC coated.
- B. Reinforcing Wire: Galvanized high carbon steel/PVC coated.
- C. Gate Hinges, Post Caps, Stretcher Bar Bands, Similar Items: Galvanized steel or malleable iron/PVC coated.
- D. Ties, Clips: Galvanized steel/PVC coated..

2.2 COATINGS:

- A. Galvanizing: All iron and steel parts hot dipped galvanized after fabrication. Zinc coating weight not less than 1.8 ounces per surface square foot.
- B. Supplemental Color Coating (if noted on plans): In addition to above metallic coatings, provide posts and rails with manufacturer's standard polymer coating according to ASTM F 1234, 10-mil minimum polyvinyl chloride (PVC) finish applied to exterior surfaces and, except for tubular shapes, to exposed interior surfaces. Color to match chain link fabric.

2.3 TOLERANCES: Standard mill tolerances for all framework members and chain link fabric.

- 2.4 FABRIC: Chain link fabric 9 gauge (0.148 inch) core wire, nominal 2" mesh, knuckle top and bottom selvages, with Class 2a PVC coating if noted on plans. Minimum breaking load of 1290 pounds. Furnish in widths and types shown on the Drawings.
- 2.5 CORNER, PULL, TERMINAL POSTS, INTERMEDIATE POSTS:
- A. Size as shown on drawings and meeting the following:
- | Trade Size | Actual O.D. | Weight lbs/ft |
|------------|-------------|---------------|
| 2"         | 1.90"       | 2.72#         |
| 2 1/2"     | 2.375"      | 3.65#         |
| 3"         | 2.875"      | 5.79#         |
| 4"         | 4.0"        | 9.10#         |
- 2.6 GATE POSTS: For swing gates under 6ft. in width - 3" (2.875" o.d.) steel pipe, nominal weight 5.79#/ft.; for swing gates over 6ft. in width - 4" (4.0" o.d. steel pipe, nominal weight 9.10#/ft.; provide diagonal 3/8" truss rods with turnbuckle at all corners, terminals and as detailed.
- 2.7 RAILS: 1 5/8" (1.66" o.d.) steel pipe, nominal weight 2.27#/ft.; not less than 18' lengths and fitted with couplings for connecting into continuous runs; couplings 6" long outside sleeves, 0.70 minimum wall thickness, allowing for expansion and contraction of rail. Join rails at intermediate posts with boulevard clamps.
- 2.8 POST CAPS AND RAIL ENDS: Sized to fit over outside of posts and rails to exclude moisture; ball caps for corner, terminal and gate posts, loop through caps to provide rail support for intermediate posts; rail ends brace banded to terminal and corner posts with 7/8" beveled galvanized steel brace band.
- 2.9 SWING GATES: Frames fabricated of steel pipe to size as shown on the Drawings; welded frame connections ground smooth prior to galvanizing; provide positive, locking latches with 1 3/8" o.d. drop bars and center-stops as detailed; provide gate stops set in concrete at each leaf full open position; provide gate post mounted keepers to automatically hold each leaf in full open position until manually released; locks provided by Owner.
- 2.10 HINGES: Tamper-proof with large bearing surfaces for clamping into position. Hinges will not twist or turn under action of gate.
- 2.11 STRETCHER BARS: 3/16" x 3/4" in lengths one inch less than full height of fabric with which they are used; provide one (1) stretcher bar for each terminal post; tow (2) for each corner, pull and gate post.
- 2.12 BANDS OR CLIPS: Flat or beveled steel 7/8" x .1156" of adequate strength for attaching stretcher bars to posts; install at intervals not to exceed 15".
- 2.13 FABRIC TIES: Steel ties for attaching fabric to rails and intermediate posts. Install at intervals not to exceed 14" o.c.
- 2.14 BOTTOM TENSION WIRE: No. 6 gauge galvanized spring coil steel wire; stretch taut from terminal post to terminal post and securely fasten to each intermediate post 2" above finished grade; weave through and attach to fence fabric at intervals not to exceed 24" with 6 ga galvanized steel wire.
- 2.15 OTHER MATERIALS: All other fittings, hardware, materials not specifically described but required for a complete and proper installation shall be as selected by the Contractor subject to the approval of the Landscape Architect.

3.0 EXECUTION

3.1 GENERAL:

- A. Do not begin installation and erection before final grading is completed unless otherwise permitted.

3.2 INSTALLATION:

- A. As detailed on the Drawings and as directed by the Landscape Architect.
- B. Evenly space posts in the line of the fence as shown on Drawings and no further than 10' o.c.
- C. Allow concrete footings to cure 72 hours minimum before applying any strain to posts.
- D. Install posts, rails, gates and other similar items plumb, level and true to required line.

3.3 ADJUSTMENT: Adjust all gate hardware and lubricate where necessary.

END OF SECTION

1.0 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. All water mains shall be in strict accordance with the local utility authority's requirements.

1.2 SUMMARY

- A. This Section includes water-distribution piping and specialties outside the building for the following:
  - 1. Water services.
- B. Utility-furnished products include water meters that will be furnished to the site, ready for installation.

1.3 DEFINITIONS

- A. Water-Distribution Piping: Interior domestic-water piping.
- B. Water Service: Exterior domestic-water piping.
- C. The following are industry abbreviations for plastic materials:
  - 1. PVC: Polyvinyl chloride plastic.

1.4 SUBMITTALS

- A. Product Data: For the following:
  - 1. Piping specialties.
  - 2. Valves and accessories.
  - 3. Water meters and accessories.
  - 4. Backflow preventers and assemblies.
  - 5. Protective enclosures.
- B. Shop Drawings: For the following:
  - 1. Precast concrete vaults, including frames and covers, ladders and drains.
  - 2. Wiring Diagrams: Power, signal and control wiring.
- C. Coordination Drawings: For piping and specialties including relation to other services in same area. Show piping and specialty sizes and valves, meter and specialty locations, and elevations.
- D. Field Quality-Control Test Reports: From Contractor.

- E. Operation and Maintenance Data: For specialties to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 include the following:
  - 1. Water meters.
  - 2. Valves.
  - 3. Backflow preventers.
  - 4. Protective enclosures.
- F. Record drawings: At project close-out of installed water service piping according to Division 1.
- G. Purging and disinfecting reports.

#### 1.5 QUALITY ASSURANCE

- A. Product Options: Drawings indicate size, profiles, and dimensional requirements of piping and specialties and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements." Other manufacturers' products with equal performance characteristics may be considered. Refer to Division 1 Section "Substitutions".
- B. 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.
- C. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- E. Comply with ASTM F 645 for selection, design, and installation of thermoplastic water piping.
- F. Comply with FM's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.
- G. NSF Compliance:
  - 1. Comply with NSF 14 for plastic potable-water-service piping.
  - 2. Comply with NSF 61 for materials for water-service piping and specialties for domestic water.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Preparation for Transport: Prepare valves, including fire hydrants, according to the following:

1. Ensure that valves are dry and internally protected against rust and corrosion.
  2. Protect valves against damage to threaded ends and flange faces.
  3. Set valves in best position for handling. Set valves closed to prevent rattling.
- B. During Storage: Use precautions for valves, including fire hydrants, according to the following:
1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
  2. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.
- C. Handling: Use sling to handle valves and fire hydrants if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.
- D. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.
- E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.
- F. Protect flanges, fittings, and specialties from moisture and dirt.
- G. Store plastic piping protected from direct sunlight. Support piping to prevent sagging and bending.

#### 1.7 PROJECT CONDITIONS

- A. 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.
- B. Perform site survey, research public utility records and verify existing utility locations. Contact utility-locating service for the area where project is located.
- C. Verify that water-service piping may be installed to comply with original design and reference standards.
- D. Site information: Reports on subsurface condition investigations made during design of project are available for informational purposes only; data in reports are not intended as representations or warranties of accuracy or continuity of conditions between soil borings. Owner assumes no responsibility for interpretations or conclusions drawn from this information.

1.8 COORDINATION

- A. Coordinate connection to water main with utility company.
- B. Coordinate piping materials, sizes, entry locations and pressure requirements with building distribution & fire protection piping.
- C. Coordinate with other utility work.
- D. Coordinate electrical wiring for tamper switches, vault heaters, and sump pumps.

2.0 - PRODUCTS

2.1 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.2 DUCTILE-IRON PIPE AND FITTINGS

- A. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint, bell- and plain-spigot end unless grooved or flanged ends are indicated.
  - 1. 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.

2.3 PVC PIPE AND FITTINGS

- A. PVC, Schedule 40 Pipe: ASTM D 1785.
  - 1. PVC, Schedule 40 Socket Fittings: ASTM D 2466.
- B. PVC, AWWA Pipe: AWWA C900, Class 200, with bell end with gasket and 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.

## 2.4 JOINING MATERIALS

- A. Refer to Division 2 Section "Utility Materials" for commonly used joining materials.
- B. Transition Couplings:
  - 1. Underground Piping, NPS 1-1/2 (DN 40) and Smaller: Manufactured fitting or coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.
  - 2. Underground Piping, NPS 2 (DN 50) and Larger: AWWA C219, metal, sleeve-type coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.
  - 3. Aboveground or Vault Piping: Pipe fitting same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.
- C. Plastic Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

## 2.5 PIPING SPECIALTIES

- A. Flexible Connectors:
  - 1. Nonferrous-Metal Piping: Bronze hose covered with bronze wire braid; with copper-tube, pressure-type, solder-joint ends or bronze flanged ends brazed to hose.
  - 2. Ferrous Piping: Stainless-steel hose covered with stainless-steel wire braid; with ASME B1.20.1, threaded steel pipe nipples or ASME B16.5, steel pipe flanges welded to hose.
- B. Dielectric Fittings: Combination of copper alloy and ferrous; threaded, solder, or plain end types; and matching piping system materials.
  - 1. Dielectric Unions: Factory-fabricated union assembly, designed for 250-psig minimum working pressure at 180 deg F (82 deg C). Include insulating material that isolates dissimilar metals and ends with inside threads according to ASME B1.20.1.
  - 2. Dielectric Flanges: Factory-fabricated companion-flange assembly, for 150- or 300-psig minimum working pressure to suit system pressures.
  - 3. Dielectric-Flange Insulation Kits: Field-assembled companion-flange assembly, full-face or ring type. Components include neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
    - a. Provide separate companion flanges and steel bolts and nuts for 150- or 300-psig minimum working pressure to suit system pressures.
  - 4. Dielectric Couplings: Galvanized-steel couplings with inert and noncorrosive thermoplastic lining, with threaded ends and 300-psig minimum working pressure at 225 deg F.
  - 5. Dielectric Nipples: Electroplated steel nipples with inert and noncorrosive thermoplastic lining, with combination of plain, threaded, or grooved end types and 300-psig minimum working pressure at 225 deg F.



## 2.6 GATE VALVES

- A. AWWA, Cast-Iron Gate Valves:
  - 1. Nonrising-Stem, Metal-Seated Gate Valves: AWWA C500, gray- or ductile-iron body and bonnet; with cast-iron or bronze double-disc gate, bronze gate rings, bronze stem, and stem nut.
    - a. Minimum Working Pressure: 200 psig.
    - b. End Connections: Mechanical joint.
    - c. Interior Coating: Complying with AWWA C550.

## 2.7 GATE VALVE ACCESSORIES AND SPECIALTIES

- A. Tapping-Sleeve Assemblies: Comply with MSS SP-60. Include sleeve and valve compatible with drilling machine.
  - 1. 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.
  - 2. Valve: AWWA, cast-iron, nonrising-stem, metal or 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," bottom section with base of size to fit over valve, and approximately 5-inch- diameter barrel.
  - 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, FM-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.
- D. Indicator Posts: UL 789, FM-approved, horizontal, wall-type, cast-iron body with operating wrench, extension rod, and cast-iron barrel.

## 2.8 CHECK VALVES

- A. AWWA Check Valves:
  - 1. Check Valves: AWWA C508, swing-check type with 175-psig working-pressure rating and resilient seat. Include interior coating according to AWWA C550 and ends to match piping.
- B. UL-Labeled Check Valves:
  - 1. Check Valves: UL 312, swing-check type with 250-psig working-pressure rating, rubber-faced checks unless otherwise indicated, and ends matching piping.

## 2.9 DETECTOR CHECK VALVES

- A. Detector Check Valves: UL 312, galvanized cast-iron body, bolted cover with air-bleed device for access to internal parts, and flanged ends; designed for 175-psig working pressure. Include one-piece bronze disc with bronze bushings, pivot, and replaceable seat. Include threaded bypass taps in inlet and outlet for bypass meter connection. Set valve to allow minimal water flow through bypass meter when major water flow is required.
  - 1. Water Meter: AWWA C700, disc type, at least one-fourth size of detector check valve. Include meter, bypass piping, gate valves, check valve, and connections to detector check valve.
- B. Detector Check Valves: UL 312, FM-approved detector check, iron body, corrosion-resistant clapper ring and seat ring material, 175-psig (1207-kPa) working pressure, flanged ends, with connections for bypass and installation of water meter.

## 2.10 WATER METERS

- A. Water meters will be furnished by the local water authority.

## 2.11 WATER-METER BOXES

- A. Description: Cast-iron body and cover for disc-type water meter with lettering "WATER METER" in cover; and 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.
- B. Description: Cast-iron body and double cover for disc-type water meter with lettering "WATER METER" in top cover; separate inner cover; air space between covers; and slotted, open-bottom base section of length to fit over service piping.
- C. Description: Polymer-concrete body and cover for disc-type water meter with lettering "WATER" in cover; and 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.

## 2.12 HOSE-CONNECTION, BACKFLOW-PREVENTION DEVICES

- A. General: ASSE standard, nonremovable-type, backflow-prevention devices with ASME B1.20.7, garden-hose threads on outlet.
- B. Hose-Connection Vacuum Breakers: ASSE 1011, nickel plated, with manual drain feature. Units attached to rough-bronze-finish hose connections may be rough bronze.
- C. Hose-Connection Backflow Preventers: ASSE 1052, suitable for at least 3m flow and applications with up to 10-foot head of water back pressure. Include two check valves and intermediate atmospheric vent.

## 2.13 BACKFLOW PREVENTERS

- A. General: ASSE standard, backflow preventers.

1. Working Pressure: 150 psig minimum, unless otherwise indicated.
  2. NPS 2 and Smaller: Bronze body with threaded ends.
  3. NPS 2-1/2 and Larger: Bronze, cast-iron, steel, or stainless-steel body with flanged ends.
    - a. Interior Lining: AWWA C550 or FDA-approved, epoxy coating for backflow preventers having cast-iron or steel body.
  4. Interior Components: Corrosion-resistant materials.
  5. Exterior Finish: Polished chrome plate if used in chrome-plated piping system.
  6. Strainer: On inlet, if indicated.
- B. Pipe-Applied, Atmospheric-Type Vacuum Breakers: ASSE 1001, with floating disc and atmospheric vent.
- C. Reduced-Pressure-Principle Backflow Preventers: ASSE 1013 or AWWA C511, suitable for continuous pressure application. Include outside screw and yoke gate valves on inlet and outlet, and strainer on inlet; test cocks; and pressure-differential relief valve with ASME A112.1.2, air-gap fitting located between two positive-seating check valves.
1. Maximum Pressure Loss: 12 psig through middle 1/3 of flow range.
- D. Double-Check-Valve Backflow Prevention Assemblies: ASSE 1015 or AWWA C510, suitable for continuous pressure application. Include outside screw and yoke gate valves on inlet and outlet, and strainer on inlet; test cocks; and two positive-seating check valves.
1. Maximum Pressure Loss: 5 psig through middle 1/3 of flow range.
- E. Double-Check-Valve Backflow Prevention Assemblies: UL 312, FM approved; with two UL 312, FM-approved, iron-body, 175-psig working-pressure, flanged-end check valves and two UL 262, FM-approved, iron-body, outside screw and yoke, flanged, 175-psig working-pressure gate valves.
1. Maximum Pressure Loss: 5 psig through middle 1/3 of flow range.
- F. Double-Check-Detector Assembly Backflow Preventers: ASSE 1048, FM approved or UL listed, and suitable for continuous pressure application. Include outside screw and yoke gate valves on inlet and outlet, and strainer on inlet. Include test cocks; two positive-seating check valves; and bypass with displacement-type water meter, valves, and double-check backflow preventer.
1. Maximum Pressure Loss: 5 psig through middle 1/3 of flow range.

#### 2.14 CONCRETE VAULTS

- A. Description: Precast, reinforced-concrete vault, designed for A-16 load designation according to ASTM C 857 and made according to ASTM C 858.
- B. Ladder: ASTM A 36/A 36M, steel or polyethylene-encased steel steps.
- C. Manhole: ASTM A 48, Class No. 35 (ASTM A 48M, Class No. 250) minimum tensile strength, gray-iron traffic frame and cover.

1. Dimensions: Not smaller than 24-inch diameter, unless otherwise indicated.
- D. Drain: ASME A112.21.1M, cast-iron floor drain with outlet of size indicated. Include body anchor flange, light-duty cast-iron grate, bottom outlet, and integral or field-installed bronze ball or clapper-type backwater valve.

#### 2.15 PROTECTIVE ENCLOSURES

- A. Protective Enclosures, General: ASSE 1060, outdoor weather-resistant enclosure designed to protect aboveground water piping equipment or specialties from vandalism. Include size and dimensions indicated but not less than those required for access and service of protected unit.
- B. Freeze-Protection Enclosures: Insulated and with heat source to maintain minimum internal temperature of 40 deg F (4 deg C) when external temperatures reach as low as minus 34 deg F (minus 36 deg C).
  1. Class I: For equipment or devices other than pressure or atmospheric vacuum breakers.
  2. Class I-V: For pressure or atmospheric vacuum breaker equipment or devices. Include drain opening in housing.
    - a. Housing: Reinforced-aluminum or fiberglass construction.
      - 1) Drain opening for units with drain connection.
      - 2) Access doors with locking devices.
      - 3) Insulation inside housing.
      - 4) Anchoring devices for attaching housing to concrete base.
    - b. Electric heating cable or heater with self-limiting temperature control.
- C. Precast concrete base of dimensions required to extend at least 6 inches beyond edges of enclosure housings. Include openings for piping.

#### 2.16 FIRE HYDRANTS

- A. All fire hydrants shall be in accordance with the specifications and standards of the local fire department and utility company.

### 3.0 - EXECUTION

#### 3.1 EARTHWORK

- A. Refer to Division 2 Section "Earthwork" 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 in applications below, unless otherwise indicated.

- C. Do not use flanges, unions, or keyed couplings for underground piping.
- D. Flanges, unions, keyed couplings, and special fittings may be used, instead of joints indicated, on aboveground piping and piping in vaults.
- E. Underground Water-Service Piping: Use any of the following piping materials for each size range:
  - 1. NPS 3/4 to NPS 3-1/2: PVC, Schedule 40 pipe and fittings
  - 2. NPS 4 to NPS 8: Ductile-iron, push-on-joint pipe; ductile-iron, push-on-joint fittings; and gasketed or joints or PVC, C900, Class 200 pipe and fittings.

### 3.3 VALVE APPLICATIONS

- A. General Application: Use mechanical-joint-end valves for NPS 3 (DN 80) and larger underground installation. Use threaded- or flanged-end valves for installation in vaults. Use UL/FM, 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, high-pressure, resilient seated gate valves with valve box.
  - 2. Underground Valves, NPS 4 and Larger, for Indicator Posts: UL/FM, 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: UL/FM, cast iron, OS&Y rising stem.
    - c. Check Valves: AWWA C508, swing-check valves.
  - 4. Detector Check Valves: Use for water-service piping in vaults and aboveground to detect unauthorized use of water.

### 3.4 JOINT CONSTRUCTION

- A. See Division 2 Section "Utility Materials" for basic piping joint construction.
- B. Make pipe joints according to the following:
  - 1. Ductile-Iron Piping, Gasketed Joints for Water-Service Piping: AWWA C600 and AWWA M41.
  - 2. Ductile-Iron Piping, Gasketed Joints for Fire-Service-Main Piping: UL 194.
  - 3. Ductile-Iron Piping, Grooved Joints: Cut-groove pipe. Assemble joints with keyed couplings, gaskets, lubricant, and bolts according to coupling manufacturer's written instructions.
  - 4. Copper Tubing Soldered Joints: ASTM B 828. Use flushable flux and lead-free solder.
  - 5. PVC Piping Gasketed Joints: Use joining materials according to AWWA C900. Construct joints with elastomeric seals and lubricant according to

ASTM D 2774 or ASTM D 3139 and pipe manufacturer's written instructions.

6. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, with OD, and with system working pressure. Refer to Division 2 Section "Utility Materials" for joining piping of dissimilar metals.

### 3.5 PIPING INSTALLATION

- A. Water-Main Connection: Arrange with utility company for tap of size and in location indicated in water main.
- B. 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.
- C. 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.
- D. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.
  1. Install PE corrosion-protection encasement according to ASTM A 674 or AWWA C105.
- E. Install PVC, AWWA pipe according to AWWA M23 and ASTM F 645.
- F. Bury piping with depth of cover over top at least 30 inches, with top at least 12 inches below level of maximum frost penetration, and according to the following:
  1. Under Driveways: With at least 36 inches cover over top.
  2. Under Railroad Tracks: With at least 48 inches cover over top.
  3. In Loose Gravelly Soil and Rock: With at least 12 inches additional cover.
- 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. 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.
- I. Anchor service-entry piping to building wall.
- J. See Division 15 Section "Domestic Water Piping" for potable-water piping inside the building.

### 3.6 ANCHORAGE INSTALLATION

- A. 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.
- B. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

### 3.7 VALVE INSTALLATION

- A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.
- B. UL/FM Gate Valves: Comply with NFPA 24. Install each underground valve and valves in vaults with stem pointing up and with vertical cast-iron indicator post.
- C. Detector Check Valves: Install in vault or aboveground.

### 3.8 DETECTOR CHECK VALVE INSTALLATION

- A. Install detector check valves for proper direction of flow. Install bypass with water meter, gate valves on each side of meter, and check valve downstream from meter.
- B. Support detector check valves, meters, shutoff valves, and piping on brick or concrete piers.

### 3.9 WATER-METER INSTALLATION

- A. Install water meters, piping, and specialties according to utility company's written requirements.

### 3.10 ROUGHING-IN FOR WATER METERS

- A. Rough-in piping and specialties for water-meter installation according to utility company's written instructions and requirements.

3.11 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 with relief drain in vault or other space 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.

3.12 VAULT INSTALLATION

- A. See Division 3 Section "Cast-in-Place Concrete" for concrete vaults.
- B. Install precast concrete vaults according to ASTM C 891.
- C. Connect drain outlet to storm drainage piping. Refer to Division 2 Section "Storm Drainage."

3.13 PROTECTIVE ENCLOSURE INSTALLATION

- A. Install concrete base level and with top approximately 2 inches above grade.
- B. Install protective enclosure over valves and equipment.
- C. Anchor protective enclosure to concrete base.

3.14 CONNECTIONS

- A. Piping installation requirements are specified in other Division 2 Sections. Drawings indicate general arrangement of piping and specialties.
- B. See Division 2 Section "Utility Materials" for piping connections to valves and equipment.
- C. Connect water-distribution piping to existing water main. Use tapping sleeve and tapping valve.
- D. Connect water-distribution piping to post hydrants and drinking fountains.
- E. Connect water-distribution piping to interior domestic-water and fire-suppression piping.
- F. Connect waste piping from drinking fountains to sanitary sewerage system. See Division 2 Section "Sanitary Sewerage" for connection to sanitary-sewer.
- G. Ground equipment according to Division 16 Section "Grounding and Bonding."
- H. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.



3.15 FIELD QUALITY CONTROL

- A. Piping Tests: Conduct piping tests before joints are covered and after 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 1-1/2 times working pressure for 2 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.

3.16 IDENTIFICATION

- A. Install continuous underground detectable warning tape during backfilling of trench for underground water-service piping. Locate below finished grade, directly over piping. See Division 2 Section "Earthwork" for underground warning tapes.
- B. Permanently attach equipment nameplate or marker, indicating plastic water-service piping, on main electrical meter panel. See Division 2 Section "Utility Materials" for identifying devices.

3.17 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 as described below:
    - 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 02510

## SECTION 02530 - SANITARY SEWERAGE

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. All sanitary sewerage shall be in strict accordance with the local sewer authority's standards and specifications.

#### 1.2 SUMMARY

- A. This Section includes sanitary sewerage outside the building.
- B. Related Sections include the following"
  - 1. Division 3 Section "Cast-in-Place Concrete" for concrete structures.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Gravity-Flow, Nonpressure-Piping Pressure Ratings: At least equal to system test pressure.

#### 1.4 SUBMITTALS

- A. Shop Drawings: Include plans, elevations, details, and attachments for the following:
  - 1. Precast concrete manholes, including frames and covers.
- B. Field Test Reports: Indicate and interpret results for compliance with performance requirements.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect pipe, pipe fittings, and seals from dirt and damage.
- B. Handle precast concrete manholes and other structures according to manufacturer's written rigging instructions.

#### 1.6 PROJECT CONDITIONS

- A. Site Information: Perform site survey, research public utility records, and verify existing utility locations.
- B. Locate existing structures and piping to be closed and abandoned.
- C. Existing Utilities: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
  - 1. Notify Architect no fewer than two days in advance of proposed utility interruptions.

2. Do not proceed with utility interruptions without Architect's written permission.

## PART 2 - PRODUCTS

### 2.1 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe and fitting, materials.

### 2.2 PIPES AND FITTINGS

- A. Ductile-Iron Sewer Pipe: ASTM A 746, for push-on joints
  1. Standard-Pattern, Ductile-Iron Fittings: AWWA C110, ductile or gray iron, for push-on joints.
  2. Compact-Pattern, Ductile-Iron Fittings: AWWA C153, for push-on joints.
  3. Gaskets: AWWA C111, rubber.
- B. PVC Pressure Pipe: AWWA C900, Class 150 for gasketed joints.
  1. PVC Pressure Fittings.
  2. Gaskets for PVC Piping: ASTM C907, for gasketed joints.
  3. Ductile-Iron, Compact Fittings: AWWA C153, for push-on joints.
  4. Gaskets for Ductile-Iron Fittings: AWWA C111, rubber.

### 2.3 MANHOLES

- A. Normal-Traffic Precast Concrete Manholes: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for rubber gasketed joints.
  1. Diameter: 48 inches minimum, unless otherwise indicated.
  2. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
  3. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.
  4. Riser Sections: 4-inch minimum thickness, and lengths to provide depth indicated.
  5. Top Section: Concentric-cone type, unless eccentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
  6. Gaskets: ASTM C 443, rubber.
  7. Grade Rings: Include two or three reinforced-concrete rings, 6- to 9-inch total thickness, that match 24-inch diameter frame and cover.
  8. Steps: ASTM C 478, individual steps or ladder. Omit steps for manholes less than 60 inches deep.
  9. Pipe Connectors: ASTM C 923, resilient, of size required, for each pipe connecting to base section.
- B. Heavy-Traffic Precast Concrete Manholes: ASTM C 913; designed according to ASTM C 890 for A-16, heavy-traffic, structural loading; of depth, shape, and dimensions indicated, with provision for rubber gasketed joints.
  1. Ballast: Increase thickness of one or more precast concrete sections or add concrete to structure, as required to prevent flotation.
  2. Gaskets: Rubber.
  3. Grade Rings: Include two or three reinforced-concrete rings, 6- to 9-inch total thickness, to match 24-inch diameter frame and cover.

4. Steps: Manufactured from deformed, 1/2-inch steel reinforcement rod complying with ASTM A 615 and encased in polypropylene complying with ASTM D 4101. Include pattern designed to prevent lateral slippage off step. Cast or anchor into sidewalls with steps at 12- to 16-inch intervals. Omit steps for manholes less than 60 inches deep.
  5. Pipe Connectors: ASTM C 923, resilient, of size required, for each pipe connecting to base section.
- C. Manhole Frames and Covers: ASTM A 536, Grade 60-40-18, ductile-iron castings for heavy-duty service. Include 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 "SANITARY SEWER" cast into cover.
- D. Manhole Cover Inserts: Manufactured, plastic form, of size to fit between manhole frame and cover and designed to prevent stormwater inflow. Include handle for removal and gasket for gastight sealing.

1. Type: Solid.

## 2.4 CONCRETE

- A. Structure 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: 2 percent through manhole.

## 2.5 PROTECTIVE COATINGS

- A. Description: One- or two-coat, coal-tar epoxy; 15-mil minimum thickness, unless otherwise indicated; factory or field applied to the following surfaces:

1. Concrete Manholes: On exterior and interior surfaces.
2. Manhole Frames and Covers: On entire surfaces.

## 2.6 CLEANOUTS

- A. Gray-Iron Cleanouts: 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. Use units with top-loading classifications according to the following applications:

1. Light Duty: In earth or grass foot-traffic areas.
2. Medium Duty: In paved foot-traffic areas.
3. Heavy Duty: In vehicle-traffic areas.
4. Extra-Heavy Duty: In roads.

5. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.
- B. PVC Cleanouts: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

### PART 3 - EXECUTION

#### 3.1 EARTHWORK

- A. Excavating, trenching, and backfilling are specified in Division 2 Section "Earthwork."

#### 3.2 IDENTIFICATION

- A. Materials and their installation are specified in Division 2 Section "Earthwork." Arrange for installing green warning tapes directly over piping and at outside edges of underground structures.
  1. Use warning tape or detectable warning tape over ferrous piping.
  2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

#### 3.3 PIPING APPLICATIONS

- A. General: Include watertight joints.
- B. Refer to Part 2 of this Section for detailed specification for pipe and fitting products listed below. Use pipe, fittings, and joining methods according to applications indicated.
- C. Gravity-Flow Piping: Use the following:
  1. Ductile-iron sewer pipe; standard- or compact-pattern, ductile-iron fittings; gaskets; and gasketed joints.

#### 3.4 SPECIAL PIPE COUPLING AND FITTING APPLICATIONS

- A. Special Pipe Couplings: Use where required to join piping and no other appropriate method is specified. Do not use instead of specified joining methods.
  1. Use the following pipe couplings for non-pressure applications:
    - a. Sleeve type to join piping, of same size, or with small difference in OD.
    - b. Increaser/reducer-pattern, sleeve type to join piping of different sizes.
    - c. Bushing type to join piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

#### 3.5 INSTALLATION, GENERAL

- A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground sanitary sewerage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical.
- 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. Maintain swab or drag in line, and pull past each joint as it is completed.

- C. Use manholes for changes in direction, unless fittings are indicated. Use fittings for branch connections, unless direct tap into existing sewer is indicated.
- D. Use 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. Install gravity-flow piping and connect to building's sanitary drains, of sizes and in locations indicated. Terminate piping as indicated.
  - 1. Install piping pitched down in direction of flow, at minimum slope of 2 percent, unless otherwise indicated.
  - 2. Install piping with 36-in minimum cover.
- F. Extend sanitary sewerage piping and connect to building's sanitary drains, of sizes and in locations indicated. Terminate piping as indicated.
- G. Install ductile-iron, force-main piping according to AWWA C600.
- H. Tunneling: Install pipe under streets or other obstructions that cannot be disturbed by tunneling, jacking, or combination of both.

### 3.6 PIPE JOINT CONSTRUCTION AND INSTALLATION

- A. General: Join and install pipe and fittings according to installations indicated
- B. Refer to Division 2 Section "Utility Materials" for basic piping joint construction and installation.
- C. Ductile-Iron Sewer Pipe with Ductile-Iron Fittings: According to AWWA C600.
  - 1. Install PE film, pipe encasement over ductile-iron sewer pipe and ductile-iron fittings according to ASTM A 674 for AWWA C105.

### 3.7 MANHOLE INSTALLATION

- A. General: Install manholes complete with appurtenances and accessories indicated.
- B. Form continuous concrete channels and benches between inlets and outlet.
- C. 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.
- D. Install precast concrete manhole sections with gaskets according to ASTM C 891.
- E. Construct cast-in-place manholes as indicated.

### 3.8 CLEANOUT INSTALLATION

- A. Install cleanouts and riser extension from sewer pipe to cleanout 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.

- 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 Insert other above surrounding grade.
- C. Set cleanout frames and covers in concrete pavement with tops flush with pavement surface.

### 3.9 TAP CONNECTIONS

- A. Make connections to existing piping and underground structures so finished Work strictly complies with local requirements.
- B. Protect existing piping and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

### 3.10 CLOSING ABANDONED SANITARY SEWERAGE 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- Insert other 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.
  - 3. Backfill to grade according to Division 2 Section "Earthwork."

### 3.11 FIELD QUALITY CONTROL

- A. Clear interior of piping and structures of dirt and superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed.
  - 1. Place plug in end of incomplete piping at end of day and when work stops.
  - 2. Flush piping between manholes and other structures to remove collected debris, if required by authorities having jurisdiction.
- B. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfills 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 of cylinder of size not less than 92.5 percent of piping diameter.
    - c. 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.
- C. 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 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. If authorities having jurisdiction do not have published procedures, perform tests as follows:
    - a. Sanitary Sewerage: Perform hydrostatic test.
      - 1) Allowable leakage is maximum of 50 gal. per inch of nominal pipe size per mile of pipe, during 24-hour period.
      - 2) Close openings in system and fill with water.
      - 3) Purge air and refill with water.
      - 4) Disconnect water supply.
      - 5) Test and inspect joints for leaks.
      - 6) Option: Test ductile-iron piping according to AWWA C600, "Hydrostatic Testing". Use test pressure of at least 10 psig
    - b. Sanitary Sewerage: Perform air test according to UNI-B-6.
      - 1) Ductile-Iron Piping: Test according to AWWA C600, Section "Hydraulic Testing."
  6. Manholes: Perform hydraulic test according to ASTM C 969.
  7. Leaks and loss in test pressure constitute defects that must be repaired.
  8. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

END OF SECTION 02530

1.0 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes storm drainage outside the building.

1.3 DEFINITIONS

- A. HDPE: High Density Polyethylene plastic.
- B. PVC: Polyvinyl chloride plastic.
- C. RCP: Reinforced concrete pipe.
- D. DIP: Ductile-iron pipe.

1.4 PERFORMANCE REQUIREMENTS

- A. Gravity-Flow, Nonpressure-Piping Pressure Ratings: At least equal to system test pressure.

1.5 SUBMITTALS

- A. Shop Drawings: Include plans, elevations, details, and attachments for the following:
  - 1. Precast concrete manholes and other structures, including frames, covers, and grates.
  - 2. Cast-in-place concrete manholes and other structures, including frames, covers, and grates.
- B. Design Mix Reports and Calculations: For each class of cast-in-place concrete.
- C. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not store plastic structures, pipe, and fittings in direct sunlight.
- B. Protect pipe, pipe fittings, and seals from dirt and damage.
- C. Handle precast concrete manholes and other structures according to manufacturer's written rigging instructions.

1.7 PROJECT CONDITIONS

- A. Site Information: Perform site survey, research public utility records, and verify existing utility locations.

- B. Locate existing structures and piping to be closed and abandoned.
- C. 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 the Architect's written permission.

## 2.0 - PRODUCTS

### 2.1 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe and fitting materials.

### 2.2 PIPES AND FITTINGS

- A. Corrugated PE Pipe and Fittings: AASHTO M 294, Type S, with smooth waterway for coupling joints.
  - 1. Soiltight Couplings: AASHTO M 294, corrugated, matching pipe and fittings to form soiltight joints.
  - 2. Silttight Couplings: PE sleeve with ASTM D 1056, Type 2, Class A, Grade 2 gasket material that mates with pipe and fittings to form silttight joints.
- B. PVC Sewer Pipe and Fittings: According to the following:
  - 1. PVC Sewer Pipe and Fittings, NPS 15 and Smaller: ASTM D 3034, SDR 35, for solvent-cemented or gasketed joints.
    - a. Gaskets: ASTM F 477, elastomeric seals.
- C. Reinforced-Concrete Sewer Pipe and Fittings: ASTM C 76, Class III, Wall B, (unless otherwise indicated) for gasketed joints.
  - 1. Gaskets: ASTM C 443, rubber.

### 2.3 SPECIAL PIPE COUPLINGS AND FITTINGS

- A. Sleeve-Type Pipe Couplings: ASTM C 1173, rubber or elastomeric sleeve and band assembly fabricated to mate with OD of pipes to be joined, for non-pressure joints.
  - 1. Sleeve Material for Concrete Pipe: ASTM C 443, rubber.
  - 2. Sleeve Material for Plastic Pipe: ASTM F 477, elastomeric seal.
  - 3. Sleeve Material for Dissimilar Pipe: Compatible with pipe materials being joined.
  - 4. Bands: Stainless steel, at least one at each pipe insert.

- B. Bushing-Type Pipe Couplings: ASTM C 1173, rubber or elastomeric bushing fabricated to mate with OD of smaller pipe and ID of adjoining larger pipe, for nonpressure joints.
1. Material for Concrete Pipe: ASTM C 443, rubber.
  2. Material for Plastic Pipe: ASTM F 477, elastomeric seal.
  3. Material for Dissimilar Pipe: Compatible with pipe materials being joined.

## 2.4 MANHOLES

- A. Normal-Traffic Precast Concrete Manholes: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for rubber gasketed joints.
1. Diameter: 48 inches I.D. 5' depth, 60" I.D. > 5' depth, unless otherwise indicated.
  2. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
  3. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section and having separate base slab or base section with integral floor.
  4. Riser Sections: 4-inch minimum thickness, and lengths to provide depth indicated.
  5. Top Section: Concentric-cone type unless eccentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
  6. Gaskets: ASTM C 443 rubber.
  7. Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch total thickness, that match 24-inch-diameter frame and cover. Final height adjustment can be made with courses of brick totaling no more than 16 inches.
  8. Steps: ASTM C 478, individual steps or ladder. Omit steps for manholes less than 48 inches deep.
  9. Pipe Connectors: ASTM C 923, resilient, of size required, for each pipe connecting to base section.
- B. Heavy-Traffic Precast Concrete Manholes: ASTM C 913; designed according to ASTM C 890 for A-16, heavy-traffic, structural loading; of depth, shape, and dimensions indicated, with provision for rubber gasketed joints.
1. Ballast: Increase thickness of one or more precast concrete sections or add concrete to structure, as required to prevent flotation.
  2. Gaskets: Rubber.
  3. Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch total thickness, that match 24-inch-diameter frame and cover.
  4. Steps: ASTM C 478, individual steps or ladder. Omit steps for manholes less than 48 inches deep.
  5. Pipe Connectors: ASTM C 923, resilient, of size required, for each pipe connecting to base section.
- C. Cast-in-Place Concrete Manholes: Construct of reinforced-concrete bottom, walls, and top; designed according to ASTM C 890 for A-16, heavy-traffic, structural loading; of depth, shape, dimensions, and appurtenances indicated.
1. Ballast: Increase thickness of concrete, as required to prevent flotation.
  2. Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch total thickness, that match 24-inch-diameter frame and cover.

3. Steps: ASTM C 478, individual steps or ladder. Omit steps for manholes less than 48 inches deep.
- D. Manhole Frames and Covers: ASTM A 536, Grade 60-40-18, ductile-iron castings designed for heavy-duty service. Include 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 "STORM SEWER" cast into cover.

## 2.5 CATCH BASINS

- A. Normal-Traffic, Precast Concrete Catch Basins: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for rubber gasketed joints.
1. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section and having separate base slab or base section with integral floor.
  2. Riser Sections: 4-inch minimum thickness, 48-inch diameter, and lengths to provide depth indicated.
  3. Top Section: Concentric-cone type unless eccentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
  4. Gaskets: ASTM C 443, rubber.
  5. Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch total thickness, that match 24-inch diameter frame and grate.
  6. Steps: ASTM C 478 individual steps or ladder. Omit steps for catch basins less than 48 inches deep.
  7. Pipe Connectors: ASTM C 923, resilient, of size required, for each pipe connecting to base section.
- B. Heavy-Traffic, Precast Concrete Catch Basins: ASTM C 913, precast, reinforced concrete; designed according to ASTM C 890 for A-16, heavy-traffic, structural loading; of depth, shape, and dimensions indicated, with provision for rubber gasketed joints.
1. Gaskets: Rubber.
  2. Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch total thickness, that match 24-inch diameter frame and grate.
  3. Pipe Connectors: ASTM C 923, resilient, of size required, for each pipe connecting to base section.
  4. Pipe Connectors: ASTM C 923, resilient, of size required, for each pipe connecting to base section.
- C. Cast-in-Place Concrete, Catch Basins: Construct of reinforced concrete; designed according to ASTM C 890 for structural loading; of depth, shape, dimensions, and appurtenances indicated.
1. Bottom, Walls, and Top: Reinforced concrete.
  2. Channels and Benches: Concrete.
  3. Pipe Connectors: ASTM C 923, resilient, of size required, for each pipe connecting to base section.
- D. Frames and Grates: ASTM A 536, Grade 60-40-18, ductile iron designed for heavy-duty service. Include flat grate with small, square or short-slotted drainage openings.
1. Size: 24 by 24 inches minimum, unless otherwise indicated.
  2. Grate Free Area: Approximately 50 percent, unless otherwise indicated.

E. Frames and Grates: ASTM A 536, Grade 60-40-18, ductile iron designed for heavy-duty service. Include 24-inch ID by 7- to 9-inch riser with 4-inch minimum width flange, and 26-inch diameter flat grate with small, square or short-slotted drainage openings.

1. Grate Free Area: Approximately 50 percent, unless otherwise indicated.

## 2.6 CONCRETE

A. General: Cast-in-place concrete according to ACI 318, ACI 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 ratio.

1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60, deformed steel.

C. Structure Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi minimum, with 0.45 maximum water-cementitious ratio.

1. Include channels and benches in manholes.
  - a. 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.
    - 1) Invert Slope: 2 percent through manhole.
  - b. Benches: Concrete, sloped to drain into channel.
    - 1) Slope: 4 percent.

2. Include channels in catch basins.

- a. 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.
  - 1) Invert Slope: 2 percent through catch basin.

D. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 maximum water-cementitious ratio.

1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60, deformed steel.

### 3.0 - EXECUTION

#### 3.1 EARTHWORK

- A. Excavating, trenching, and backfilling are specified in Division 2 Section "Earthwork."

#### 3.2 IDENTIFICATION

- A. Materials and their installation are specified in Division 2 Section "Earthwork." Arrange for installing green warning tapes directly over piping and at outside edges of underground structures.

1. Use or detectable warning tape over ferrous piping.
2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

#### 3.3 PIPING APPLICATIONS

- A. General: Include watertight, silttight, or soiltight joints, unless watertight or silttight joints are indicated.
- B. Refer to Part 2 of this Section for detailed specifications for pipe and fitting products listed below. Use pipe, fittings, and joining methods according to applications indicated.
- C. Gravity-Flow Piping: As indicated on the drawings.

#### 3.4 SPECIAL PIPE COUPLING AND FITTING APPLICATIONS

- A. Special Pipe Couplings: Use where required to join piping and no other appropriate method is specified. Do not use instead of specified joining methods.
  1. Use the following pipe couplings for non-pressure applications:
    - a. Sleeve type to join piping, of same size, or with small difference in OD.
    - b. Increaser/reducer-pattern, sleeve type to join piping of different sizes.
    - c. Bushing type to join piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

#### 3.5 INSTALLATION, GENERAL

- 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 design considerations into account. Install piping as indicated, to the extent practical.
- 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. Maintain swab or drag in line and pull past each joint as it is completed.

- C. Use manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.
- D. Use 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. Install gravity-flow piping and connect to building's storm drains, of sizes and in locations indicated. Terminate piping as indicated.
  - 1. Install piping pitched down in direction of flow, at minimum slope of 1 percent, unless otherwise indicated.
  - 2. Install piping with 36-inch minimum cover, unless otherwise indicated.
- F. Extend storm drainage piping and connect to building's storm drains, of sizes and in locations indicated. Terminate piping as indicated.

### 3.6 PIPE JOINT CONSTRUCTION AND INSTALLATION

- A. General: Join and install pipe and fittings according to installations indicated.
- B. Install with top surfaces of components, except piping, flush with finished surface.
- C. PE Pipe and Fittings: As follows:
  - 1. Join pipe, tubing, and fittings with couplings for soiltight joints according to manufacturer's written instructions.
  - 2. Install according to ASTM D 2321 and manufacturer's written instructions.
  - 3. Install corrugated piping according to the Corrugated Polyethylene Pipe Association's "Recommended Installation Practices for Corrugated Polyethylene Pipe and Fittings."
- D. PVC Pressure Pipe and Fittings: Join and install according to AWWA M23.
- E. PVC Sewer Pipe and Fittings: As follows:
  - 1. Join pipe and gasketed fittings with gaskets according to ASTM D 2321.
  - 2. Install according to ASTM D 2321.
- F. Concrete Pipe and Fittings: Install according to ACPA's "Concrete Pipe Installation Manual." Use the following seals:
  - 1. Round Pipe and Fittings: ASTM C 443, rubber gaskets.
  - 2. Arch Pipe: ASTM C 877, Type I, sealing bands.
- G. Ductile-iron Culvert Piping: Install according to AWWA C600 for push-on joints.
- H. System Piping Joints: Make joints using system manufacturer's couplings, unless otherwise indicated.
- I. Join piping made of different materials or dimensions with couplings made for this application. Use couplings that are compatible with and that fit both systems' materials and dimensions.



### 3.7 MANHOLE INSTALLATION

- A. General: Install manholes, complete with appurtenances and accessories indicated.
- B. Form continuous concrete channels and benches between inlets and outlet.
- C. 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.
- D. Install precast concrete manhole sections with gaskets according to ASTM C 891.
- E. Construct cast-in-place manholes as indicated.

### 3.8 CATCH-BASIN INSTALLATION

- A. Construct catch basins to sizes and shapes indicated.
- B. Set frames and grates to elevations indicated.

### 3.9 STORM DRAINAGE 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 dissipators at outlets, as indicated.

### 3.10 CONCRETE PLACEMENT

- A. Place cast-in-place concrete according to ACI 318 and ACI 350R.

### 3.11 TAP CONNECTIONS

- A. Make connections to existing piping and underground structures so finished Work complies as nearly as practical with requirements specified for new Work.
- B. 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.
- C. Make branch connections from side into existing piping. 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.
- D. Make branch connections from side into existing piping, NPS 18 or larger, or to underground structures 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 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.

1. Use concrete that will attain minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.
  2. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.
- E. Protect existing piping and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

### 3.12 CLOSING ABANDONED STORM DRAINAGE 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 Structures: Excavate around structure as required and use one procedure below:
1. Remove structure and close open ends of remaining piping.
  2. Remove top of structure 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.
  3. Backfill to grade according to Division 2 Section "Earthwork."

### 3.13 FIELD QUALITY CONTROL

- A. Clear interior of piping and structures of dirt and superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed.
1. In large, accessible piping, brushes and brooms may be used for cleaning.
  2. Place plug in end of incomplete piping at end of day and when work stops.
  3. Flush piping between manholes and other structures to remove collected debris, if required by authorities having jurisdiction.
- B. 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. 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.
- C. 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 authorities having jurisdiction.
  3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
  4. Submit separate reports for each test.
  5. Leaks and loss in test pressure constitute defects that must be repaired.
  6. Replace leaking piping using new materials and repeat testing until leakage is within allowances specified.

END OF SECTION 02630

1.0 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Extent of chain link fences and gates is indicated on drawings.

1.2 QUALITY ASSURANCE

- A. Provide chain link fences and gates as complete units controlled by a single source including necessary erection accessories, fittings, and fastenings.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's technical data, and installation instructions for metal fencing, fabric, gates and accessories.

2.0 - PRODUCTS

2.1 GENERAL

- A. Dimensions indicated for pipe, roll-formed, and H-sections are outside dimensions, exclusive of coatings.

1. Fence shall be as indicated on Drawings.

2.2 STEEL FABRIC

- A. Fabric: Extruded, No. 9 ga., before vinyl coating, size steel wires, 2" mesh, with all top selvages knuckled.

1. Furnish one piece fabric widths.  
2. Vinyl fabric shall be fused and bonded per ASTM F-668-93A Sec. 1.2.3 Class 2b.

2.3 FRAMING AND ACCESSORIES

- A. Steel Framework, General: Vinyl coated frame work shall be SS-20.

1. Fused and bonded PVC coated fittings and accessories.

- B. Provide chain link fence fabric and gates of 2", knuckle and knuckle, copper bearing steel fabric.

- C. End, Corner and Pull Posts: Minimum sizes and weights as follows:

1. Up to 6' fabric height, 2.875" OD steel pipe, 5.79 lbs. Per lin. Ft.  
2. Over 6' fabric height, 3" OD steel pipe.

- D. Line Posts: Space 10' o.c. maximum, unless otherwise indicated, of following minimum sizes and weights.

1. Up to 6' fabric height, 1.90" OD steel pipe, 2.70 lbs. per lin. ft.

2. Over 8' fabric height, 2.875" OD steel pipe, 5.79 lbs. per lin. ft.
- E. Gate Posts: Furnish posts for supporting single gate leaf, or one leaf of a double gate installation, for nominal gate widths as follows:
1. Leaf width up to 6', 2.875" OD pipe, 4.85 lbs. per lin. ft.
- F. Top Rail: Manufacturer's longest lengths, with expansion type couplings, approximately 6" long, for each joint. Provide means for attaching top rail securely to each gate, corner, pull and end post.
1. 1.66" OD pipe, 2.27 lbs. per ft.
- G. Tension Wire: 7-gage, coated coil spring wire used in lieu of bottom rail.
1. Locate at bottom of fabric.
- H. Wire Ties: 11 ga. galvanized steel or 11 ga. aluminum wire, to match fabric core material.
- I. Post Brace Assembly: Manufacturer's standard adjustable brace at end and gate posts and at both sides of corner and pull posts, with horizontal brace located at mid-height of fabric. Use same material as top rail for brace, and truss to line posts with 0.375" diameter rod and adjustable tightener.
- J. Post Tops: Provide weathertight closure cap with loop to receive tension wire or top rail; one cap for each post.
- K. Stretcher Bars: One-piece lengths equal to full height of fabric, with minimum cross-section of 3/16" x 3/4". Provide one stretcher bar for each gate and end post, and two for each corner and pull post, except where fabric is integrally woven into post.
- L. Stretcher Bar Bands: Space not over 15" o.c., to secure stretcher bars to end, Corner, pull, and gate posts.

## 2.4 GATES

- A. Fabrication: Fabricate perimeter frames of gates from metal and finish to match fence framework. Assemble gate frames by welding or with special fittings and rivets for rigid connections, providing security against removal or breakage connections. Provide horizontal and vertical members to ensure proper gate operation and attachment of fabric, hardware and accessories. Space frame members maximum of 8' apart unless otherwise indicated.
1. Provide same fabric as for fence, unless otherwise indicated. Install fabric with stretcher bars at vertical edges and at top and bottom edges. Attach stretcher bars to gate frame at not more than 15" o.c.
  2. Install diagonal cross-bracing consisting of 3/8" diameter adjustable length truss rods on gates to ensure frame rigidity without sag or twist.
- B. Swing Gates: Fabricate perimeter frames of minimum 1.90" OD pipe.
- C. Gate Hardware: Provide hardware and accessories for each gate, galvanized per ASTM A 153, and in accordance with the following:

1. Hinges: Size and material to suit gate size, non-lift-off type, offset to permit 180 degree gate opening. Provide 1-1/2 pair of hinges for each leaf over 6" nominal height.
  2. Latch: Forked type or plunger-bar type to permit operation from either side of gate, with padlock eye as integral part of latch.
- D. Concrete: Provide concrete consisting of portland cement, ASTM C 150, aggregates, ASTM C 33, and clean water. Mix materials to obtain concrete with a minimum 28-day compressive strength of 2500 psi using at least 4 sacks of cement per cu. yd., 1" maximum size aggregate, maximum 3" slump, and 2% to 4% entrained air.

### 3.0 – EXECUTION

#### 3.1 INSTALLATION

- A. Do not begin installation and erection before final grading is completed, unless otherwise permitted.
- B. Excavation: Drill or hand excavate (using post hole digger) holes for posts to diameters and spacings indicated, in firm, undisturbed or compacted soil.
1. If not indicated on drawings, excavate holes for each post to minimum 12" diameter.
  2. Unless otherwise indicated excavate hole depths approximately 3" lower than post bottom, with bottom of posts set not less than 36" below finish grade surface.
- C. Setting Posts: Center and align posts in holes 3" above bottom of excavation.
1. Place concrete around posts and vibrate or tamp for consolidation. Check each post of vertical and top alignment, and hold in position during placement and finishing operations.
  2. Unless otherwise indicated, top of concrete footings shall be 2" below finish grade.
- D. Top Rails: Run rail continuously through post caps, bending to radius for curved runs. Provide expansion couplings as recommended by fencing manufacturer.
- E. Center Rails: Provide center rails where indicated. Install in one piece between posts and flush with post on fabric side, using special offset fittings where necessary.
- F. Brace Assemblies: Install braces so posts are plumb when diagonal rod is under proper tension.
- G. Tension wire: Install tension wires through post cap loops before stretching fabric and tie to each post cap with not less than 6 ga. galvanized wire. Fasten fabric to tension wire using 11 ga. galvanized steel hog rings spaced 24" o.c.
- H. Fabric: Leave approximately 2" between finish grade and bottom selvage, unless otherwise indicated. Pull fabric taut and tie to posts, rails and tension wires. Install fabric on security side of fence, and anchor to framework so that fabric remains in tension after pulling force is released.

- I. Stretcher Bars: Thread through or clamp to fabric 4" o.c., and secure to posts with metal bands spaced 15" o.c.
- J. Gates: Install gates plumb, level, and secure for full opening without interference. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.
- K. Tie Wires: Use U-shaped wire, conforming to diameter of pipe to which attached, clasping pipe and fabric firmly with ends twisted at least two full turns. Bend ends of wire to minimize hazard to persons or clothing.
- L. Tie fabric to line posts, with wire ties spaced 12" o.c. Tie fabric to rails and braces, with wire ties spaced 24" o.c. Tie fabric to tension wires, with hog rings spaced 24" o.c.
- M. Fasteners: Install nuts for tension bands and hardware bolts on side of fence opposite fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

END OF SECTION 02710

## ALUMINUM ORNAMENTAL FENCE SYSTEM – SECTION 02715

### 1.0 - GENERAL

- 1.1 Work Included  
The contractor shall provide all labor, materials and all necessary items for the installation of the Echelon Plus® ornamental aluminum fence system defined herein.
- 1.2 Related Work  
Section 02300 - Earthwork  
Section 03300 - Concrete
- 1.3 System Description  
The manufacturer shall supply a total ornamental aluminum fencing system of the Ameristar Echelon Plus® Majestic design. The system shall include all components (i.e., pickets, posts, rails, gates and hardware) required.
- 1.4 Quality Assurance  
The contractor shall provide qualified installers who are thoroughly familiar with the type of construction involved and the materials specified.
- 1.5 References  
ASTM B117 - Practice for Operating Salt-Spray (Fog) Apparatus.  
ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles and Tubes.  
ASTM D523 - Test Method for Specular Gloss.  
ASTM D822 - Practice for Conducting Tests on Paint and Related Coatings and Materials using Filtered Open-Flame Carbon-Arc Light and Water Exposure Apparatus.  
ASTM D1654 - Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments.  
ASTM D2244 - Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.  
ASTM D2794 - Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).  
ASTM D3359 - Test Method for Measuring Adhesion by Tape Test.
- 1.6 Submittal  
The manufacturer's submittal package shall be submitted prior to installation to confirm compliance with all requirements for materials specified in this section.
- 1.7 Product Handling And Storage  
Upon receipt at the job site, all materials shall be checked to ensure that no damages occurred during shipping or handling. Materials shall be stored in such a manner to ensure proper ventilation and drainage and to protect against damage, weather, vandalism and theft.

### 2.0 - MATERIALS

- 2.1 Manufacturer
- A. The ornamental fence system shall conform to Ameristar's Echelon Plus aluminum ornamental fencing as used in this specification as Basis of Design, Majestic style manufactured by Ameristar Fence Products, Inc.
- B. Other manufacturers may submit their product for pre-approval to the Architect at least 10 days prior to bid. Comply with Section 01360 - Product Substitution.



## 2.2 Material

- A. Aluminum material for fence framework (i.e., tubular pickets, rails and posts) shall conform to the requirements of ASTM B221. The aluminum extrusions for posts and rails shall be Alloy and Temper Designation 6005-T52. The aluminum extrusions for pickets shall be Alloy and Temper Designation 6063-T52.
- B. Pickets shall be 3/4" square x .045" thick. Horizontal rails shall be 1-1/4" x 1-7/16" Forerunner™ channel with .060" thick top & internal web wall, and .090" thick side walls and shall be punched to allow picket to pass through the top of the rail. The Forerunner rail shall be constructed with an internal web insert providing a raceway for the pickets to be retained with a 1/8" retaining rod. The number of rails shall vary with the style, height and strength as determined by manufacturer. Fence posts and gate posts shall meet the minimum size requirements of manufacturer.
- C. Accessories: Aluminum castings shall be used for all post caps, scrolls, finials, and other miscellaneous hardware. Hinges and latches shall be fabricated from aluminum, stainless steel or composite materials as required to achieve intended design function.

## 2.3 Fabrication

- A. Pickets, rails and posts shall be pre-cut to specified lengths. ForeRunner rails shall be pre-punched to accept pickets. Grommets shall be inserted into the pre-punched holes in the rails and pickets shall be inserted through the grommets so that pre-drilled picket holes align with the internal upper raceway of the ForeRunner rails. Retaining rods shall be inserted into each ForeRunner rail so that they pass through the pre-drilled holes in each picket, thus completing the panel assembly.
- B. The manufactured framework shall be subjected to the Ameristar thermal stratification coating process as a minimum, a six-stage pretreatment/wash and an electrostatic spray application of a polyester finish. The topcoat shall be a "no-mar" TGIC polyester powder coat finish with a minimum thickness of 2 mils (0.0508mm). The color shall be as approved by Architect to match existing.
- C. Finish: All fence components shall be subject to a six-stage pretreatment/wash followed by an electrostatic spray application of a "no-mar" TGIC polyester powder coat finish with a minimum thickness of 2-4 mils. The color shall be as approved by Architect to match existing.
- D. Completed panels shall be capable of supporting a 200 lb. load (applied at midspan) without permanent deformation. Panels without rings shall be biasable to a 12.5% change in grade.
- E. Swing gates shall be fabricated using 1-1/4" x 1-7/16" Forerunner rail, 1.75" sq. x .125" gate ends, and 3/4" sq. x .080 pickets. Gates that exceed 6' in width will have a 1.75" sq. x .125" intermediate upright. All rail and upright intersections shall be joined by welding. All picket and rail intersections shall also be joined by welding.

## 3.0 - EXECUTION

### 3.1 Preparation

All new installation shall be laid out by the contractor in accordance with the construction plans.

### 3.2 Fence Installation

Fence post shall be spaced according to Table 3, plus or minus 1/2". For installations that must be raked to follow sloping grades, the post spacing dimension must be measured along the grade. Fence panels shall be attached to posts with brackets supplied by the

manufacturer. Posts shall be set in concrete footers 33" depth recommended (Note: In some cases, local restrictions of freezing weather conditions may require a greater depth). The "Earthwork" and "Concrete" sections of this specification shall govern material requirements for the concrete footer. Posts setting by other methods such as plated posts or grouted core-drilled footers are permissible only if shown by engineering analysis to be sufficient in strength for the intended application.

3.3 Fence Installation Maintenance

When cutting/drilling rails or posts adhere to the following steps to seal the exposed surfaces:

1. Remove all metal shavings from cut area.
2. Apply custom finish paint matching fence color. Failure to seal exposed surfaces per steps 1 & 2 above will negate warranty. Ameristar spray cans or paint pens shall be used to finish exposed surfaces; it is recommended that paint pens be used to prevent overspray. Use of non-Ameristar parts or components will negate the manufactures' warranty.

3.4 Gate Installation

Gate posts shall be spaced according to the manufacturers' gate drawings, dependent on standard out-to-out gate leaf dimensions and gate hardware selected. Type and quantity of gate hinges shall be based on the application; weight, height, and number of gate cycles. The manufacturers' gate drawings shall identify the necessary gate hardware required for the application. Gate hardware shall be provided by the manufacture of the gate and shall be installed per manufacturer's recommendations.

3.5 Cleaning

The contractor shall clean the jobsite of excess materials; post-hole excavations shall be scattered uniformly away from posts.

**Table 1 – Minimum Sizes for Echelon Plus Posts**

Fence Posts		Panel Height		
2-1/2" x 2-1/2" x .060" w/ reinforced web		Up to 6' Height		
Gate Leaf	Gate Height			
	Up to & Including 4'	Over 4' Up to & Including 5'	Over 5' Up to & Including 6'	
Up to 4'	2 1/2" x 2-1/2" x .060" Alum.	3" x 3" x .120" Alum.	4" x 4" x .250" Alum. or 3" x 3" x 12ga. Steel	
4'1" to 6'	3" x 3" x .120" Alum.	4" x 4" x .250" Alum. or 3" x 3" x 12ga. Steel	3" x 3" x 12ga. Steel	
6'1" to 8'	4" x 4" x .250" Alum. or 3" x 3" x 12ga. Steel	4" x 4" x 11ga. Steel	4" x 4" x 11ga. Steel	

**Table 2 – Coating Performance Requirements**

Quality Characteristics	ASTM Test Method	Performance Requirements
Adhesion	D3359 – Method B	Adhesion (Retention of Coating) over 90% of test area (Tape and knife test).
Corrosion Resistance	B117 & D1654	Corrosion Resistance over 1000 hours (Scribed per D1654; failure mode is accumulation of 1/8" coating loss from scribe or medium #8 blisters).
Impact Resistance	D2794	Impact Resistance over 60 inch lb. (Forward impact using 0.625" ball).
Weathering Resistance	D822, D2244, D523 (60' Method)	Weathering Resistance over 1,000 hours (Failure mode is 60% loss of gloss or color variance of more than 3 delta-E color units).

**Table 3 – Echelon Plus – Post Spacing By Bracket Type**

8' Nominal (91-3/4" Rail)					
Span	8' Nominal (91-3/4" Rail)				
Post Size	2-1/2"	2-1/2"	3"	2-1/2"	3"
Bracket Type	Echelon Plus Line Boulevard (ABB3)	Echelon Plus Swivel* (ABB2)		Echelon Plus Flat Mount (ABB1)	
Post Settings ± 1/2" O.C.	95"	*95"	*95-1/2"	95"	95-1/2"
6' Nominal (73-1/16" Rail)					
Span	6' Nominal (73-1/16" Rail)				
Post Size	2-1/2"	2-1/2"	3"	2-1/2"	3"
Bracket Type	Echelon Plus Line Boulevard (ABB3)	Echelon Plus Swivel* (ABB2)		Echelon Plus Flat Mount (ABB1)	
Post Settings ± 1/2" O.C.	76-1/4"	*76-1/4"	*76-3/4"	76-1/4"	76-3/4"

\*Note: When using ABB2 swivel brackets on either or both ends of a panel installation, care must be taken to ensure the spacing between post and adjoining pickets meets applicable codes. This will require trimming one or both ends of the panel.

END OF SECTION

## 1.0 GENERAL

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

## 1.2 SUMMARY:

- A. Furnish all labor, materials, tools and equipment necessary to install all synthetic turf as indicated on the Drawings. The installation of all new materials shall be performed in strict accordance with the manufacturer's installation instructions and in accordance with all approved shop drawings.
- B. Perimeter edge attachment required for the system shall be as shown on the Drawings and as recommended by the manufacturer.
- C. Related Work includes:
  - 1. Section 02710 - Synthetic Turf Base and Drainage

## 1.3 SUBMITTALS:

- A. At time of bid opening or within 3 days if deemed apparent lowest bid, For Landscape Architect approval of the specified synthetic turf system submit (Owner reserves right to refuse bid based on failure to provide information and/or comply with this requirement):
  - 1. Specify in writing the turf system does not violate any other manufacturer's patents, patents allowed or patents pending.
  - 2. Standard printed specifications of the synthetic turf system to be installed on this project along with Manufacturer's data.
  - 3. An affidavit attesting that the synthetic turf material to be installed meets the requirements defined by the manufacturer's currently published specifications and any modifications outlined in those technical specifications.
  - 4. Certify that the crumb rubber infill (CRI) is derived from only used, whole, vulcanized automobile, SUV, or truck tires and produced in compliance with North American tire manufacturing specifications. Shipment and/or Order Certification shall include at least the following information:
    - a. Type and origin of raw material (certify that it comes from tires)
    - b. Production facility
    - c. Production method (cryogenic or ambient)
    - d. Fiber content (%)
    - e. CRI sieve/gradation analysis
  - 5. Warranty assigned to all turf products.
  - 6. Written verification of both Manufacturer and Installer Quality Assurance specifications (same section) being met.
  - 7. Submit the fiber manufacturer's name, type of fiber, composition of fiber, and origin.
  - 8. Notify the Owner in writing of any class-action lawsuits, bankruptcies, and/or field failures associated with Manufacturer and/or Installer.
- B. Prior to ordering of materials, Landscape architect to approve:
  - 1. Shop Drawings indicating:
    - a) Field Layout
    - b) Field Marking Plan and details.
    - c) Roll/Seaming Layout
    - d) Methods of attachment and perimeter conditions.
    - e) Installation details; edge detail, other insets and covers.
  - 2. Three (3) synthetic turf samples, min. 12" x 12" in size, of each type and color of the same synthetic turf to be installed.

- C. Prior to Final Acceptance, submit to the Owner:
  1. Three (3) copies of Maintenance Manuals, which will include all necessary instructions for the proper care and preventative maintenance of the synthetic turf system, including painting and markings.
  2. Project Record Documents: Record actual locations of seams, drains or other pertinent information.
  3. Warranty: Submit Manufacturer Warranty and ensure that forms have been completed in Owner's name and registered with Manufacturer
  4. Proof of all infill material and quantity delivered to site.
  5. Within 30 days of field completion, or at owner-approved time, provide the necessary testing data to the owner that the finished field meets the required shock attenuation, as per ASTM F1936 (Baseball and Softball infields and warning tracks excluded).

1.4 STANDARDS:

- A. ASTM Standard Test Methods (latest standards):
  - D1577- Standard Test Method for Linear Density of Textile Fiber
  - D5848- Standard Test Method for Mass Per Unit Area of Pile Yarn Floor Covering
  - D418- Standard Test Method for Testing Pile Yarn Floor Covering Construction
  - D1338- Standard Test Method for Tuft Bind of Pile Yarn Floor Coverings
  - D1682- Standard Method of Test for Breaking Load and Elongation of Textile Fabrics
  - D5034- Standard Test Method of Breaking Strength and Elongation of Textile Fabrics (Grab Test)
  - F1015- Standard Test Method for Relative Abrasiveness of Synthetic Turf Playing Surfaces
  - D4491- Standard Test Methods for Water Permeability of Geotextiles by Permittivity
  - D2859- Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials
  - F355- Standard Test Method for Shock-Absorbing Properties of Playing Surfaces.
  - F1936- Standard Test Method for Shock-Absorbing Properties of North American Football Field Playing Systems as Measured in the Field
  - D1557- Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort.
- B. National Federation of State High School Associations (NFHS)
- C. The Synthetic Turf Council, Inc., Suggested Guidelines for Crumb Rubber in Synthetic Turf Systems.
- D. The Synthetic Turf Council, Inc., Guidelines for the Essential Elements of Synthetic Turf Fields.

1.5 QUALITY ASSURANCE:

- A. Manufacturer Qualifications:
  1. Company specializing in manufacturing products specified in this section.
  2. Experienced in the manufacture and installation of specified type of infilled grass system for a minimum of three years and minimum of 10 completed NFHS Baseball/Softball Fields of like size and character within last 2 years. This includes use of a fiber, backing, the backing coating, and the installation method.
  3. Have ISO 9001, ISO 14001 and OHSAS 18001 certifications demonstrating its manufacturing efficiency with regards to quality, environment, and safety management systems.

- B. Installer Qualifications:
  - 1. Provide competent workmen skilled in this specific type of synthetic grass installation.
  - 2. The designated Supervisory Personnel on the project must be certified, in writing by the turf Manufacturer, as competent in the installation of this material, including sewing seams and proper installation of the infill mixture. Prove minimum of 10 completed NFHS Baseball/Softball Fields of like size and character within last 3 years.
  - 3. The Manufacturer shall have a representative on site to certify the installation and Warranty compliance.
- C. Prior to the beginning of installation, the installer of the synthetic turf shall inspect the sub-base and accept in writing the sub-base surface planarity and compaction. The Installer shall have the dimensions of the field and locations for markings measured by a registered surveyor to verify conformity to the specifications and applicable standards. A record of the finished field as-built measurements shall be made.

#### 1.6 DELIVERY, STORAGE AND HANDLING:

- A. Deliver products to project site in wrapped condition.
- B. Store products under cover and elevated above grade.

#### 1.7 WARRANTIES:

- A. Refer to General Conditions of the Contract, Article 35 for additional requirements.
- B. Provide a warranty to the owner that covers defects in materials and workmanship of the turf for a period of 8 years from the date of Substantial Completion. The turf manufacturer must verify that their onsite representative has inspected the installation and that the work conforms to the manufacturer's requirements.
- C. The manufacturer's warranty shall include general wear and damage caused from UV degradation. The warranty shall specifically exclude vandalism and acts of God beyond the control of the owner or the manufacturer.
- D. Provide a Warranty to the owner that covers defects in the installation workmanship, and further warrant that the installation was done in accordance with both the manufacturer's recommendations and any written directives of the Manufacturer's onsite representative.
- E. All turf warranties shall be non-prorated, limited to repair or replacement of the affected areas, at the option of the Manufacturer, and shall include all necessary materials, labor, transportation costs, etc. to complete said repairs. All warranties are contingent on the full payment by the Owner of all pertinent invoices.

#### 1.8 MAINTENANCE SERVICE

- A. Train the Owner's facility maintenance staff in the use of the turf Manufacturer's recommended grooming equipment.
- B. Train the Owner's facility maintenance staff in daily maintenance and proper upkeep of the field.

## 2.0 - PRODUCTS

### 2.1 GENERAL

- A. The turf fabric shall be manufactured and installed by a sole responsible entity. Installation "subcontractors" shall not be permitted unless pre-qualified and approved by the Landscape Architect.
- B. All components and their installation method shall be designed and manufactured for the use on outdoor athletic fields. The materials specified are to withstand full climate exposure, be resistant to insect infestation, rot, fungus, mildew, ultra-violet light and heat degradation, and shall have the basic characteristics of flow through drainage, allowing free movement of surface run-off through the turf and into the subsurface drainage layer.
- C. The finished playing surface shall appear as mowed grass with no irregularities.

### 2.2 SYNTHETIC TURF SYSTEM:

- A. Approved manufacturers are as follows:
  - 1. AstroTurf
  - 2. Shaw Sports Turf
  - 3. FieldTurf
  - 4. SprinTurf
  - 5. Tencate/GeoSurfaces/Greenfields
  - 6. Approved Substitutes
- B. Synthetic Turf
  - 1. Infield: Max. 2" pile ht.; Min. 55 oz w/ thatch
  - 2. Outfield: Max. 2 1/4" pile ht.; min. 46 oz face wt.
  - 3. Hitting Cage (over concrete): Max. 1" pile ht.; Non-infilled, polyethylene slit-film with PE or nylon thatch; min. 58 oz. face wt.; Min. 5mm attached pad.
  - 4. Bullpens (over stone): Match infield
  - 5. Replacement Panels: Min. Match adjacent turf system. Notify LA if different turf characteristics are preferred
- C. Infill
  - 1. Warning track: SafeShell/Olive Pit/Approved Substitute with Sand
  - 2. Infield: SafeShell/Olive Pit/Approved Substitute with Sand
  - 3. Outfield Grass: Crumb Rubber with Sand
  - 4. All: min. 5 1/2 LBS/SF infill, ratio determined by MFGR system requirements
- D. Pad – None required unless specifically noted above.
- E. Colors – Required colors for owner selection include white, clay, tan, light brown, brown, dark green, light green, dark/light green blend.

### 2.3 FIELD EQUIPMENT

- A. None Required

### 3.0 EXECUTION

#### 3.1 GENERAL:

- A. The installation shall be performed in full compliance with approved Shop Drawings.
- B. Only trained technicians, skilled in the installation of athletic synthetic turf systems working under the direct supervision of the approved installer supervisors, shall undertake any cutting, sewing, gluing, topdressing or brushing operations.
- C. The designated supervisory personnel on the project must be certified, in writing by the turf Manufacturer, as competent in the installation of the system.
- D. All designs, markings, layouts, and materials shall conform to all currently applicable NFHS rules and other standards that may apply to this type of synthetic grass installation.

#### 3.2 EXAMINATION:

- A. Verify that all sub-base, drainage and leveling is complete prior to installation.
- B. The surface to receive the synthetic turf shall be inspected by the Installer, and prior to the beginning of installation, the Installer must accept in writing the sub-base surface planarity and compaction. The surface must be perfectly clean as installation commences and shall be maintained in that condition throughout the process.
- C. The compaction of the aggregate base shall be 95%, according to Standard Proctor, and the surface tolerance shall not exceed 0-1/4 inch over 10 feet and 0-1/2" from design grade.

#### 3.3 INSTALLATION:

- A. Install system in accordance with Manufacturer's instructions. Any variance from these requirements must be accepted in writing, by the Manufacturer's onsite representative, and submitted to the Landscape Architect/Owner, verifying that the changes do not in any way affect the warranty. Infill materials shall be approved by the Manufacturer and installed in accordance with the Manufacturer's standard procedures.
- B. The turf rolls are to be installed directly over the properly prepared base. Extreme care should be taken to avoid disturbing the base, both in regard to compaction and planarity. Repair and properly compact any disturbed areas of the base.
- C. The full width rolls shall be laid out across the field. Turf shall be of sufficient length to permit full cross-field installation from sideline to sideline. No head or cross seams will be allowed in the main playing area between the sidelines. Utilizing sewing procedures, each roll shall be attached to the next. When all of the rolls of the playing surface have been installed, the sideline areas shall be installed at right angles to the playing field turf.
- D. Install specific inlays as required by the drawings and specifications and in accordance with the Manufacturer's standard procedures.
- E. Apply infill materials in numerous thin lifts. Brush turf as the mixture is applied. Place so that fiber reveal is 3/4" to 1/2".
- F. Install the infill to fill the voids between the fibers and allow the fibers to remain vertical and non-directional.



- G. Attach turf to the perimeter edge detail in accordance with the Manufacturer's standard procedures. Edge detail shall result in a straight, tight, firmly attached edge that will resist de-lamination forces associated with normal play and use.
- H. Provide Hook/Loop replacement panels at all Pitching Panes at initial install. Initial installation of Hook/Loop Batter's and Catcher's boxes is optional. If not provided at initial install, MFGR agrees to install first replacement at owner's request within warranty period. See quantity requirement in same specification section. Verify with owner prior to construction.

3.4 FIELD MARKINGS:

- A. The field will have the following lines tufted:
  - 1. NFHS Softball standards
  - 2. Additional shown on Drawings

3.5 CLEANING:

- A. Protect installed turf from subsequent construction operations.
- B. Do not permit traffic over unprotected surface.
- C. Provide the labor, supplies, and equipment as necessary for final cleaning of surfaces and installed items.
- D. All usable remnants of new material shall become the property of the Owner.
- E. Keep the area clean throughout the project and clear of debris.
- F. Clean as necessary to leave the work area in a clean, immaculate condition ready for immediate occupancy and use by the Owner.

3.6 OTHER MATERIALS AND EQUIPMENT:

- A. Repair Materials – Upon substantial completion, provide directly to Owner the following items in the minimum quantities indicated (per field):
  - 1. Turf Fabric, 500 s.f. (each color) with at least one piece 15' wide and 30' long
  - 2. 4" width Color Fabric, Minimum 100 l.f. of each color specified for inlaid line striping.
  - 3. Rubber – Construction Surplus only
  - 4. Sand – Construction Surplus only
  - 4. Natural infill – Pallet of Totable weatherproof bags.
- B. Replacement Panels (per field):
  - 1. Provide four (4) Catcher/batter boxes.
  - 2. Provide eight (8) pitcher's lanes.

END OF SECTION

1.0 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
  - 1. Hot-mix asphalt paving.
  - 2. Hot-mix asphalt patching.
  - 3. Hot-mix asphalt paving overlay.
  - 4. Asphalt surface treatments.
  - 5. Pavement-marking paint.
  - 6. Cold milling of existing hot-mix asphalt pavement.
- B. Related Sections include the following:
  - 1. Division 2 Section "Earthwork" for aggregate base courses.

1.3 DEFINITIONS

- A. Hot-Mix Asphalt Paving Terminology: Refer to ASTM D 8 for definitions of terms.
- B. DOT: Department of Transportation.

1.4 SYSTEM DESCRIPTION

- A. Provide hot-mix asphalt paving according to materials, workmanship, and other applicable requirements of standard specifications of state or local DOT. Retain first subparagraph below if standard specifications are indicated on Drawings.
  - 1. Standard Specification: Alabama Department of Transportation (ALDOT) "Standard specifications for highway construction" latest edition.
  - 2. Measurement and payment provisions and safety program submittals included in the standard specifications do not apply to this Section.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.
- B. Job-Mix Designs: For each job mix proposed for the Work.
- C. Material Test Reports: For each paving material.
- D. Material Certificates: For each paving material, signed by manufacturers.

1.6 QUALITY ASSURANCE

- A. **Manufacturer Qualifications:** A qualified manufacturer.
  - 1. Manufacturer shall be a paving-mix manufacturer registered with and approved by authorities having jurisdiction or the DOT of the state in which Project is located.
- B. **Testing Agency Qualifications:** Qualified according to ASTM D 3666 for testing indicated, as documented according to ASTM E 548.
- C. **Regulatory Requirements:** Comply with "Standard Specifications for Highway Construction" latest edition of ALDOT for asphalt paving work.
- D. **Asphalt-Paving Publication:** Comply with AI MS-22, "Construction of Hot Mix Asphalt Pavements," unless more stringent requirements are indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.
- B. Store pavement-marking materials in a clean, dry, protected location within temperature range required by manufacturer. Protect stored materials from direct sunlight.

1.8 PROJECT CONDITIONS

- A. **Environmental Limitations:** Do not apply asphalt materials if subgrade is wet or excessively damp or if the following conditions are not met:
  - 1. Prime and Tack Coats: Minimum surface temperature of 60 deg F.
  - 2. Slurry Coat: Comply with weather limitations of ASTM D 3910.
  - 3. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
  - 4. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.
- B. **Pavement-Marking Paint:** Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for oil-based materials, 50 deg F for water-based materials, and not exceeding 95 deg F.

2.0 - PRODUCTS

2.1 AGGREGATES

- A. **General:** Use materials and gradations that have performed satisfactorily in previous installations.
- B. **Coarse Aggregate:** Course aggregate shall comply with ALDOT Section 801.
- C. **Fine Aggregate:** Fine aggregate shall comply with ALDOT Section 802.

1. For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.

D. Mineral Filler: Mineral filter shall comply with ALDOT Section 805.

## 2.2 ASPHALT MATERIALS

A. Base course: Place to width and depth shown and comply with ALDOT Section 825, Type B.

B. Asphalt Binder: Bituminous concrete binder layer to width and depth shown on the drawings in accordance with ALDOT Section 424B.

C. Prime Coat: Shall be in accordance with ALDOT Section 401.

D. Tack Coat: Shall be in accordance with ALDOT Section 405.

E. Surface Course: Shall be in accordance with ALDOT Section 424A.

F. Water: Potable.

## 2.3 AUXILIARY MATERIALS

A. Herbicide: Commercial chemical for weed control, registered by the EPA. Provide in granular, liquid, or wet-able powder form.

B. Sand: ASTM D 1073, Grade Nos. 2 or 3.

C. Joint Sealant: ASTM D 3405, hot-applied, single-component, polymer-modified bituminous sealant.

D. Pavement-Marking Paint: Alkyd-resin type, lead and chromate free, ready mixed, complying with FS TT-P-115, Type I or AASHTO M 248, Type N.

1. Color: As indicated on the drawings.

## 2.4 MIXES

A. Hot-Mix Asphalt: Dense, hot-laid, hot-mix asphalt plant mixes meeting the requirements of the applicable sections of the ALDOT "Standard Specifications for Highway Construction" and complying with the following requirements:

1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.
2. Base Course: ALDOT 825, Type B.
3. Binder Course ALDOT 424B.
4. Surface Course: ALDOT 424A.

## 3.0 - EXECUTION

### 3.1 EXAMINATION

A. Verify that subgrade is dry and in suitable condition to support paving and imposed loads.

B. Verify that subgrade elevation is as indicated on the drawings.

- C. Proof-roll subbase using heavy, pneumatic-tired rollers to locate areas that are unstable or that require further compaction.
- D. Proceed with paving only after unsatisfactory conditions have been corrected.

### 3.2 COLD MILLING

- A. Clean existing pavement surface of loose and deleterious material immediately before cold milling. Remove existing asphalt pavement by cold milling to grades and cross sections indicated.
  - 1. Mill to a depth of 1-1/2 inches.
  - 2. Mill to a uniform finished surface free of gouges, grooves, and ridges.
  - 3. Control rate of milling to prevent tearing of existing asphalt course.
  - 4. Repair or replace curbs, manholes, and other construction damaged during cold milling.
  - 5. Excavate and trim unbound-aggregate base course, if encountered, and keep material separate from milled hot-mix asphalt.
  - 6. Transport milled hot-mix asphalt to asphalt recycling facility.
  - 7. Keep milled pavement surface free of loose material and dust.

### 3.3 PATCHING

- A. Hot-Mix Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into 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. Pump hot undersealing asphalt under rocking slabs until slab is stabilized or, if necessary, crack slab into pieces and roll to reseat pieces firmly.
  - 2. Remove disintegrated or badly cracked pavement. Excavate rectangular or trapezoidal patches, extending into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Recompact existing unbound-aggregate base course to form new subgrade.
- C. Tack Coat: Apply uniformly to vertical surfaces abutting or projecting into new, hot-mix asphalt paving 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. Patching: Partially fill excavated pavements with hot-mix asphalt base mix and, while still hot, compact. Cover asphalt base course with compacted, hot-mix surface layer finished flush with adjacent surfaces.

### 3.4 REPAIRS

- A. **Leveling Course:** Install and compact leveling course consisting of hot-mix asphalt surface course to level sags and fill depressions deeper than 1 inch in existing pavements.
  - 1. Install leveling wedges in compacted lifts not exceeding 3 inches thick.
- B. **Crack and Joint Filling:** Remove existing joint filler material from cracks or joints to a depth of.
  - 1. Clean cracks and joints in existing hot-mix asphalt pavement.
  - 2. Use emulsified-asphalt slurry to seal cracks and joints less than 1/4 inch wide. Fill flush with surface of existing pavement and remove excess.
  - 3. Use hot-applied joint sealant to seal cracks and joints more than 1/4 inch wide. Fill flush with surface of existing pavement and remove excess.

### 3.5 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.
  - 1. Sweep loose granular particles from surface of unbound-aggregate base course. Do not dislodge or disturb aggregate embedded in compacted surface of base course.
- B. **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.
  - 1. Mix herbicide with prime coat if formulated by manufacturer for that purpose.
- C. **Prime Coat:** Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.3 to 0.50 gal./sq. yd. Apply in accordance with ALDOT Section 401.03 (d) 4. Apply enough material to penetrate and seal but not flood surface. Allow prime coat to cure for 72 hours minimum.
  - 1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
  - 2. Protect primed substrate from damage until ready to receive paving.
- 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.

### 3.6 HOT-MIX ASPHALT PLACING

- A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to 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. Place hot-mix asphalt base course in number of lifts and thicknesses indicated.
  2. Place hot-mix asphalt surface course in single lift.
  3. Spread mix at minimum temperature of 250 deg F.
  4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes, unless otherwise indicated.
  5. 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.
1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete a section of asphalt base course before placing asphalt surface course.
- 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.

### 3.7 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 as described in AI MS-22, "Construction of Hot Mix Asphalt Pavements."
  5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
  6. Compact asphalt at joints to a density within 2 percent of specified course density.

### 3.8 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 vibratory-plate compactors in areas inaccessible to rollers.
1. Complete compaction before mix temperature cools to 185 deg F (85 deg C).
- 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: 96 percent of reference laboratory density according to AASHTO T 245, but not less than 94 percent nor greater than 100 percent.
  - 2. Average Density: 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent nor 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. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.
- G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
- H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

### 3.9 INSTALLATION TOLERANCES

- A. 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. 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.

### 3.10 PAVEMENT MARKING

- A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.
- B. Allow paving to age for 15 days before starting first coat of pavement marking. Second coat shall be placed 30 – 60 days after the first coat.



- C. Sweep and clean surface to eliminate loose material and dust.
- D. Apply 2 coats of paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils per coat.

3.11 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and to prepare test reports.
  - 1. Testing agency will conduct and interpret tests and state in each report whether tested Work complies with or deviates from specified requirements.
- B. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- C. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.
- D. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.
- E. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to ASTM D 979.
  - 1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.
  - 2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.
    - a. One core sample will be taken for every 1000 sq. yd. or less of installed pavement, with no fewer than 3 cores taken.
    - b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.
- F. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.12 DISPOSAL

- A. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill.
  - 1. Do not allow excavated materials to accumulate on-site.

END OF SECTION 02741

SITE CONCRETE WALKS, CURBS & PAVING - SECTION 02751

1.0 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes exterior cement concrete for the following:
1. Driveways and roadways.
  2. Parking lots.
  3. Curbs and gutters.
  4. Walkways.
  5. Site walls and footings.
- B. Related Sections include the following:
1. Division 2 Section "Earthwork" for subgrade preparation, grading, and subbase course.

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, expansive hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume.

1.4 SUBMITTALS

- A. Product Data: For each type of manufactured material and product indicated.
- B. Design Mixes: For each concrete pavement mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.
- C. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated, based on comprehensive testing of current materials:
- D. Material Certificates: Signed by manufacturers certifying that each of the following materials complies with requirements:
1. Cementitious materials and aggregates.
  2. Steel reinforcement and reinforcement accessories.
  3. Fiber reinforcement.
  4. Admixtures.
  5. Curing compounds.
  6. Applied finish materials.
  7. Bonding agent or adhesive.
  8. Joint fillers.

## 1.5 QUALITY ASSURANCE

- A. **Installer Qualifications:** An experienced installer who has completed pavement work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. **Manufacturer Qualifications:** Manufacturer of ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.
  - 1. **Manufacturer must be certified according to the National Ready Mix Concrete Association's Plant Certification Program.**
- C. **Testing Agency Qualifications:** An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.
- D. **Source Limitations:** Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant and each aggregate from one source.
- E. **ACI Publications:** Comply with ACI 301, "Specification for Structural Concrete," unless modified by the requirements of the Contract Documents.
- F. **Concrete Testing Service:** Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixes.

## 1.6 PROJECT CONDITIONS

- A. **Traffic Control:** Maintain access for vehicular and pedestrian traffic as required other construction activities.

## 2.0 - PRODUCTS

### 2.1 FORMS

- A. **Form Materials:** Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.
  - 1. **Use flexible or curved forms for curves of a radius 100 feet or less.**
- B. **Form-Release Agent:** Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

### 2.2 STEEL REINFORCEMENT

- A. **Plain-Steel Welded Wire Fabric:** ASTM A 185, fabricated from as-drawn steel wire into flat sheets.
- B. **Deformed-Steel Welded Wire Fabric:** ASTM A 497, flat sheet.
- C. **Epoxy-Coated Welded Wire Fabric:** ASTM A 884, Class A, plain steel.
- D. **Reinforcement Bars:** ASTM A 615/A 615M, Grade 60 deformed.

- E. Epoxy-Coated Reinforcement Bars: ASTM A 775; with ASTM A 615, Grade 60, deformed bars.
- F. Steel Bar Mats: ASTM A 184; with ASTM A 615, Grade 60, deformed bars; assembled with clips.
- G. Plain Steel Wire: ASTM A 82, as drawn.
- H. Epoxy-Coated Wire: ASTM A 884, Class A coated, plain steel.
- I. Joint Dowel Bars: Plain steel bars, ASTM A 615, Grade 60. Cut bars true to length with ends square and free of burrs.
- J. Epoxy-Coated Joint Dowel Bars: ASTM A 775; with ASTM A 615, Grade 60, plain steel bars.
- K. Tie Bars: ASTM A 615, Grade 60, deformed.
- L. Hook Bolts: ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6), internally and externally threaded. Design hook-bolt joint assembly to hold coupling against pavement form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.
- M. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcement bars, welded wire fabric, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete or fiber-reinforced concrete of greater compressive strength than concrete, and as follows:
  - 1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.
  - 2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer coated wire bar supports.
- N. Epoxy Repair Coating: Liquid two-part epoxy repair coating, compatible with epoxy coating on reinforcement.

### 2.3 CONCRETE MATERIALS

- A. General: Use the same brand and type of cementitious material from the same manufacturer throughout the Project.
- B. Portland Cement: ASTM C 150, Type I or II.
  - 1. Fly Ash: ASTM C 618, Class F or C. Use one brand of cement throughout project unless otherwise accepted.
  - 2. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
- C. Blended Hydraulic Cement: ASTM C 595M, Type IS, portland blast-furnace slag cement.
- D. Blended Hydraulic Cement: ASTM C 595M, Type IP portland pozzolan cement.

- E. Blended Hydraulic Cement: ASTM C 595M, Type I (PM) pozzolan-modified portland cement.
- F. Blended Hydraulic Cement: ASTM C 595M, Type I (SM) slag-modified portland cement.
- G. Aggregate: ASTM C 33, uniformly graded, from a single source, with coarse aggregate as follows:
  - 1. Class: 4S.
  - 2. Class: 4M.
  - 3. Class: 1N.
  - 4. Maximum Aggregate Size: 1-1/2 inches nominal.
  - 5. Maximum Aggregate Size: 1 inch nominal.
  - 6. Maximum Aggregate Size: 3/4 inch nominal.
  - 7. Do not use fine or coarse aggregates containing substances that cause spalling.
- H. Water: ASTM C 94.

#### 2.4 ADMIXTURES

- A. General: Admixtures certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cement and to be compatible with other admixtures.
- B. Air-Entraining Admixture: ASTM C 260.
- C. Water-Reducing Admixture: ASTM C 494, Type A.
- D. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
- E. Water-Reducing Non-Chloride Accelerating Admixture: ASTM C 494, Type E.
- F. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.

#### 2.5 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) 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.
- E. Clear Solvent-Borne Liquid-Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.
- F. Clear Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

- G. White Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type 2, Class B.

## 2.6 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber, or ASTM D 1752, cork or self-expanding cork.
- B. Coloring Agent: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, nonfading, and resistant to lime and other alkalis.
  - 1. Color: As selected by Architect from manufacturer's full range.
- C. Pavement-Marking Paint: Alkyd-resin type; ready mixed; complying with FS TT-P-115, Type I, or AASHTO M 248, Type N.
  - 1. Color: As indicated.
- D. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery with emery aggregate containing not less than 50 percent aluminum oxide and not less than 25 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.
- E. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- F. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class and grade to suit requirements, and as follows:
  - 1. Type II, non-load bearing, for bonding freshly mixed concrete to hardened concrete.
  - 2. Types I and II, non-load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
  - 3. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
- G. Chemical Surface Retarder: Water-soluble, liquid set retarder with color dye, for horizontal concrete surface application, capable of temporarily delaying final hardening of concrete to a depth of 1/8 to 1/4 inch.
- H. Colored Dry-Shake Hardener: Factory-packaged dry combination of portland cement, graded quartz aggregate, coloring pigments, and plasticizing admixture. Use coloring pigments that are finely ground, nonfading mineral oxides interground with cement.
  - 1. Color: As selected by Architect from manufacturer's full range.

## 2.7 CONCRETE MIXES

- A. Prepare design mixes, proportioned according to ACI 211.1 ACI 301 and ACI 318-89, Section 5.3, for each type and strength of normal-weight concrete determined by either laboratory trial mixes or field experience.

- B. Use a qualified independent testing agency for preparing and reporting proposed mix designs for the trial batch method.
- C. Proportion mixes to provide concrete with the following properties:
  - 1. Compressive Strength (28 Days): 4000 psi for site walls and footings.
  - 2. Compressive Strength (28 Days): 3000 psi unless noted.
  - 3. Maximum Water-Cementitious Materials Ratio: 0.50 for site walls.
  - 4. Maximum Water-Cementitious Materials Ratio: 0.53 unless noted.
  - 5. Slump Limit: 3-5 inches.
- D. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than Portland cement in concrete as follows:
  - 1. Fly Ash: 25 percent.
  - 2. Combined Fly Ash and Pozzolan: 25 percent.
  - 3. Ground Granulated Blast-Furnace Slag: 50 percent.
  - 4. Combined Fly Ash or Pozzolan, and Ground Granulated Blast-Furnace Slag: 50 percent Portland cement minimum, with fly ash or pozzolan not exceeding 25 percent.
- E. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content as follows within a tolerance of plus or minus 1.5 percent:
  - 1. Air Content: 5.5 percent for 1-1/2-inch maximum aggregate.
  - 2. Air Content: 6.0 percent for 1-inch maximum aggregate.
  - 3. Air Content: 6.0 percent for 3/4-inch maximum aggregate.
- F. Synthetic Fiber: Uniformly disperse in concrete mix at manufacturer's recommended rate, but not less than 1.0 lb/cu. yd.
- G. Coloring Agent: Add coloring agent to mix according to manufacturer's written instructions.

## 2.8 CONCRETE MIXING

- A. Ready-Mixed Concrete: Comply with requirements and with ASTM C 94 and ASTM C 1116.
  - 1. When air temperature is between 85 deg F (30 deg C) and 90 deg F (32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.
- B. Project-Site Mixing: Comply with requirements and measure, batch, and mix concrete materials and concrete according to ASTM C 94. Mix concrete materials in appropriate drum-type batch machine mixer.
  - 1. For mixers of 1 cu. yd. or smaller capacity, continue mixing at least one and one-half minutes, but not more than five minutes after ingredients are in mixer, before any part of batch is released.
  - 2. For mixers of capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd.

3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mix type, mix time, quantity, and amount of water added.

### 3.0 - EXECUTION

#### 3.1 PREPARATION

- A. Proof-roll prepared subbase surface to check for unstable areas and verify need for additional compaction. Proceed with pavement only after nonconforming conditions have been corrected and subgrade is ready to receive pavement.
- B. Remove loose material from compacted subbase surface immediately before placing concrete.

#### 3.2 EDGE FORMS AND SCREED CONSTRUCTION

- A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement 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.

#### 3.3 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating reinforcement and with recommendations in CRSI's "Placing Reinforcing Bars" for placing and supporting reinforcement.
  1. Apply epoxy repair coating to uncoated or damaged surfaces of epoxy-coated reinforcement.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.
- C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.
- D. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.
- E. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch overlap to adjacent mats.

#### 3.4 JOINTS

- A. General: Construct construction, isolation, and contraction joints and tool edgings true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated.



1. When joining existing pavement, place transverse joints to align with previously placed joints, unless otherwise indicated.
- B. Construction Joints: Set construction joints at side and end terminations of pavement and at locations where pavement operations are stopped for more than one-half hour, unless pavement terminates at isolation joints.
1. Provide preformed galvanized steel or plastic keyway-section forms or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.
  2. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of pavement strips, unless otherwise indicated.
  3. Provide tie bars at sides of pavement strips where indicated.
  4. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
  5. Use epoxy bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.
1. Locate expansion joints at intervals of 50 feet, unless otherwise indicated.
  2. Extend joint fillers full width and depth of joint.
  3. Terminate joint filler less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
  4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
  5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
  6. Protect top edge of joint filler during concrete placement with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.
- D. Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt-coat one-half of dowel length to prevent concrete bonding to one side of joint.
- E. 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, as follows:
1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with groover tool to the following radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover marks on concrete surfaces.
    - a. Radius: 1/4 inch.
  2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.

- F. Edging: Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with an edging tool to the following radius. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces.

- 1. Radius: 1/4 inch.

### 3.5 CONCRETE PLACEMENT

- A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcement steel, and items to be embedded or cast in. Notify other trades to permit installation of their work.
- B. Remove snow, ice, or frost from subbase surface and reinforcement before placing concrete. Do not place concrete on frozen surfaces.
- C. Moisten subbase to provide a uniform dampened condition at the time concrete is placed. Do not place concrete around manholes or other structures until they are at the required finish elevation and alignment.
- D. Comply with requirements and with recommendations in ACI 304R for measuring, mixing, transporting, and placing concrete.
- E. Do not add water to concrete during delivery, at Project site, or during placement.
- F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
- G. Consolidate concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures to consolidate concrete according to recommendations in ACI 309R.
  - 1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand-spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels, and joint devices.
- H. Place concrete in two operations; strike off initial pour for entire width of placement and to the required depth below finish surface. Lay welded wire fabric or fabricated bar mats immediately in final position. Place top layer of concrete, strike off, and screed.
  - 1. Remove and replace portions of bottom layer of concrete that have been placed more than 15 minutes without being covered by top layer, or use bonding agent if approved by Architect.
- I. Screed pavement surfaces with a straightedge and strike off. Commence initial floating using bull floats or darbies to form an open textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading dry-shake surface treatments.
- J. Curbs and Gutters: When automatic machine placement is used for curb and gutter placement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce curbs and gutters to required cross section,

- lines, grades, finish, and jointing as specified for formed concrete. If results are not approved, remove and replace with formed concrete.
- K. Slip-Form Pavers: When automatic machine placement is used for pavement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce pavement to required thickness, lines, grades, finish, and jointing as required for formed pavement.
1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of paver machine during operations.
- L. When adjoining pavement lanes are placed in separate pours, do not operate equipment on concrete until pavement has attained 85 percent of its 28-day compressive strength.
- M. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
1. When air temperature has fallen to or is expected to fall below 40 deg F (4.4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.
  2. Do not use frozen materials or materials containing ice or snow.
  3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, unless otherwise specified and approved in mix designs.
- N. Hot-Weather Placement: Place concrete according to recommendations in ACI 305R and as follows when hot-weather conditions exist:
1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 deg F (32 deg C). Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
  2. Cover reinforcement steel with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
  3. Fog-spray forms, reinforcement steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

### 3.6 CONCRETE FINISHING

- A. General: Wetting of concrete surfaces during screeding, initial floating, or finishing operations is prohibited.
- B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and the 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 (1.6 to 3 mm) deep with a stiff-bristled broom, perpendicular to line of traffic.

### 3.7 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and follow recommendations in ACI 305R for hot-weather protection during curing.
- B. 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.
- C. Begin curing after finishing concrete, but not before free water has disappeared from concrete surface.
- D. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:
  1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
    - a. Water.
    - b. Continuous water-fog spray.
    - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
  2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
  3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

### 3.8 PAVEMENT TOLERANCES

- A. Comply with tolerances of ACI 117 and as follows:
  1. Elevation: 1/4 inch.
  2. Thickness: Plus 3/8 inch, minus 1/4 inch.
  3. Surface: Gap below 10-foot- long, unlevelled straightedge not to exceed 1/4 inch.

4. Lateral Alignment and Spacing of Tie Bars and Dowels: 1 inch.
5. Vertical Alignment of Tie Bars and Dowels: 1/4 inch.
6. Alignment of Tie-Bar End Relative to Line Perpendicular to Pavement Edge: 1/2 inch.
7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Pavement Edge: Length of dowel 1/4 inch per 12 inches.
8. Contraction Joint Depth: Plus 1/4 inch, no minus.
9. Joint Width: Plus 1/8 inch, no minus.

### 3.9 PAVEMENT MARKING

- A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.
- B. Allow concrete pavement to cure for 30 days and be dry before starting first coat of pavement marking. Second coat shall be placed 30 – 60 days after the first.
- C. Sweep and clean surface to eliminate loose material and dust.
- D. Apply 2 coats of paint with mechanical equipment to produce pavement markings of dimensions indicated with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils per coat.

### 3.10 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing and inspection agency to sample materials, perform tests, and submit test reports during concrete placement. Sampling and testing for quality control may include those specified in this Article.
- B. Testing Services: Testing shall be performed according to the following requirements:
  1. Sampling Fresh Concrete: Representative samples of fresh concrete shall be obtained according to ASTM C 172, except modified for slump to comply with ASTM C 94.
  2. Slump: ASTM C 143; one test at point of placement for each compressive-strength test, but not less than one test for each day's pour of each type of concrete. Additional tests will be required when concrete consistency changes.
  3. Air Content: ASTM C 231, pressure method; one test for each compressive-strength test, but not less than one test for each day's pour of each type of air-entrained concrete.
  4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each set of compressive-strength specimens.
  5. Compression Test Specimens: ASTM C 31; one set of four standard cylinders for each compressive-strength test, unless otherwise indicated. Cylinders shall be molded and stored for laboratory-cured test specimens unless field-cured test specimens are required.
  6. Compressive-Strength Tests: ASTM C 39; one set for each day's pour of each concrete class exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd.. One specimen shall be tested at 7 days and two specimens at 28 days; one specimen shall be retained in reserve for later testing if required.

7. When frequency of testing will provide fewer than five compressive-strength tests for a given class of concrete, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
  8. When total quantity of a given class of concrete is less than 50 cu. yd. Architect may waive compressive-strength testing if adequate evidence of satisfactory strength is provided.
  9. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, current operations shall be evaluated and corrective procedures shall be provided for protecting and curing in-place concrete.
  10. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive compressive-strength test results equal or exceed specified compressive strength and no individual compressive-strength test result falls below specified compressive strength by more than 500 psi.
- C. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 24 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing agency, concrete type and class, location of concrete batch in pavement, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
- D. Additional Tests: Testing agency shall make additional tests of the concrete when test results indicate slump, air entrainment, concrete strengths, or other requirements have not been met, as directed by Architect. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed.

### 3.11 REPAIRS AND PROTECTION

- A. Remove and replace concrete pavement that is broken, damaged, or defective, or does not meet requirements in this Section.
- B. Drill test cores where directed by Architect when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with portland cement concrete bonded to pavement with epoxy adhesive.
- C. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.
- D. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 02751

## LOUVERED FENCE AND GATES – SECTION 02831

### PART 1 – GENERAL

#### 1.1. DESCRIPTION

- A. This section describes the following fence system:
  - 1. Fixed louver modular fencing panels fabricated with extruded aluminum louvers and flat aluminum bars including extruded aluminum fence posts and aluminum louver gates. Louvered security fence and gates shall be furnished and installed as shown on the plans and specified herein, overall height of vertical louver framework shall be per the drawings.

#### 1.2. REQUIREMENTS

- A. Furnish materials, labor, expertise and equipment necessary to complete all work specified in this section and as shown on the drawings.
- B. Structural Performance: Provide product and installation capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.
  - i. Uniform pressure of 30 lbf/sq. ft. acting inward or outward.
  - ii. Thermal Movements resulting from a temperature change (range) of 120 degrees Fahrenheit ambient and 180 degrees Fahrenheit material surfaces.

#### 1.3. SUBMITTALS

- A. Shop drawings and manufacturer's literature: Provide specifications and construction detail drawings to substantiate quality of materials and provide details of fabrication and installation.
- B. Submittals shall be in accordance with standard construction practices to include complete detailed layout of all panels, posts, gates. Submittals shall include plan layout, elevations and section views of panels, posts and gates.
- C. Certificate: manufacturer's certification that materials meet specification requirements.

#### 1.4. REFERENCES

- A. ASTM B 209 – Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- B. ASTM B 221 – Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles and Tubes.
- C. ASTM D3363 – Standard Test Method for Film Hardness by Pencil Test.
- D. ASTM D2794 – Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation.
- E. ASTM B117 – Standard Practice for Operating Salt Spray Apparatus.

- F. ASTM D822 – Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.
- G. AWS D1.2 Structural Welding Code – Aluminum.

## 1.5. QUALITY ASSURANCE

- A. Installation of fence and materials shall conform to the requirements of the fence manufacturer.
- B. The fence shall be warranted from any defects in materials and workmanship for a period as specified in the relevant section of the contract documents.

## PART 2 – PRODUCTS

### 2.1. MATERIALS

- A. Louvered security fence:
  - 1. Approved Louvered Fence System, Manufacturer:
    - a. "Palm Shield", American Fence Company
    - b. Pre-approved equal
  - 2. Material Descriptions:
    - a. Extruded Aluminum: ASTM B 221, Alloy 6063 – Temper T-6.
    - b. Sheet Aluminum: ASTM B211, Alloy 6063 – Temper T6.
    - c. Powder Coating Material Hardness: ASTM 3363 2H.
  - 2. Louver Panel Description:
    - a. Louver Panel Height: per the drawings.
    - b. Louver Panel Width: Not to exceed 6'.
    - c. Louver fencing system consisting of horizontal, fixed louver, modular fence panels fabricated with extruded aluminum framing bars and supported by extruded aluminum fence posts.
    - d. Extended Flange to allow for a minimum of ½ inch overlap of louvers for 100% direct visual screening.
    - e. Fixed Louver Bars: 0.1250 inch thick louver with an installed profile of 2 inch X 2.873 inch tall.
    - f. Louver Vertical Framework: 3 inch x 3 inch x ¼ inch aluminum angle. Framework supporting the louvers shall be solid welded and mitered.
    - g. Louver Horizontal Top Cap: 3 inch x 3 inch x ¼ inch aluminum top cap.



- h. Louver Horizontal Bottom Cap: 3 inch x 3 inch x ¼ inch angle bottom cap.
  - i. Cross Bar: 1 inch x 1/8 inch aluminum flat bar.
3. Fence Posts:
- a. Panel posts shall be 4 inch square by ¼ inch minimum extruded tubular aluminum sections with solid aluminum caps. Length as specified on the contract drawings.
  - b. On center post spacing shall be as specified by manufacturer.
  - c. All fence posts to be plated with 10" x 10" x ¾" aluminum plates with four ¾" hole for anchors.
4. Fittings and accessories: All fittings and accessories shall be stainless steel and sized as specified by the fence manufacturer. Fence panels to be attached to posts with ¼" x 1" stainless steel screws. Panels and posts are predrilled to support level installation.
5. Anchor Bolts: Anchor bolts shall be bolted to the concrete and adequate to support loads based on screening height, exposures and loading.
6. Gates: Swing to exterior of enclosure, size as shown on contract drawings.
- a. Louver spacing, style and appearance shall be identical to fence panels.
  - b. Gate hinges to be Gorilla barrel hinge with ¾" rod, ball bearing, and grease zert. Hinge plate to be ½" thick plates offset to create a 5/8" gap. Standard hardware as required by the gate manufacturer for complete functional operation. Hinges to be bolted to gate frame and field welded to steel gate posts.
  - c. Gate latch to be internal lock with exterior grab handles. Lock may be keyed and rekeyed. Lock is accessible from both sides of gate.
  - d. Welded frame, size as shown on the contract drawings, extruded aluminum tubing with aluminum fixed louver panels to match fencing material.
  - e. Drop rods to be 1" schedule 40 pipe and through bolted to gate frame.
  - f. Hardware: Size and type as determined by the manufacturer. Provide three hinges per leaf.
    - 1. Provide 1 inch diameter center cane bolt assembly and strike, each door.
    - 2. Provide padlockable slide bolt assembly.
  - g. Gate shall have welded frame fabricated from extruded aluminum tubing

with aluminum fixed louver panels to match fencing material. Frame configurations shall be as indicated on the contract drawings.

- h. Gate posts shall be as determined by manufacture. Gate posts to be specified to support gates.
6. Factory Finish: Aluminum fence panels, posts and gates shall receive polyester powder coating.
- a. Polyester powder coating: Electrostatically applied colored polyester powder coating heat cured to chemically bond finish to metal substrate.
  - b. Color shall be as selected by Owner.
  - c. Minimum hardness measured in accordance with ASTM D3363 2H.
  - d. Direct impact resistance tested in accordance with ASTM D2794. Withstand 160 inch-pounds.
  - e. Salt spray resistance tested in accordance with ASTM B117: No undercutting, rusting, or blistering after 500 hours in 5 percent salt spray at 95° F and 95% relative humidity after 1,000 hours, less than 3/16 inches undercutting.
  - f. Weatherability tested in accordance with ASTM D822: No film failure and 88 percent gloss retention after 1 year exposure in South Florida with test panels tilted 45°.

## PART 3 – EXECUTION

### 3.1 INSPECTION

- A. Verify that final grading in fence location is completed and without irregularities which will interfere with fence installation. PalmShield is designed to be installed on a level surface. Variations in height, slopes, stairs steeping shall be shown on contract drawings and on submittal drawings.
- B. Field verify all fence dimensions and layout prior to commencing installation.
- C. Do not commence work until unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install fence in accordance with manufacturer's installation instructions.
- B. Install fence plumb and level. Posts are plated and mounted to top of surface.
- C. Do not install bent, bowed or otherwise damaged panels. Remove damaged components from site and replace.
- D. Secure fence panels with stainless with ¼" x 1" stainless steel screws to fence posts. All posts and panels will be predrilled to support level installation.

E. Gates

- a. Install gates and adjust hardware for smooth operation

## SECTION 03300 - CAST-IN-PLACE CONCRETE

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
  - 1. Footings.
  - 2. Foundation walls
  - 3. Slabs-on-grade.
  - 4. Concrete toppings
- B. Related Sections include the following:
  - 1. Section 02300 "Earth Work" for drainage fill under slabs-on-grade.
  - 2. Section 02751 for concrete pavement and walks.
  - 3. Division 5 for metals.

#### 1.3 DEFINITIONS

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

#### 1.4 SUBMITTALS

- A. Shop Drawings, General:
  - 1. Submit all shop drawings on one reproducible print and two copies only. The reproducible print will be returned. All other reproductions required by the Contractor are the responsibility of the Contractor and shall be made after reproducible is returned.
  - 2. The contractor shall fill out the Concrete Submittal Checklist and include it as part of his mix design and/or shop drawing submittal package(s). Submittals without the checklist will be returned unchecked as an incomplete submittal. The checklist sheet is located at the end of this specification section.
    - a. If there are questions, clarifications, modifications, or other items where information, a response, or approval is requested, such items must be written on the checklist. Only indicating such items on the shop drawings or within the calculations is not sufficient. Where items are not specifically listed on the checklist and subsequently not explicitly approved by the Structural Engineer of Record, such items are not to be considered approved or considered.

3. All shop drawings which are resubmitted for any reason shall have all revised items clouded or identified for each submittal.
  4. Contract documents shall not be used for shop drawing, including erection plans or details.
- B. Product Data: For each type of product indicated.
- C. Design Mixtures: Prepare design mixes for each type and strength of concrete by either laboratory trial mixtures or field experience methods as specified in ACI 318-05 Section 5.3. If trial mixtures method used, the contractor is to provide and use an independent testing facility for preparing and reporting proposed mix designs.
1. All concrete mix designs shall include the following information:
    - a. Proportions of cement, fine and coarse aggregate and water.
    - b. Water/cement ratio, design strength, slump and air content.
    - c. Type of cement and aggregates.
    - d. Type and dosage of all admixtures.
    - e. Type, color and dosage of integral coloring compounds, where applicable.
    - f. Special requirements for pumping.
    - g. Any special characteristics of the mix which require precautions in the mixing, placing or finishing techniques to achieve the finished product specified.
    - h. Dated test data for the laboratory trial mixture or field experience method.
    - i. Material certifications (materials shall meet the requirements of section 2.5 below)
      - 1) Cementitious materials.
      - 2) Admixtures.
      - 3) Aggregates
  2. Submit written reports to Architect and Structural Engineer of Record of each proposed mix for each class of concrete at least 15 days prior to start of work. Do not begin concrete production until proposed mix designs have been reviewed and approved by Architect and Structural Engineer of Record.
- D. Contract documents shall not be used for shop drawing, including erection plans or details.
- E. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.
- F. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork.
1. Shop drawings for formwork, prepared for fabrication and erection of forms for specific finished concrete surfaces. Show form construction including jointing, special form joint or reveals, location and pattern of form tie placement, and other items that affect exposed concrete visually.
    - a. Architect's review is for general architectural applications and features only. Design of formwork for structural stability and efficiency is Contractor's responsibility.
- G. Samples: Submit samples of materials as requested by Architect, including names, sources, and descriptions for waterstops, vapor retarder and other products indicated by Architect.
- H. Welding certificates.
- I. Qualification Data: For Installer, manufacturer and testing agency.

J. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:

1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

K. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Form materials and form-release agents.
4. Steel reinforcement and accessories.
5. Fiber reinforcement.
6. Waterstops.
7. Curing compounds.
8. Floor and slab treatments.
9. Bonding agents.
10. Adhesives.
11. Vapor retarders.
12. Semirigid joint filler.
13. Joint-filler strips.
14. Repair materials.

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

M. Field quality-control test and inspection reports.

N. Minutes of preinstallation conference.

#### 1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.
2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.

- D. The Owner shall employ an approved Testing Agency to perform concrete and concrete related tests and inspections (that are not specifically noted as the contractor's responsibility) as required by the Building Code, Project Documents, the Architect, and the Structural Engineer of Record.
- E. The contractor shall employ at his expense an approved Testing Agency as defined above to perform the following:
  - 1. Evaluation of trial mixtures and/or concrete testing for mix design submission.
  - 2. Qualification of proposed materials and establishment of concrete mixtures.
  - 3. Other testing services needed or required by the contractor.
- F. Materials and installed work may require testing and retesting at any time during progress of work. Tests, including retesting of rejected materials for installed work, shall be done at Contractor's expense.
- G. Testing Responsibilities of the Contactor:
  - 1. Submit data on qualifications of Contractor's proposed testing agency. Use of testing services will not relieve the Contractor of the responsibility to furnish materials and construction in full compliance with the Contract Documents.
  - 2. Furnish any labor necessary to assist Owner's testing agency in obtaining and handling samples at the project site or at the source of materials.
  - 3. Advise Owners Testing Agency at least 24 hours in advance of operations to allow for completion of quality tests and assignment of personnel.
  - 4. At the Contractor's expense, provide and maintain for the sole use of the Owner's Testing agency adequate facilities for the safe storage and proper curing of concrete test specimens on the project site for initial curing as required by ASTM C31.
- H. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.
- I. Welding: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code-Reinforcing Steel."
- J. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
  - 1. ACI 301, "Specification for Structural Concrete," Sections 1 through 5.
  - 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
  - 3. ACI 302 "Guide for Concrete Floor and Slab Construction".
  - 4. ACI 304 "Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete".
  - 5. ACI 305 "Hot Weather Concreting".
  - 6. ACI 306 "Cold Weather Concreting".
  - 7. ACI 309 "Guide for Consolidation of Concrete".
  - 8. ACI 347 "Recommended Practice for Concrete Formwork".
  - 9. Concrete Reinforcing Steel Institute (CRSI), "Manual of Standard Practice."
- K. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semirigid joint fillers, forms and form removal limitations, shoring and reshoring procedures, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

L. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
  - a. Contractor's superintendent.
  - b. Independent testing agency responsible for concrete design mixtures.
  - c. Ready-mix concrete manufacturer.
  - d. Concrete subcontractor.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.
- B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
  2. Products: Subject to compliance with requirements, provide one of the products specified.
  3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
  4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

#### 2.2 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
  1. Plywood, metal, or other approved panel materials.
  2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
    - a. High-density overlay, Class 1 or better.
    - b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
    - c. Structural 1, B-B or better; mill oiled and edge sealed.



- d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.
- D. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch (19 by 19 mm), minimum.
- E. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces, and adhesion of membranes to concrete.
  - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- F. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
  - 1. Furnish units that will leave no corrodible metal closer than 1 inch (25 mm) to the plane of exposed concrete surface.
  - 2. Furnish ties that, when removed, will leave holes no larger than 1 inch (25 mm) in diameter in concrete surface.
  - 3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

## 2.3 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.
- B. Galvanized Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420) ASTM A 706/A 706M, deformed bars, ASTM A 767/A 767M, Class I zinc coated after fabrication and bending.
- C. Epoxy-Coated Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420) ASTM A 706/A 706M, deformed bars, epoxy coated, with less than 2 percent damaged coating in each 12-inch (300-mm) bar length.
- D. Plain-Steel Wire: ASTM A 82, as drawn.
- E. Deformed-Steel Wire: ASTM A 496.
- F. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.
- G. Deformed-Steel Welded Wire Reinforcement: ASTM A 497, flat sheet.

## 2.4 REINFORCEMENT ACCESSORIES

- A. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A 775/A 775M.
- B. Zinc Repair Material: ASTM A 780, zinc-based solder, paint containing zinc dust, or sprayed zinc.
- C. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
  - 1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
  - 2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.
  - 3. For zinc-coated reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.

## 2.5 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
  - 1. Portland Cement: ASTM C 150, Type I, gray or white. Supplement with the following:
    - a. Fly Ash: ASTM C 618, Class C or F.
      - 1) Limit use of fly ash to not exceed 25 percent of cementitious content by weight.
    - b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
      - 1) Limit use of Ground Granulated Blast-Furnace Slag to not exceed 50 percent of cementitious content by weight.
  - 2. Blended Hydraulic Cement: ASTM C 595, Type [IS, portland blast-furnace slag] [IP, portland-pozzolan] [I (PM), pozzolan-modified portland] [I (SM), slag-modified portland] cement.
- B. Silica Fume: ASTM C 1240, amorphous silica.
- C. Normal-Weight Aggregates: ASTM C 33, Class 3M coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.
  - 1. Maximum Coarse-Aggregate Size: 3/4 inch (19 mm) nominal.
  - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- D. Water: ASTM C 94/C 94M and potable.

## 2.6 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C 260.
- B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride. Use of admixture must be approved by the Structural Engineer of Record. Include admixtures as part of mix design submittal.
1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
  2. Retarding Admixture: ASTM C 494/C 494M, Type B.
  3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
  4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
  5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
  6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
- C. Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete and complying with ASTM C 494/C 494M, Type C. Set-Accelerating Corrosion-Inhibiting Admixtures must be approved by the Structural Engineer of Record. Include admixtures as part of mix design submittal.
1. Available Products:
    - a. Boral Material Technologies, Inc.; Boral BCN.
    - b. Euclid Chemical Company (The); Eucon CIA.
    - c. Grace Construction Products, W. R. Grace & Co.; DCI.
    - d. Master Builders, Inc.; Rheocrete CNI.
    - e. Sika Corporation; Sika CNI.
- D. Non-Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, non-set-accelerating, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete. Non-Set-Accelerating Corrosion-Inhibiting Admixture must be approved by the Structural Engineer of Record. Include admixtures as part of mix design submittal.
1. Available Products:
    - a. Axim Concrete Technologies; Catexol 1000CI.
    - b. Boral Material Technologies, Inc.; Boral BCN2.
    - c. Grace Construction Products, W. R. Grace & Co.; DCI-S.
    - d. Master Builders, Inc.; Rheocrete 222+.
    - e. Sika Corporation; FerroGard-901.
- E. Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, nonfading, and resistant to lime and other alkalis. See architectural drawings and site plan for concrete requiring color pigment.
1. Available Manufacturers:
    - a. Bayer Corporation.
    - b. ChemMasters.
    - c. Conspec Marketing & Manufacturing Co., Inc.; a Dayton Superior Company.

- d. Davis Colors.
- e. Elementis Pigments, Inc.
- f. Hoover Color Corporation.
- g. Lambert Corporation.
- h. Scofield, L. M. Company.
- i. Solomon Colors.

- 2. Color: As selected by Architect from manufacturer's full range.

## 2.7 WATERSTOPS

- A. Flexible PVC Waterstops: CE CRD-C 572, with factory-installed metal eyelets, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.

- 1. Available Manufacturers:

- a. Bometals, Inc.
- b. Greenstreak.
- c. Meadows, W. R., Inc.
- d. Tamms Industries, Inc.
- e. Vinylex Corp.

- 2. Profile: As indicated.
- 3. Dimensions: As indicated; nontapered.

## 2.8 VAPOR RETARDERS

- A. Underslab Vapor Barrier 1: 15 mil minimum thickness, Multi-layer, fabric-, cord-, grid-, or aluminum-reinforced, high density polyethylene, or polyolefin equivalent, complying with ASTM E 1745, Class A; stated by manufacturer as suitable for installation in contact with soil or granular fill under concrete slabs. Single ply polyethylene is prohibited.

- 1. Accessory Products: Vapor retarder manufacturer's recommended tape, adhesive, mastic, prefabricated boots, etc., for sealing seams and penetrations in vapor retarder.
- 2. Basis of Design Product:
  - a. STEGO INDUSTRIES LLC Product Stego Wrap (15-mil) Vapor Barrier ; [www.stegoindustries.com](http://www.stegoindustries.com)
- 3. Other Acceptable products
  - a. Fortifiber Building Systems Group Product Moistop Ultra® 15; [www.fortifiber.com](http://www.fortifiber.com).
  - b. Reef Industries Product Griffolyn 15 Mil ; [www.reefindustries.com](http://www.reefindustries.com).
  - c. W.R. Meadows Inc. Product PERMINATOR 15 ; [www.wrmeadows.com](http://www.wrmeadows.com).
  - d. Substitutions: See Section 01 6000 - Product Requirements.

- B. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size 57, with 100 percent passing a 1-1/2-inch (37.5-mm) sieve and 0 to 5 percent passing a No. 8 (2.36-mm) sieve.

- C. Fine-Graded Granular Material: Clean mixture of crushed stone, crushed gravel, and manufactured or natural sand; ASTM D 448, Size 10, with 100 percent passing a 3/8-inch (9.5-mm) sieve, 10 to 30 percent passing a No. 100 (0.15-mm) sieve, and at least 5 percent passing No. 200 (0.075-mm) sieve; complying with deleterious substance limits of ASTM C 33 for fine aggregates.

## 2.9 FLOOR AND SLAB TREATMENTS

- A. General: The contractor shall coordinate and insure that all floor and slab treatments, curing materials and compounds, finish floor materials, related materials, paints, and repair compounds are compatible.
- B. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; colorless; that penetrates, hardens, and densifies concrete surfaces. To be applied where concrete indicated to be sealed in Architectural Drawings.
  - 1. Available Products:
    - a. Burke by Edoco; Titan Hard.
    - b. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Intraseal.
    - c. Dayton Superior Corporation; Day-Chem Sure Hard.
    - d. Euclid Chemical Company (The); Euco Diamond Hard.
    - e. L&M Construction Chemicals, Inc.; Seal Hard.
    - f. Meadows, W. R., Inc.; Liqui-Hard.
    - g. Nox-Crete Products Group, Kinsman Corporation; Duranox.
- C. For additional information on color stained concrete see 03032 Color Stained concrete specifications.

## 2.10 CURING MATERIALS

- A. General: The contractor shall coordinate and insure that all floor and slab treatments, curing materials and compounds, finish floor materials, related materials, paints, and repair compounds are compatible. Evaporation retarder shall not be used where epoxy floor covering is to be placed; slab shall be wet cured with Absorptive Cover or Moisture-Retaining Cover as indicated below.
  - 1. The contractor shall verify and be responsible for insuring the VOC emission limits of authorities having jurisdiction are not exceeded during the project.
- B. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
  - 1. Available Products:
    - a. Burke by Edoco; BurkeFilm.
    - b. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Aquafilm.
    - c. Dayton Superior Corporation; Sure Film.
    - d. Euclid Chemical Company (The); Eucobar.
    - e. L&M Construction Chemicals, Inc.; E-Con.
    - f. Meadows, W. R., Inc.; Sealtight Evapre.
    - g. Nox-Crete Products Group, Kinsman Corporation; Monofilm.
    - h. Sika Corporation, Inc.; SikaFilm.
- C. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.

- D. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet or natural fiber matting attached to plastic sheet backing. Acceptable product is Aquacure by DRC, exclusive distributor - Greenstreak Group, Inc. 800-325-9504, or equal.
- E. Water: Potable.
- F. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating. Review curing compounds with manufacturer and waterproofing manufacturer to make sure curing compound does not inhibit adhesion.

1. Available Products:

- a. Anti-Hydro International, Inc.; AH Curing Compound #2 DR WB.
- b. Burke by Edoco; Aqua Resin Cure.
- c. ChemMasters; Safe-Cure Clear.
- d. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; W.B. Resin Cure.
- e. Dayton Superior Corporation; Day Chem Rez Cure (J-11-W).
- f. Euclid Chemical Company (The); Kurez DR VOX.
- g. Kaufman Products, Inc.; Thinfilm 420.
- h. Lambert Corporation; Aqua Kure-Clear.
- i. L&M Construction Chemicals, Inc.; L&M Cure R.
- j. Meadows, W. R., Inc.; 1100 Clear.
- k. Nox-Crete Products Group, Kinsman Corporation; Resin Cure E.
- l. Symons Corporation, a Dayton Superior Company; Resi-Chem Clear Cure.
- m. Tamms Industries, Inc.; Horncure WB 30.
- n. Unitex; Hydro Cure 309.
- o. US Mix Products Company; US Spec Maxcure Resin Clear.
- p. Vexcon Chemicals, Inc.; Certi-Vex Enviocure 100.

- G. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.

1. Available Products:

- a. Anti-Hydro International, Inc.; AH Clear Cure WB.
- b. Burke by Edoco; Spartan Cote WB II.
- c. ChemMasters; Safe-Cure & Seal 20.
- d. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Cure and Seal WB.
- e. Dayton Superior Corporation; Safe Cure and Seal (J-18).
- f. Euclid Chemical Company (The); Aqua Cure VOX.
- g. Kaufman Products, Inc.; Cure & Seal 309 Emulsion.
- h. Lambert Corporation; Glazecote Sealer-20.
- i. L&M Construction Chemicals, Inc.; Dress & Seal WB.
- j. Meadows, W. R., Inc.; Vocomp-20.
- k. Metalcrete Industries; Metcure.
- l. Nox-Crete Products Group, Kinsman Corporation; Cure & Seal 150E.
- m. Symons Corporation, a Dayton Superior Company; Cure & Seal 18 Percent E.
- n. Tamms Industries, Inc.; Clearseal WB 150.
- o. Unitex; Hydro Seal.
- p. US Mix Products Company; US Spec Hydrasheen 15 percent
- q. Vexcon Chemicals, Inc.; Starseal 309.

- H. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, 18 to 25 percent solids, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.

1. Available Products:

- a. Burke by Edoco; Spartan Cote WB II 20 Percent.
- b. ChemMasters; Safe-Cure Clear.
- c. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; High Seal.
- d. Dayton Superior Corporation; Safe Cure and Seal (J-19).
- e. Euclid Chemical Company (The); Diamond Clear VOX.
- f. Kaufman Products, Inc.; SureCure Emulsion.
- g. Lambert Corporation; Glazecote Sealer-20.
- h. L&M Construction Chemicals, Inc.; Dress & Seal WB.
- i. MBT Protection and Repair, Div. of ChemRex; MasterKure-N-Seal VOC.
- j. Meadows, W. R., Inc.; Vocomp-20.
- k. Metalcrete Industries; Metcure 0800.
- l. Nox-Crete Products Group, Kinsman Corporation; Cure & Seal 200E.
- m. Sonneborn, Div. of ChemRex; Kure-N-Seal.
- n. Symons Corporation, a Dayton Superior Company; Cure & Seal 18 Percent E.
- o. Tamms Industries, Inc.; Clearseal WB STD.
- p. Unitex; Hydro Seal 18.
- q. US Mix Products Company; US Spec Radiance UV-25
- r. Vexcon Chemicals, Inc.; Starseal 0800.

- I. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

1. Available Products:

- a. Burke by Edoco; Cureseal 1315.
- b. ChemMasters; Spray-Cure & Seal Plus.
- c. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Sealcure 1315.
- d. Dayton Superior Corporation; Day-Chem Cure and Seal (J-22UV).
- e. Euclid Chemical Company (The); Super Diamond Clear.
- f. Kaufman Products, Inc.; Sure Cure 25.
- g. Lambert Corporation; UV Super Seal.
- h. L&M Construction Chemicals, Inc.; Lumiseal Plus.
- i. Meadows, W. R., Inc.; CS-309/30.
- j. Metalcrete Industries; Seal N Kure 0.
- k. Sonneborn, Div. of ChemRex; Kure-N-Seal 5.
- l. Tamms Industries, Inc.; LusterSeal 300.
- m. Unitex; Solvent Seal 1315.
- n. US Mix Products Company; US Spec CS-25
- o. Vexcon Chemicals, Inc.; Certi-Vex AC 1315

- J. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

1. Available Products:

- a. Burke by Edoco; Cureseal 1315 WB.
- b. ChemMasters; Polyseal WB.

- c. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Sealcure 1315 WB.
- d. Euclid Chemical Company (The); Super Diamond Clear VOX.
- e. Kaufman Products, Inc.; Sure Cure 25 Emulsion.
- f. Lambert Corporation; UV Safe Seal.
- g. L&M Construction Chemicals, Inc.; Lumiseal WB Plus.
- h. Meadows, W. R., Inc.; Vocomp-30.
- i. Metalcrete Industries; Metcure 30.
- j. Symons Corporation, a Dayton Superior Company; Cure & Seal 31 Percent E.
- k. Tamms Industries, Inc.; LusterSeal WB 300.
- l. Unitex; Hydro Seal 25.
- m. US Mix Products Company; US Spec Radiance UV-25.
- n. Vexcon Chemicals, Inc.; Vexcon Starseal 1315.

- K. For additional information on finishing and sealing floor surfaces to receive color stained concrete see COLOR STAINED CONCRETE - RESURFACING - SECTION 03032

## 2.11 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.
- B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 typically unless noted or aromatic polyurea at traffic areas with a Type A shore durometer hardness range of 90 to 95 per ASTM D 2240.
- C. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
  - 1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
- E. Reglets: Fabricate reglets of not less than 0.0217-inch- (0.55-mm-) thick, galvanized steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

## 2.12 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3.2 mm) and that can be feathered at edges to match adjacent floor elevations.
  - 1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
  - 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
  - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by underlayment manufacturer.
  - 4. Compressive Strength: Not less than 4100 psi (29 MPa) at 28 days when tested according to ASTM C 109/C 109M.



- B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3.2 mm) and that can be feathered at edges to match adjacent floor elevations.
1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
  2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
  3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by topping manufacturer.
  4. Compressive Strength: Not less than 5000 psi (34.5 MPa) at 28 days when tested according to ASTM C 109/C 109M.

### 2.13 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Concrete type, slump, air content, and maximum water to cementitious content shall be as shown on the Structural Drawings.
- C. Cementitious Materials: Use fly ash, pozzolan, ground granulated blast-furnace slag, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent. Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
1. Fly Ash: 25 percent.
  2. Combined Fly Ash and Pozzolan: 25 percent.
  3. Ground Granulated Blast-Furnace Slag: 50 percent.
  4. Combined Fly Ash or Pozzolan and Ground Granulated Blast-Furnace Slag: 50 percent portland cement minimum, with fly ash or pozzolan not exceeding 25 percent.
  5. Silica Fume: 10 percent.
  6. Combined Fly Ash, Pozzolans, and Silica Fume: 35 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
  7. Combined Fly Ash or Pozzolans, Ground Granulated Blast-Furnace Slag, and Silica Fume: 50 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
- D. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 percent by weight of cement.
- E. Admixtures: Use admixtures according to manufacturer's written instructions.
1. Use of admixture must be approved by the Structural Engineer of Record. Include admixtures as part of mix design submittal
  2. Use water-reducing, high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
  3. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

4. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
  5. Use corrosion-inhibiting admixture in concrete mixtures where indicated.
- F. Slump Limits: Proportion and design mixes to result in slump at point of placement as shown on the drawings.
1. When use of a Type I or II plasticizing admixture conforming to ASTM C 1017 or when a Type F or G high range water reducing admixture conforming to ASTM C494 is permitted, concrete shall have a slump of 2 to 4 inches before the admixture is added and a maximum slump of 8 inches at the point of delivery after the admixture is added.
- 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.

#### 2.14 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Building Members: Proportion normal-weight concrete mixture as follows:
1. Minimum Compressive Strength: As indicated in drawings.
  2. Maximum Water-Cementitious Materials Ratio: As indicated in drawings.
  3. Slump Limit: As indicated in drawings. 8 inches (200 mm), plus or minus 1 inch (25 mm), for concrete with verified slump indicated in drawings before adding high-range water-reducing admixture or plasticizing admixture].
  4. Air Content: As indicated in drawings, at point of delivery for 3/4-inch (19-mm) nominal maximum aggregate size.

#### 2.15 FABRICATING REINFORCEMENT

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

#### 2.16 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.
1. Mixing and delivery time shall not exceed 90 minutes.
  2. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.
- B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.
1. For mixer capacity of 1 cu. yd. (0.76 cu. m) or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
  2. For mixer capacity larger than 1 cu. yd. (0.76 cu. m), increase mixing time by 15 seconds for each additional 1 cu. yd. (0.76 cu. m).
  3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

## PART 3 - EXECUTION

### 3.1 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
  - 1. Class A, 1/8 inch (3.2 mm) for smooth-formed finished surfaces.
  - 2. Class C, 1/2 inch (13 mm) for rough-formed finished surfaces.
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
  - 1. Install keyways, reglets, recesses, and the like, for easy removal.
  - 2. Do not use rust-stained steel form-facing material.
- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- H. Chamfer exterior corners and edges of permanently exposed concrete.
- I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

### 3.2 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

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

### 3.3 REMOVING AND REUSING FORMS

- A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete, if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.
  1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 75 percent of its 28-day design compressive strength.
  2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

### 3.4 VAPOR RETARDERS

- A. Plastic Vapor Retarders: Convene preconstruction meeting prior to starting work. Place, protect, and repair vapor retarders according to ASTM E 1643 and manufacturer's written instructions.
  1. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended tape.
- B. Bituminous Vapor Retarders: Place, protect, and repair vapor retarders according to manufacturer's written instructions.

### 3.5 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" and Structural Drawings for placing reinforcement.
  1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
  - 1. Weld reinforcing bars according to AWS D1.4, where indicated.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.
- F. Epoxy-Coated Reinforcement: Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963/D 3963M. Use epoxy-coated steel wire ties to fasten epoxy-coated steel reinforcement.
- G. Zinc-Coated Reinforcement: Repair cut and damaged zinc coatings with zinc repair material according to ASTM A 780. Use galvanized steel wire ties to fasten zinc-coated steel reinforcement.

### 3.6 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
  - 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
  - 2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.
  - 3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
  - 4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
  - 5. Space vertical joints in walls no further than 90' on center. Locate joints midway between piers integral with walls, near corners, and in concealed locations where possible.
  - 6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
  - 7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
  - 1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch (3.2 mm). Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
  - 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3.2-mm-) wide joints into concrete

- when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
3. Slab reinforcement shall not cross contraction joints.
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
  2. Terminate full-width joint-filler strips not less than 1/2 inch (13 mm) or more than 1 inch (25 mm) below finished concrete surface where joint sealants, specified in Division 07 Section "Joint Sealants," are indicated.
  3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

### 3.7 WATERSTOPS

- A. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of the Work. Field fabricate joints in waterstops according to manufacturer's written instructions.

### 3.8 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.
- C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
  2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
  3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

- E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
  2. Maintain reinforcement in position on chairs during concrete placement.
  3. Screed slab surfaces with a straightedge and strike off to correct elevations.
  4. Slope surfaces uniformly to drains where required.
  5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
- F. Cold-Weather Placement: Comply with the recommendations and intent of ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
1. When average high and low temperature is expected to fall below 40 deg F (4.4 deg C) for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301. Deliver concrete to meet the following minimum temperatures immediately after placement:
    - a. 55 deg F for sections less than 12in. in the least dimension.
    - b. 50 deg F for sections 12in. to 36in. in the least dimension.
    - c. 45 deg F for sections 36in. to 72in. in the least dimension.
    - d. 40 deg F for sections greater than 72in. in the least dimension.
    - e. The temperature of concrete as placed shall not exceed these values by more than 20 deg F.
  2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
  3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- G. Hot-Weather Placement: Comply with ACI 301 and as follows:
1. Maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
  2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

### 3.9 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to concrete surfaces not exposed to public view.
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, to be covered with a coating or covering material applied directly to concrete.
- C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:
1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
  2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
  3. Cork-Float Finish: Wet concrete surfaces and apply a stiff grout. Mix one part portland cement and one part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.
- D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

### 3.10 FINISHING FLOORS AND SLABS

- A. General: Comply with the recommendations and intent of ACI 302.1R recommendations for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch (6 mm) in 1 direction.
1. Apply scratch finish to surfaces indicated by Architect and to receive concrete floor toppings, to receive mortar setting beds for bonded cementitious floor finishes.
- C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraighening until surface is left with a uniform, smooth, granular texture.
1. Apply float finish to surfaces indicated by Architect to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.
- D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.



1. Apply a trowel finish to surfaces indicated by Architect, exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
  2. Finish surfaces to the following tolerances, according to ASTM E 1155 (ASTM E 1155M), for a randomly trafficked floor surface:
    - a. Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on-grade.
  3. Finish and measure surface so gap at any point between concrete surface and an unlevelled, freestanding, 10-foot- (3.05-m-) long straightedge resting on 2 high spots and placed anywhere on the surface does not exceed 3/16 inch (4.8 mm).
- E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated by Architect, where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.
1. Comply with flatness and levelness tolerances for trowel finished floor surfaces.
- F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.
1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.
- G. Slip-Resistive Finish: Before final floating, apply slip-resistive aggregate or aluminum granule finish where indicated and to concrete stair treads, platforms, and ramps. Apply according to manufacturer's written instructions and as follows:
1. Uniformly spread 25 lb/100 sq. ft. (12 kg/10 sq. m) of dampened slip-resistive aggregate or aluminum granules over surface in 1 or 2 applications. Tamp aggregate flush with surface, but do not force below surface.
  2. After broadcasting and tamping, apply float finish.
  3. After curing, lightly work surface with a steel wire brush or an abrasive stone and water to expose slip-resistive aggregate or aluminum granules.
- H. Dry-Shake Floor Hardener Finish: After initial floating, apply dry-shake floor hardener to surfaces according to manufacturer's written instructions and as follows:
1. Uniformly apply dry-shake floor hardener at a rate of 100 lb/100 sq. ft. (49 kg/10 sq. m) unless greater amount is recommended by manufacturer.
  2. Uniformly distribute approximately two-thirds of dry-shake floor hardener over surface by hand or with mechanical spreader, and embed by power floating. Follow power floating with a second dry-shake floor hardener application, uniformly distributing remainder of material, and embed by power floating.
  3. After final floating, apply a trowel finish. Cure concrete with curing compound recommended by dry-shake floor hardener manufacturer and apply immediately after final finishing.

### 3.11 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-

place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.
- D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel-finish concrete surfaces.

### 3.12 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with the recommendations and intent of ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
  - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
    - a. Water.
    - b. Continuous water-fog spray.
    - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.
  - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
    - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
    - b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.

- c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project..
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
    - a. After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.
  4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

### 3.13 LIQUID FLOOR TREATMENTS

- A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions to concrete floors indicated in Architectural Drawings to be troweled and sealed.
  1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
  2. Do not apply to concrete that is less than seven days' old unless otherwise required by manufacturer.
  3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.
- B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.

### 3.14 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
  1. Defer joint filling until concrete has aged at least one month. Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.
- C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches (50 mm) deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

### 3.15 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 (1.18-mm) sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
  - 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension in solid concrete, but not less than 1 inch (25 mm) in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
  - 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
  - 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
  - 1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch (0.25 mm) wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
  - 2. After concrete has cured at least 14 days, correct high areas by grinding.
  - 3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
  - 4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
  - 5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch (6 mm) to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
  - 6. Repair defective areas, except random cracks and single holes 1 inch (25 mm) or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch (19-mm) clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

7. Repair random cracks and single holes 1 inch (25 mm) or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Architect's approval.

### 3.16 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Testing and Inspecting: Owner will engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
- C. Inspections:
  1. Steel reinforcement placement.
  2. Steel reinforcement welding.
  3. Headed bolts and studs.
  4. Verification of use of required design mixture.
  5. Concrete placement, including conveying and depositing.
  6. Curing procedures and maintenance of curing temperature.
  7. Verification of concrete strength before removal of shores and forms from beams and slabs.
- D. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
  1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.
  2. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. (76 cu. m) or fraction thereof of each concrete mixture placed each day.
    - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
  3. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
  4. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
  5. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each composite sample.

6. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
  7. Compression Test Specimens: ASTM C 31/C 31M.
    - a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
    - b. Cast and field cure two sets of two standard cylinder specimens for each composite sample.
  8. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
    - a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days. Compression test specimens for days not specified shall be at the contractor's expense.
    - b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
  9. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
  10. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).
  11. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
  12. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Structural Engineer of Record but will not be used as sole basis for approval or rejection of concrete.
  13. Additional Tests: Testing and inspecting agency shall make additional tests of concrete at the Contractor's expense when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Structural Engineer of Record. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
  14. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
  15. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.
- E. Measure floor and slab flatness and levelness according to ASTM E 1155 (ASTM E 1155M) within 24 hours of finishing.

## CONCRETE SUBMITTAL CHECKLIST

*This submittal checklist must be provided with all concrete and reinforcing steel packages that are to be submitted to Structural Design Group. Absence of a properly completed checklist may result in the return of the submittal unchecked or as revise and resubmit.*

<b>MIX DESIGN</b>		
Included?	Description	Location in project documentation where this requirement is located.
<input type="checkbox"/>	Field data or trial mixture strength data	Spec Section 03300, Part I, Subsection 1.4
<input type="checkbox"/>	Verify Mix Design Constraints Limit Fly Ash to 25% Limit Proportions per Spec Section 03300, Part II, Subsection 2.5 W/C ratio, Air, Slump per General Notes	Spec Section 03300, Part II, Subsection 2.5  General Notes – Section 4.0
<input type="checkbox"/>	Mix Design Data: 1. Proportions of cement, fine and coarse aggregate and water. 2. Water/cement ratio, design strength, slump and air content. 3. Type of cement and aggregates. 4. Type and dosage of all admixtures. 5. Type, color and dosage of integral coloring compounds, where applicable. 6. Special requirements for pumping. 7. Any special characteristics of the mix which require precautions in the mixing, placing or finishing techniques to achieve the finished product specified. 8. Material certifications 1) Cementitious materials. 2) Admixtures. 3) Aggregates .	Spec Section 03300, Part I, Subsection 1.4  Spec Section 03300, Part I, Subsection 2.5, 2.6
<b>REBAR SHOP DRAWINGS</b>		
Included?	Description	Location in project documentation where this requirement is located.
<input type="checkbox"/>	Submit all shop drawings on one reproducible print and two reproductions only.	General Notes - Section 2.0 Spec Section 03300, Part I, Subsection 1.4
<input type="checkbox"/>	Contract documents not used for shop drawing.	Spec Section 03300, Part I, Subsection 1.4
<input type="checkbox"/>	Resubmitted shop drawings have all revised items clouded or identified.	Spec Section 03300, Part I, Subsection 1.4
<input type="checkbox"/>	Any requested information, clarifications, requests for approvals, modifications, etc. as listed in Spec Section 03300, Part I, Subsection 1.4 are included by the contractor below.	Spec Section 03300, Part I, Subsection 1.4

<b>FORMWORK, RE-SHORE, OTHER SHOP DRAWINGS</b>		
<b>Included?</b>	<b>Description</b>	<b>Location in project documentation where this requirement is located.</b>
<input type="checkbox"/>	Submit all shop drawings on one reproducible print and two reproductions only.	General Notes - Section 2.0 Spec Section 03300, Part I, Subsection 1.4
<input type="checkbox"/>	Contract documents not used for shop drawing, including erection plans or details	Spec Section 03300, Part I, Subsection 1.4
<input type="checkbox"/>	Resubmitted shop drawings have all revised items clouded or identified.	Spec Section 03300, Part I, Subsection 1.4
<input type="checkbox"/>	Any requested information, clarifications, requests for approvals, modifications, etc. as listed in Spec Section 03300, Part I, Subsection 1.4 are included by the contractor below.	Spec Section 03300, Part I, Subsection 1.4
<input type="checkbox"/>	Calculations stamped by an Engineer registered in the state where the project is located.	Spec Section 03300, Part I, Subsection 1.4
<b>QUESTIONS, ETC. PER SECTION 03300, PART I, SUBSECTION 1.4</b>		



END OF SECTION 03300

1.0 - GENERAL

1.1 Related Documents

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

1.2 Summary

- A. This Section includes unit masonry assemblies consisting of, but not limited to the following:
  - 1. Concrete Masonry Units
  - 2. Mortar and Grout
  - 3. Insulation in masonry walls
- B. Related Sections: The following Sections contain requirements that relate to this Section:
  - 1. Division 7 Section "Flashing and Sheet Metal" for exposed sheet-metal flashing installed in masonry
  - 2. Division 7 Section-07910 - "Joint Sealants" for sealing joint in mockup
  - 3. Division 7 - 07720 - Wall flashing
  - 4. Division 7 - Section 07180 -Dampproofing
  - 5. Division 8 - Section "FRP Doors"
  - 6. Division 8 - Section 08110 -Hollow Metal Doors and Frames
- C. Products installed but not furnished under this Section include the following:
  - 1. Hot dip-galvanized Steel lintels for unit masonry
  - 2. Wood nailers and blocking built into unit masonry
  - 3. Manufactured reglets in masonry joints for metal flashing specified in Division 7 Section "Flashing and Sheet Metal."

1.3 Submittals

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product data for each different masonry unit, accessory, and other manufactured product specified.
- C. Samples for initial selection of the following:
  - 1. Unit masonry samples in full size form showing the full range of colors and textures available for each different exposed masonry unit required.
- D. Samples for verification of the following:
  - 1. Full-size units for each different exposed masonry unit required showing the full range of exposed colors, textures, and dimensions to be expected in the completed construction.

- a. Include size-variation data for Type FBS brick, verifying that actual range of sizes for brick falls within ASTM C 216 dimension tolerances.
  - b. Weep holes/vents in color to match mortar color.
- 2. Accessories embedded in the masonry.
- E. List of Materials Used in Construction Mockups: List generic names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.
  - 1. Submittal is for information only. Neither receipt of list nor approval of mockup constitutes approval of deviations from the Contract Documents, unless such deviations are specifically brought to the attention of the Architect and approved in writing.
- F. Material certificates for the following, signed by manufacturer and Contractor, certifying that each material complies with requirements.
  - 1. Each different cement product required for mortar and grout, including name of manufacturer, brand, type, and weight slips at time of delivery.
  - 2. Each material and grade indicated for reinforcing bars.
  - 3. Each type and size of joint reinforcing.
  - 4. Each type and size of anchors, ties, and metal accessories.
- G. Material test reports from a qualified independent testing agency, employed and paid by Contractor or manufacturer, indicating and interpreting test results relative to compliance of the following proposed masonry materials with requirements indicated:
  - 1. Mortar complying with property requirements of ASTM C 270.
  - 2. Grout complying with property requirements of ASTM C 476.
  - 3. Masonry units complying with property requirements of ASTM C90.
- H. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

#### 1.4 Quality Assurance

- A. Clay Masonry Unit Test: For each clay masonry unit indicated, per ASTM C 67
- B. Concrete Masonry Unit Test: For each different concrete masonry unit indicated, per ASTM C 140
- C. Mortar Test: Test mortar properties per test methods of ASTM C 270
- D. Evaluate mortar composition and properties per ASTM C 780
- E. Grout Test: Test grout for compressive strength per ASTM C 1019
- F. Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire resistance ratings determined per ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by another means, as acceptable to authorities having jurisdiction.

- G. Single-Source Responsibility for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from one source and by a single manufacturer for each different product required.
- H. Single-Source Responsibility for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source or producer for each aggregate.
- I. Mockup: Prior to installing unit masonry, construct sample wall panel(s) to verify selections made under sample submittals and to demonstrate aesthetic effects as well as other qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for final unit of Work.
  - 1. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section "Project Meetings."
  - 2. Locate mockups on site in the locations indicated or, if not indicated, as directed by Architect.
    - a. Include exterior face brick wall with field and accent brick and a control joint.
    - b. Seal control joint complying with Division 7 Section "Joint Sealants".
  - 3. Build mockups for the following types of masonry full thickness, including face and back-up wythes as well as accessories. Include a sealant-filled joint at least 16 inches long in each mockup.
    - a. Typical exterior face brick wall with through wall flashing installed for a 24 inch length in corner of mockup approximately 16" down from top of mockup with a 12 inch length of flashing left exposed to view (omit masonry above half of flashing).
    - b. Typical interior masonry unit wall.
    - c. Clean exposed faces of mockups with masonry cleaner "Sure Klean 600" or other masonry manufacturer approved cleaner.
    - d. Protect accepted mockups from the elements with weather-resistant membrane.
  - 4. Notify Architect one week in advance of the dates and times when mockups will be constructed.
  - 5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed work.
    - a. Acceptance of mockup is for color, texture and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship and other material and construction qualities specifically approved by Architect in writing.
    - b. Approval of mockups does not constitute approval of deviations from Contract Documents contained in mockups, unless such deviations are specifically approved by Architect in writing.
    - c. When directed, demolish and remove mockups from Project site.
    - d. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 Special Inspections

Cooperate and adhere to the requirements of 2021 International Building Code - Special Inspections. All masonry and masonry reinforcing shall be subject to special inspections and

observations, at stage intervals deemed necessary, by the Owners' third party Inspector, Engineer and/or the Architect prior to grout filling.

1.6 Special Markings

- A. The contractor shall chalk-line mark the floor slab for masonry wall locations.
- B. The contractor shall mark on the floor slab location of reinforcing dowels to serve grouted cells so as to be clear as to locations of vertical cell reinforcement.
- C. The contractor shall mark the concrete sub-floor with temporary marker paint to identify location of structural CMU reinforcing dowels so as to accurately locate reinforced cells during wall erection. Markings should be transferred to CMU surfaces as installation allows.
- D. Prefabricated Corner and "T" Wall Reinforcing - upon arrival to the job site and while material is in bundle state, the ends shall be spray painted in the field with permanent bright red paint for easy recognition during site inspections.

1.7 Special Sequencing

- A. After the special markings have been provided and prior to the start of CMU installation, an inspection of the concrete floor slab and CMU reinforcing dowels shall be required.
- B. CMU wall construction designed to receive structural reinforcement and cell grouting shall be installed in such sequencing as to consolidate the work of placing reinforcement and cell grouting to minimum concentrate intervals encompassing such significant quantities as to warrant truck delivery of ready-mixed grout.
- C. The work event of placing structural reinforcement and grouting shall require continuous special observation by the Owner's third party Inspector(s) as required by the 2021 International Building Code. Grout mix samples shall be required for testing purposes. The General Contractor shall directly schedule special masonry observations at least 24 hours in advance and notify Architect accordingly. Cost associated with special sequencing shall be considered and included in base bid.

1.8 Delivery, Storage, and Handling

- A. Store masonry units on elevated platforms, under cover, and in a dry location to prevent their deterioration or damage due to moisture, temperature changes, contaminants, corrosion, and other causes. If units become wet, do not install until they are in an air-dried condition.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Store aggregates where grading and other required characteristics can be maintained, and contamination avoided.
- D. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.9 Project Conditions

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

1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.
  2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
1. Protect base of walls from rain-splashed mud and mortar splatter by coverings spread on ground and over wall surface.
  2. Protect sills, ledges, and projections from mortar droppings.
  3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
  4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt on completed masonry.
- D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Remove and replace unit masonry damaged by frost or freezing conditions. Comply with the following requirements:
1. Cold-Weather Construction: When the ambient temperature is within the limits indicated, use the following procedures:
    - a. 40 to 32 deg F: Heat mixing water or sand to produce mortar temperatures between 40 and 120 deg F
  2. Cold-Weather Protection: When the mean daily temperature is within the limits indicated, provide the following protection:
    - a. 40 to 25 deg F : Cover masonry with a weather-resistant membrane for 48 hours after construction.
    - b. 25 to 20 deg F: Cover masonry with insulating blankets or provide enclosure and heat for 48 hours after construction to prevent freezing. Install wind breaks when wind velocity exceeds 15 mi./h.
    - c. 20 deg F and Below: Provide enclosure and heat to maintain temperatures above 32 deg F within the enclosure for 48 hours after construction.
  3. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until masonry has dried out, but not less than 7 days after completion of cleaning.
- E. Hot-Weather Requirements: Protect unit masonry work when temperature and humidity conditions produce excessive evaporation of water from mortar and grout. Provide artificial shade and wind breaks and use cooled materials as required. Do not apply mortar to substrates with temperatures of 100 deg F and above.

## 2.0 - PRODUCTS

### 2.1 Manufacturers

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
1. Portland Cement, Mortar Cement, Masonry Cement, and Lime:
    - a. Essroc Materials, Inc.
    - b. Glen-Gery Corporation
    - c. Lafarge Corporation
  2. Joint Reinforcement, Ties, and Anchors:
    - a. Dur-O-Wal, Inc.
    - b. Heckman Building Products, Inc.
    - c. Hohmann & Barnard, Inc.
    - d. Wire-Bond

### 2.2 Concrete Masonry Units

- A. General: Provide shapes indicated and as follows for each form of concrete masonry unit required:
1. Provide special shapes for lintels, corners, jambs, sash, control joints, headers, bonding and other special conditions.
  2. Bullnose units are required for all outside corners of vertical surfaces, unless otherwise indicated.
- B. Concrete Masonry Units: ASTM C 90 and as follows:
1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2,000 psi.
  2. Weight Classification: **NORMAL**
  3. Aggregates: Do not use aggregate made from pumice, scoria or tuff.
  4. Provide Type N-I moisture-controlled units
  5. Size: Manufactured to the actual dimensions indicated on Drawings within tolerances specified in the applicable referenced ASTM specification. Typical unit 8" nominal, 6" nominal, 4" nominal, or 12" nominal as indicated on drawings.
- C. Custom Textured and Color Concrete Masonry Split Face Units  
Units shall be made with either white marble or white limestone to meet ASTM C - 90-90 Type I. Units shall be of size as indicated and/or as required and shall be laid in stack bond. Furnish all necessary halves, flush ends, and specials. Face detail shall be as indicated on drawings and details.

### 2.3 Mortar and Grout Materials

- A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
- B. Masonry Cement: ASTM C91
- C. Hydrated Lime: ASTM C 207, Type S (for CMU) Type N (for face brick).

- D. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C 207.
- E. Aggregate for Mortar: ASTM C 144; except for joints less than 1/4 inch, use aggregate graded with 100 percent passing the No. 16 sieve.
  - 1. White-Mortar Aggregates: Natural white sand and or ground white stone.
- F. Aggregate for Grout: ASTM C 404.
- G. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortar.
- H. Cold Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494, Type C; and recommended by the manufacturer for use in masonry mortar of composition indicated.
- I. Ready-Mixed Mortar: Cementitious materials, water, and aggregate complying with requirements specified in this Article; combined with set-controlling admixtures to produce a ready-mixed mortar complying with ASTM C 1142.
- J. Water: Potable.
- K. Products: Subject to compliance with requirements, provide one of the following:
  - 1. Cold Weather Admixture:
    - a. "Accelguard 80"; Euclid Chemical Co.
    - b. "Morset"; W. R. Grace & Co.
  - 2. Mortar shall be approved equal to Lafarge as selected by Architect from full range of mortar colors available.

#### 2.4 Ties and Anchors, General

- A. General: Provide ties and anchors specified in subsequent articles that comply with requirements for metal and size of this Article, unless otherwise indicated. Provide ties that will extend into the brick veneer a minimum of one half of the veneer width.
- B. Wire: As follows:
  - 1. Galvanized Carbon-Steel Wire: ASTM A 82; with ASTM A 153, Class B-2 coating for wire ties and anchors in exterior walls.
  - 2. Wire Diameter: 0.1875 inch.

#### 2.5 Bent Wire Ties and Cornices

- A. Individual units prefabricated from bent wire to comply with requirements indicated below:
  - 1. Type for Masonry where Wythes are of Different Material: Adjustable ties composed of 2 parts; 1 with pintles, the other with eyes; with maximum misalignment of 1-1/4 inches. Ties shall be long enough to extend through rigid wall insulation and into outer wythe a minimum of 2 inches.
- B. Joint Reinforcement: Provide welded-wire units prefabricated with deformed continuous side rods and plain cross rods into straight lengths of not less than 10',



with prefabricated corner and tee units, and complying with requirements indicated below:

1. Width: Fabricate joint reinforcement in units with widths of approximately 2" less than nominal width of walls and partitions as required to provide mortar coverage of not less than 5/8" on joint faces exposed to exterior and 1/2" elsewhere.
2. Ladder design with cross rods spaced not more than 16" o.c. One side rod for each face shell of concrete masonry back-up and one rod for brick wythe.
3. Wire Size: 0.1875" diameter for deformed rods; No. 9 cross rods.  
Hot dipped galvanized, Class 3. H. Reinforcing;
4. Brick to block ties: 3/16" diameter adjustable double hook & eye; Hohmann & Barnard Lox-All Adjustable Eye-Wire, Dur-o-wall or equal.

## 2.6 Embedded Flashing Materials

### A. Vinyl Flashing:

1. Thickness: 40 mil thick.
2. Application: Use where flashing is fully concealed in masonry

### B. Adhesive for Flashings: Of type recommended by manufacturer of flashing material for use indicated.

### C. Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to the following:

1. Vinyl Flashing:
  - a. Gibraltar
  - b. Nervastral
  - c. AFCO

## 2.7 Single-Wythe CMU Flashing

### Single-Wythe Concrete Masonry Unit Drainage System: BlockFlash™

Install CMU cell flashing pans with built in adjoining bridge made from recycled polypropylene with chemical stabilizers that prevent UV degradation. Flashing pans have a sloped design to direct moisture to the integrated weep spout. Designed to be built into mortar bed joints to expel moisture (unimpeded by mortar droppings) to the exterior of CMU walls. Drainage Mats and Insect Guards included. Product: Subject to compliance with requirements, provide "BlockFlash™" as manufactured by Mortar Net Solutions.

## 2.8 Miscellaneous Masonry Accessories

### A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Type 2, Class A, Grade 1; compressible up to 35 percent; of width and thickness indicated; formulated from Neoprene.

### B. Preformed Metal Control-Joints: Heckman 16 oz. copper – Type 93U, designed to fit brick size and configuration as indicated.

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

### D. Weep Holes: Provide the following:

1. Wicking material: Cotton sash cord in length required to produce 2 inch exposure on exterior and 18 inches in cavity between wythes.

- E. Sealer for Brick: Prosoco-Siloxane-Weather Seal
- F. Rebar Positioners: 3/16" diameter, hot-dipped galvanized and provided at 48" vertical centers in each reinforced cell.

2.9 Wall Reinforcement and Anchors

- A. Continuous wall reinforcement at 16" o.c. for all masonry walls shall be hot-dipped galvanized and of either truss or ladder design with tabs for exterior two Wythe walls. Reinforcement shall have not less than No. 9 steel wire cross rods and No. 9 deformed side rods. Wires shall conform to ASTM A82. Reinforcement shall have a drip when used in cavity walls, use rectangular pintle sections 16" o.c. in back-up masonry and adjustable double eyelet sections in face brick where rigid insulation is indicated or required in cavity space or where face brick and back-up masonry is not run up together. Use manufacturer's pre-formed corners and intersecting sections and splice as recommended. Basis of material selection shall be Hohmann & Barnard #270 or approved equals by Heckmann Building Products, Wire Bond and Dur-O-Wall.

2.10 Masonry Cleaners

- A. Job Mixed Detergent Solution: Solution of ½ cup dry measure tetrasodium polyphosphate and 1/2 cup dry measure laundry detergent dissolved in 1 gallon of water.
- B. Proprietary Detergent Solution: Manufacturer's standard strength cleaner designed for removing mortar/grout stains, efflorescence and other new construction stains from new masonry surfaces as acceptable to masonry material manufacturer. "Sure Klean" No. 600 Detergent; ProSoCo, Inc., or approved equal. Do not use acid cleaners.

2.11 Mortar and Grout Mixes

- A. General: Do not add admixtures including coloring pigments, air-entraining agents, accelerators, retarders, water repellent agents, anti-freeze compounds or other admixtures, unless otherwise indicated.
  - 1. Do not use calcium chloride in mortar or grout.
- B. Mixing: Combine and thoroughly mix cementitious, water and aggregates in a mechanical batch mixer; comply with referenced ASTM standards for mixing time and water content.
- C. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification, for types of mortar required, unless otherwise indicated.
  - 1. Limit cementitious materials in mortar to portland cement-lime.
  - 2. Use Type S or N mortar.
- D. Colored Pigmented Mortar: Select and proportion pigments with other ingredients to produce color required. Do not exceed pigment-to-cement ratio of 1-to-10, by weight.
- E. Grout for Unit Masonry: Comply with ASTM C 476 for grout for use in construction of reinforced and non-reinforced unit masonry. Use grout of consistency indicated or if not otherwise indicated, of consistency (fine or coarse) at time of placement

which will completely fill all spaces intended to receive grout. Grout to have minimum 2,500 psi compressive strength at 28 days when tested in accordance with ASTM C1019.

1. Use fine grout in grout spaces less than 2" in horizontal direction, unless otherwise indicated.
2. Use coarse grout in grout spaces 2" or more in least horizontal dimension, unless otherwise indicated.

### 3.0 - EXECUTION

#### 3.1 Examination

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of unit masonry. Do not proceed with installation until unsatisfactory conditions have been corrected.
  1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of unit masonry.
  2. Examine rough-in and built-in construction to verify actual locations of piping connections prior to installation.

#### 3.2 General

- A. Lay out all masonry work according to the dimensions shown on the drawings. No work shall be laid unless the temperature is 35° F. and rising.
- B. All masonry work shall be laid straight, level, plumb, and true. Exterior walls shall be laid continuously around the entire structure and in no case racked up more than five (5) feet.
- C. Build in all flashing, anchors, reinforcing, inserts, wall plugs, lintels, bearing plates, bond beams and items as required to accommodate the work of others.
- D. All special details such as chases, openings, expansion joints, projections, corbels, etc., shall be built as required and/or indicated on the drawings.
- E. Lay all masonry, brick and block in full bed of mortar completely filling all joints with mortar. Allow for caulking joints at all window and door frames, and at all wall intersections.
- F. Joints of all exposed masonry surfaces shall be finished after the mortar has taken its initial set. Use a straight edge for horizontal joints. Vertical joints shall be in alignment from top to bottom.
- G. At the end of each day or when rain or frost is imminent, the tops of masonry walls and similar surfaces shall be properly protected by covering top of wall with a strong waterproof membrane well secured in place.
- H. Consult all other trades in advance and make provisions for the installation of their work to avoid cutting and patching. Do all cutting and patching of masonry required to accommodate work of others.
- I. Unfinished work shall be stepped back to permit joining of new work. Masonry work may be toothed only when approved. Before connecting new work with work previously built, sweep clean, remove loose mortar and thoroughly wet the old brick.

- J. As the work progresses, mortar daubs and smears shall be cleaned from masonry work.
- K. Door frames shall be set before the masonry walls are built. As the masonry walls are built around these frames, the inside of the frames shall be grouted solid with mortar. NOTE: See HOLLOW METAL DOORS AND FRAMES - SECTION 08110 for requirements to coat interior of frames prior to grouting.
- L. Extend all rated walls to the underside of structural deck above unless otherwise approved. Fit walls neatly with all joints filled where two levels of ceiling occur, extend walls to high level. Extend all partition walls to 8" above adjacent ceiling.
- M. Weep holes: Provide weep holes in head joints 32" o.c. at thru wall flashing where air space is not open downward. Weep holes shall be below finish floor line and above finish grade.
- N. MORTAR IN CONTACT WITH COPPER PIPING WILL NOT BE ACCEPTED. Coordinate with plumbing or mechanical contractor if copper is encountered without sleeving/insulation. Anticipate additional corrective work.

### 3.3 Installation, General

- A. Thickness: Build cavity and composite walls and other masonry construction to the full thickness shown. Build single-wythe walls to the actual thickness of the masonry units, using units of thickness indicated.
- B. Build chases and recesses to accommodate items specified in this and other Sections of the Specifications.
- C. Leave openings for equipment to be installed before completion of masonry. After installing equipment, complete masonry to match construction immediately adjacent to the opening.
- D. Cut masonry units with motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide continuous pattern and to fit adjoining construction. Use full-size units without cutting, where possible. Allow units cut with water-cooled saws to dry before placing, unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- E. Mix units for exposed unit masonry from several pallets or cubes as they are placed to produce uniform blend of colors and textures.
- F. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.
- G. Wetting of Brick: Wet brick prior to laying if the initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested per ASTM C 67. Allow units to absorb the water so they are damp but not wet at the time of laying.

### 3.4 Construction Tolerances

- A. Variation from Plumb: For vertical lines and surfaces of columns, walls, and arrises, do not exceed 1/4 inch in 10 feet, nor 3/8 inch in 20 feet, nor 1/2 inch in 40 feet or more. For external corners, expansion joints, control joints, and other conspicuous lines, do not exceed 1/4 inch in 20 feet, nor 1/2 inch in 40 feet or more. For vertical

alignment of head joints, do not exceed plus or minus 1/4 inch in 10 feet , nor 1/2 inch maximum.

- B. Variation from Level: For bed joints and lines of exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines, do not exceed 1/4 inch in 20 feet, nor 1/2 inch in 40 feet or more. For top surface of bearing walls, do not exceed 1/8 inch in 10 feet, nor 1/16 inch within width of a single unit.
- C. Variation of Linear Building Line: For position shown in plan and related portion of columns, walls, and partitions, do not exceed 1/2 inch in 20 feet, nor 3/4 inch in 40 feet) or more.
- D. Variation in Cross-Sectional Dimensions: For columns and thickness of walls, from dimensions shown, do not exceed minus 1/4 inch nor plus 1/2 inch.
- E. Variation in Mortar-Joint Thickness: Do not vary from bed-joint thickness indicated by more than plus or minus 1/8 inch with a maximum thickness limited to 1/2 inch. Do not vary bed-joint thickness from bed-joint thickness of adjacent course by more than 1/8 inch. Do not vary from head-joint thickness indicated by more than plus or minus 1/8 inch. Do not vary head-joint thickness from adjacent head-joint thickness by more than 1/8 inch. Do not vary from collar-joint thickness indicated by more than minus 1/4 inch or plus 3/8 inch.

### 3.5 Laying Masonry Walls

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint widths and for accurate locating of openings, movement-type joints, returns, and offsets. Avoid the use of less-than-half-size units at corners, jambs, and where possible at other locations.
- B. Lay walls to comply with specified construction tolerances, with courses accurately spaced and coordinated with other construction.
- C. Bond Pattern for Exposed Masonry:
  - 1. Lay CMU in stacked bond pattern
- D. Lay concealed masonry with all units in a wythe as above. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
- E. Stopping and Resuming Work: In each course, rack back 1/2-unit length for one-half running bond or 1/3-unit length for one-third running bond; do not tooth. Clean exposed surfaces of set masonry, wet clay masonry units lightly if required, and remove loose masonry units and mortar prior to laying fresh masonry.
- F. Built-in Work: As construction progresses, build-in items specified under this and other Sections of the Specifications. Fill in solidly with masonry around built-in items.
- G. Fill space between hollow metal frames and masonry solidly with mortar, unless otherwise indicated.
- H. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath in the joint below and rod mortar or grout into core.
- I. Fill cores in hollow concrete masonry units with grout 24 inches under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

- J. Build non load-bearing interior partitions full height of story to underside of solid floor or roof structure above and as follows:
1. Install compressible filler in joint between top of partition and underside of structure above.
  2. Wedge non load-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.

### 3.6 Mortar Bedding and Jointing

- A. Lay hollow concrete masonry units as follows:
1. With full mortar coverage on horizontal and vertical face shells.
  2. Bed all webs in mortar.
  3. For starting course on footings where cells are not grouted, spread out full mortar bed, including areas under cells.
  4. Maintain joint widths indicated, except for minor variations required to maintain bond alignment. If not indicated, lay walls with 3/8-inch joints.
  5. Fill bottom course of all CMU solid with mortar.
  6. Fill all courses of CMU adjacent to fill in area of ramp and stage solid with mortar.
- B. Lay solid brick-size masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not furrow bed joints or slush head joints.
1. Lay all brick with full head and bed joints.
  2. At cavity walls, bevel beds away from cavity to minimize mortar protrusions into cavity. As work progresses, trowel mortar fins protruding into cavity flat against cavity face of brick.
  3. Maintain joint widths indicated, except for minor variations required to maintain bond alignment. If not indicated, lay walls with 1/4-to-3/8-inch joints. Three brick courses and three mortar courses in 8-inch vertical to course with CMU.
- C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.
- D. Cut joints flush for masonry walls that are to receive plaster or other direct-applied finishes (other than paint), unless otherwise indicated.

### 3.7 Structural Bonding of Multiwythe Masonry

- A. Use individual metal ties installed in horizontal joints to bond wythes together. Provide ties as shown, but not less than 1 metal tie for 4 sq. ft. of wall area spaced not to exceed 24 inches o.c. horizontally and vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches of openings and space not more than 36 inches apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches o.c. vertically.
- B. Corners: Provide interlocking masonry unit bond in each course at corners, unless otherwise shown. Provide continuity with horizontal joint reinforcing at corners by using prefabricated "L" units as well as masonry bonding.
- C. Intersecting and Abutting Walls: Unless vertical expansion or control joints are shown at juncture, provide same type of bonding specified for structural bonding

between wythes and space by providing continuity with horizontal joint reinforcing at corners by using prefabricated "T" units.

### 3.8 Cavities

- A. Keep cavities clean of mortar droppings and other materials during construction. Strike joints facing cavities flush.
  - 1. Use wood strips temporarily placed in cavity to collect mortar droppings. As work progresses, remove strips, clean off mortar droppings, and replace in cavity.
  - 2. Tie exterior wythe to back-up with individual metal ties. Stagger alternate courses.

### 3.9 Anchoring Masonry to Structural Members

- A. Anchor masonry to structural members where masonry abuts or faces structural members to comply with the following:
  - 1. Space weldable rebar couplers at horizontal bond beams as indicated, but not more than 24 inches o.c. vertically.

### 3.10 Cavity Wall and Masonry Cell Insulation

- A. On units of plastic board insulation, place small dabs of adhesive, spaced approximately 12 inches o.c. both ways on inside face or attach to inside face with plastic fasteners designed for his purpose. Verify compatibility of adhesive and bituminous damproofing specified in Division 7. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as shown.
- B. Fill cracks and open gaps in insulation with crack sealer compatible with insulation and masonry.

### 3.11 Horizontal Joint Reinforcement

- A. General: Provide continuous horizontal joint reinforcement as indicated. Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2" elsewhere. Lap reinforcing a minimum of 6 inches.
  - 1. Space reinforcement not more than 16 inches vertically o.c.
  - 2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
  - 3. Provide reinforcement in mortar joints 1 block course above and below wall openings and extending 12 inches beyond opening.
    - a. Reinforcing above is in addition to continuous reinforcement.
- B. Cut or interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.
- C. Provide continuity at corners and wall intersections by using prefabricated "L" and "T" sections. Cut and bend reinforcement units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures and other special conditions.

### 3.12 Control and Expansion Joints

- A. General: Install control and expansion joints in unit masonry where indicated. Build-in related items as the masonry progresses. Do not form a continuous span through movement joints unless provisions are made to prevent in-plane restraint of wall or partition movement.
- B. Form control joints in concrete masonry by installing preformed control-joint gaskets designed to fit standard sash block.
- C. Form expansion joints in brick made from clay or shale by forming an open joint of width indicated, but not less than 3/8 inch for installation of sealant and backer rod specified in Division 7 Section "Joint Sealants." Maintain joint free and clear of mortar.

### 3.13 Lintels

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

### 3.14 Flashing, Weep Holes, and Vents

- A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to the downward flow of water in the wall, and where indicated.
- B. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Place through-wall flashing on sloping bed of mortar and cover with mortar. Seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer before covering with mortar.
- C. Install flashing as follows:
  - 1. At composite masonry walls, including cavity walls, extend flashing from exterior face of outer wythe of masonry, through the outer wythe, turned up a minimum of 4 inches and through the inner wythe to within 1/2 inch of the interior face of the wall in exposed masonry. Where interior surface of inner wythe is concealed by furring, carry flashing completely through the inner wythe and turn up approximately 2 inches unless otherwise indicated.
  - 2. At lintels and shelf angles extend flashing a minimum of 4 inches into masonry at each end. At heads and sills, extend flashing 4 inches at ends and turn up not less than 2 inches to form a pan.
  - 3. Flashing installation is to be inspected and approved in writing by Architect before proceeding with masonry work.
- D. Install weep holes in the head joints in exterior wythes of the first course of masonry immediately above embedded flashing and as follows:
  - 1. Form weep holes with product specified in Part 2 of this Section.
  - 2. Form weep holes by keeping head joints free and clear of mortar.
  - 3. Space weep holes 24 inches o.c.



- E. Trim wicking material used in weep holes flush with outside face of wall after mortar has set.
  - 1. Install through-wall flashing and weep holes above horizontal blocking.
- F. Install reglets and nailers for flashing and other related construction where shown to be built into masonry.

### 3.15 Grouting of CMU Walls

- A. Contractor to notify Owner's Testing Agent prior to all grouting of steel reinforced CMU.
- B. All cavities with steel reinforcing to be cleaned of all debris and broken CMU prior to filling with grout.
- C. All reinforcing steel in cells to be filled with grout or concrete to be continuous with laps as required by code.
- D. Grout for filled masonry cells is not to be dropped more than five (5) feet.

### 3.16 Repairing, Pointing and Cleaning

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or if units do not match adjoining units. Install new units to match adjoining units; install in fresh mortar or grout, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point-up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for application of sealants.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears prior to tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
  - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
  - 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
  - 3. Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film or waterproof masking tape.
  - 4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing the surfaces thoroughly with clear water.
  - 5. Clean brick by bucket and brush hand-cleaning method described in BIA Technical Note No. 20 Revised, using approved masonry cleaner.
  - 6. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2 applicable to type of stain present on exposed surfaces.
- E. Protection: Provide final protection and maintain conditions that ensure unit masonry is without damage and deterioration at time of Substantial Completion.

3.17 Sealing of Brick

- A. Take precautions to avoid harm to building occupants, pedestrians, nearby property and all non-masonry surfaces from contact with sealer and fumes. Protect and/or divert auto and pedestrian traffic.
- B. Test masonry (minimum 4 ft x 4 ft area) before overall application to assure compatibility and desired water repellent results. (Treated and cured masonry should shed water and not wet out.) Apply tests using the same equipment as for job application and allow to cure 24 to 48 hours. Test panels should remain available for inspection by Architect.
- C. Surface Preparation:
  - 1. Fill all cracks and voids to avoid penetration of fumes into the building. (Such openings may permit moisture, sealer or sealer fumes to penetrate wall.) Make sure that all caulks and sealants are in place and completely cured.
  - 2. Clean dirt, oil and other contaminants from the surface. Use appropriate proprietary cleaners (do not use raw acids) where necessary. Rinse with pressure equipment at 500 to 1,500 psi to thoroughly remove all detergent residues. Do not apply to surfaces that are wet to the touch. Best results are obtained on dry surfaces. Internal moisture should also be dissipated.

3.18 Masonry Waste Disposal

- A. Recycling: Undamaged, excess masonry materials are Contractor's property and shall be removed from the project site.

END OF SECTION

## SECTION 05120 - STRUCTURAL STEEL

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes fabrication and erection of structural steel work, as shown on drawings including schedules, notes, and details showing size and location of members, typical connections, and types of steel required.
  - 1. Structural steel is that work defined in American Institute of Steel Construction (AISC) "Code of Standard Practice" and as otherwise shown on drawings.
  - 2. Miscellaneous Metal Fabrications are specified elsewhere in Division 5.
  - 3. Refer to Division 3 for anchor bolt installation in concrete and Division 4 for anchor bolt installation in masonry.

#### 1.3 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
  - 1. Submit all shop drawings on three copies only unless specified otherwise in the general conditions. Two prints will be returned to the architect. All copies required by the Contractor are the responsibility of the Contractor and shall be made after reproducible is returned.
- B. Product data or manufacturer's specifications and installation instructions for following products. Include laboratory test reports and other data to show compliance with specifications (including specified standards). This data is submitted for information only.
  - 1. Structural steel (each type), including certified copies of mill reports covering chemical and physical properties.
  - 2. High-strength bolts (each type), including nuts and washers.
    - a. Include Direct Tension Indicators if used.
  - 3. Structural steel primer paint.
  - 4. Shrinkage-resistant grout.
- C. Shop drawings including complete details and schedules for fabrication and assembly of structural steel members, procedures, and diagrams.
  - 1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.

2. Include embedment drawings.
  3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
  4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.
  5. Contract documents shall not be used for shop drawing, including erection plans or details.
  6. All shop drawings which are resubmitted for any reason shall have all revised items clouded or identified for each submittal.
  7. All structural steel connections not specifically detailed on the drawings shall be designed to resist forces indicated, by the Contractor.
  8. For structural-steel connections indicated to comply with design loads, include structural analysis data, signed and sealed by the qualified professional engineer responsible for their preparation.
  9. For each connection, the following shall be noted on the shop drawings:
    - a. Required design reaction
    - b. Calculation sheet number for design
    - c. Capacity of detailed connection
    - d. Stamp of Engineer submitting calculations for the connection
  10. All shop drawings which do not provide this information will be returned unchecked as an incomplete submittal.
- D. Test reports conducted on shop- and field-bolted and welded connections. Include data on type(s) of tests conducted and test results.

#### 1.4 QUALITY ASSURANCE

- A. Codes and Standards: Comply with provisions of following, except as otherwise indicated:
1. American Institute of Steel Construction (AISC) "Code of Standard Practice for Steel Buildings and Bridges", dated June 10, 1992.
    - a. General: AISC "Code of Standard Practice" shall apply except to the extent that references are made to the responsibility of the Owner and/or Architect or Engineer in which event those references shall have no applicability. Where a conflict exists between the Code of Standard Practice and the Contract Documents, the Contract Documents shall govern.
  2. AISC "Specifications for Structural Steel Buildings," including "Commentary".
  3. AISC "Specifications for Structural Steel Buildings, Section 10, Architecturally Exposed Structural Steel".
  4. "Specifications for Structural Joints using ASTM A325 or A490 Bolts" approved by the Research Council on Structural Connections.

5. American Welding Society (AWS) D1.1 "Structural Welding Code - Steel."
  6. ASTM A6 "General Requirements for Delivery of Rolled Steel Plates, Shapes, Sheet Piling and Bars for Structural Use."
- B. Qualifications for Welding Work: Qualify welding procedures and welding operators in accordance with AWS "Qualification" requirements.
1. Provide certification that welders to be employed in work have satisfactorily passed AWS qualification tests.
  2. If re-certification of welders is required, retesting will be Contractor's responsibility.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to site at such intervals to ensure uninterrupted progress of work.
- B. Deliver anchor rods and anchorage devices, which are to be embedded in cast-in-place concrete or masonry, in ample time to not to delay work.
- C. Store materials to permit easy access for inspection and identification. Keep steel members off ground by using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration. If bolts and nuts become dry or rusty, clean and relubricate before use.
1. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Metal Surfaces, General: For fabrication of work that will be exposed to view, use only materials that are smooth and free of surface blemishes including pitting, rust and scale seam marks, roller marks, rolled trade names, and roughness. Remove such blemishes by grinding, or by welding and grinding, prior to cleaning, treating, and applying surface finishes.
- B. Structural Steel: ASTM A992, Grade 50 for wide flange beams; ASTM A36 elsewhere.
- C. Cold-Formed Steel Tubing: ASTM A500, Grade B.
- D. Hot-Formed Steel Tubing: ASTM A501.
- E. Steel Pipe: ASTM A53, Type E or S, Grade B; or ASTM A501.
- F. Moment Connection Material: Unless noted otherwise on the drawings, stiffener plates, doubler plates, gusset plates and the connecting plates shall be the same grade of steel as members being connected.
- G. Headed Stud-Type Shear Connectors: ASTM A108, Grade 1015 or 1020, cold-finished carbon steel with dimensions complying with AISC Specifications.

- H. Anchor Rods: ASTM A307 Grade A, headed type with supplementary requirements S1, unless otherwise indicated.
- I. Unfinished Threaded Fasteners: ASTM A307, Grade A, regular low-carbon steel bolts and nuts.
  - 1. Provide either hexagonal or square heads and nuts, except use only hexagonal units for exposed connections.
- J. High-Strength Threaded Fasteners: Heavy hexagon structural bolts, heavy hexagon nuts, and hardened washers, as follows:
  - 1. Quenched and tempered medium-carbon steel bolts, nuts, and washers, complying with ASTM A325.
    - a. Where indicated as galvanized, provide units that are zinc coated, either mechanically deposited complying with ASTM B695, Class 50, or hot-dip galvanized complying with ASTM A153.
  - 2. Quenched and tempered alloy steel bolts, nuts, and washers, complying with ASTM A490.
- K. Electrodes for Welding: Comply with AWS Code.
- L. Structural Steel Primer Paint: Red oxide primer.
- M. Cement Grout: Portland cement (ASTM C150, Type I or Type III) and clean, uniformly graded, natural sand (ASTM C404, Size No. 2). Mix at a ratio of 1.0 part cement to 3.0 parts sand, by volume, with minimum water required for placement and hydration.
- N. Nonmetallic Shrinkage-Resistant Grout: Premixed, nonmetallic, noncorrosive, nonstaining product containing selected silica sands, Portland cement, shrinkage compensating agents, plasticizing and water-reducing agents, complying with CE-CRD-C621.
  - 1. Available Products: Subject to compliance with requirements, products that may be incorporated in the work include, but are not limited to, the following:
    - a. 100 Non-Shrink Grout (Non-Metallic); Conspec, Inc.
    - b. Supreme Grout; Cornix, Inc.
    - c. Sure Grip Grout; Dayton Superior.
    - d. Euco N.S.; Euclid Chemical Co.
    - e. Crystex; L & M Construction Chemicals, Inc.
    - f. Masterflow 713; Master Builders.
    - g. Sealtight 588 Grout; W. R. Meadows.
    - h. Propak; Protex Industries, Inc.
    - i. Set Non-Shrink; Set Products, Inc.
    - j. Five Star Grout; U.S. Grout Corp.

## 2.2 FABRICATION

- A. Shop Fabrication and Assembly: Fabricate and assemble structural assemblies in shop to greatest extent possible. Fabricate items of structural steel in accordance with AISC Specifications and as indicated on final shop drawings. Provide camber in structural members where indicated.
  - 1. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence

that will expedite erection and minimize field handling of materials.

2. Where finishing is required, complete assembly, including welding of units, before start of finishing operations. Provide finish surfaces of members exposed in final structure free of markings, burrs, and other defects.
- B. Connections: Weld or bolt shop connections, as indicated.
1. Bolt field connections, except where welded connections or other connections are indicated.
    - a. Provide high-strength threaded fasteners for all principal bolted connections, except where unfinished bolts are indicated.
- C. Simple Beam Connections: Standard double angle framed beam connections using bolts as specified.
1. Seated Beam Connections and Stiffened Seated Beam Connections shall not be used unless indicated on the drawings or unless Engineer approval is obtained to verify capacity of supporting member for the resulting eccentricity. The fabricator must verify and bear responsibility that the use of such connections does not interfere with Architectural or MEP requirements.
- D. High-Strength Bolted Construction: Install high-strength threaded fasteners in accordance with AISC "Specifications for Structural Joints using ASTM A325 or A490 Bolts."
- E. Welded Construction: Comply with AWS Code for procedures, appearance and quality of welds, and methods used in correcting welding work.
- F. Steel Wall Framing: Select members that are true and straight for fabrication of steel wall framing. Straighten as required to provide uniform, square, and true members in completed wall framing.
- G. Holes for Other Work: Provide holes required for securing other work to structural steel framing and for passage of other work through steel framing members, as shown on final shop drawings.
- H. Provide threaded nuts welded to framing and other specialty items as indicated to receive other work.
- I. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame-cut holes or enlarge holes by burning. Drill holes in bearing plates.

### 2.3 SHOP PAINTING

- A. General: Shop-paint structural steel, except those members or portions of members to be embedded in concrete or mortar. Paint embedded steel that is partially exposed on exposed portions and initial 2 inches of embedded areas only.
1. Do not paint surfaces to be welded or high-strength bolted with slip-critical-type connections.
  2. Do not paint surfaces scheduled to receive sprayed-on fireproofing.
  3. Apply 2 coats of paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

B. Painting: Provide a one-coat, shop-applied paint system complying with Steel Structures Painting Council (SSPC) Paint System Guide No. 7.00.

C. Painting of steel exposed to weathering in the finished configuration of the structure:

1. Surface Preparation: Clean surfaces to be painted. Remove rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:

SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning.

2. Prime Coat: Immediately after surface preparation, provide one coat of grey shop applied Organic Zinc Rich Urethane Primer, such as Tnemec 90-97, at 2.5 to 3.5 mils DFT which meets the following performance requirements:
  - a. Solids by Volume: 63%
  - b. Zinc Content: 83% by weight.
  - c. Salt Spray (Fog): ASTM B 117, Scribed Panels, 50,000 hours exposure.
  - d. Adhesion: ASTM 4541 – Type V – no less than 2,083 psi(14.36 MPa) pull.
  - e. Prohesion: ASTM G85 Prohesion Cabinet Testing. 15,000 hours.
  - f. Cathodic Disbondment: ASTM G8, Method A.
  - g. Immersion: ASTM D 870 Potable Water Immersion. 7 year exposure.
  - h. AISC Static Fatigue: Primer shall meet requirements of a Class B surface with a mean slip coefficient no less than 0.50 and a tension creep not in excess of .005 inch over SSPC-SP6 prepared substrate.
3. Touch Up Primer/Preparation before Finish Coats: Immediately after erection all surfaces shall be cleaned per SSPC – SP1 followed by spot repair preparation of SSPC-SP11 Power tool clean to white metal. Remove all foreign materials and contaminants, clean field welds, bolted connections, and abraded areas of shop paint. All damaged and abraded areas shall have feathered edges. Field touch-up with one coat of Prime Coat, paint applied at 2.5-3.5 Mil DFT prior to finish coat.
4. Intermediate Coat: Provide one grey finish coat of an Aliphatic Acrylic Polyurethane, such as Tnemec Series 1075 Endura-Shield II, at 3.0 to 5.0 mils DFT which meets the following performance requirements:
  - a. Solids by Volume: 71%
  - b. Salt Spray (Fog): ASTM B 117, 2,000 hours exposure.
  - c. Abrasion: ASTM 4060 (CS-17 Wheel, 1,000 gram load, 1,000 cycles). No more than 139 mg loss.
  - d. Adhesion: ASTM 4541 – no less than 1,423 psi(9.81 MPa) pull.
  - e. Flexibility: ASTM D 522 (Method A) – no less than 14.4% elongation.
  - f. Hardness: ASTM 3363- no gouging with an HB or less pencil.
  - g. Humidity: ASTM 4585- 4,000 hours exposure.
  - h. Impact: ASTM B 2794 – no cracking or delamination of film after 35 inch-pounds direct impact.
  - i. Prohesion: ASTM G85 – 10,000 hours exposure.
5. Finish Coat: Provide one finish coat (color to be selected by architect) of an Advanced Thermoset Solution Fluoropolymer, such as Tnemec Series 1070 Fluoronar, at 2.0 to 3.0 mils DFT which meets the following performance requirements:
  - a. Solids by Volume: 60%
  - b. Salt Spray (Fog): ASTM B 117 – 10,000 hours exposure
  - c. Abrasion: ASTM 4060 – (CS-17 Wheel, 1,000 gram load, 1,000 cycles) no more than 103 mg loss.



- d. Adhesion: ASTM 4541 – Type V – no less than 1,930 psi(13.3 MPa) pull.
- e. Flexibility: ASTM D 522 (Method A)- no less than 14.83% elongation.
- f. Hardness: ASTM 3363 – no gouging with an 8H or less pencil.
- g. Humidity: ASTM 4585 – 3,000 hours exposure.
- h. Impact: ASTM B 2794 - no cracking or delamination of film after 35 inch-pounds direct impact.

6. Any Field Painting to be brush or roller applied.

7. Owners testing agent to continuously review the surface preparation and application of the painting of steel exposed to weathering in the finished configuration of the structure.

## 2.4 SOURCE QUALITY CONTROL

A. General: Materials and fabrication procedures are subject to inspection and tests in mill, shop, and field, conducted by a qualified inspection agency. Such inspections and tests will not relieve Contractor of responsibility for providing materials and fabrication procedures in compliance with specified requirements.

1. Promptly remove and replace materials or fabricated components that do not comply.

B. Design of Members and Connections: Details shown are typical; similar details apply to similar conditions, unless otherwise indicated. Verify dimensions at site whenever possible without causing delay in the work.

1. Promptly notify Architect whenever design of members and connections for any portion of structure are not clearly indicated.

## PART 3 - EXECUTION

### 3.1 ERECTION

A. Surveys: Employ a licensed land surveyor for accurate erection of structural steel. Check elevations of concrete and masonry bearing surfaces, and locations of anchor bolts and similar devices, before erection work proceeds, and report discrepancies to Architect. Do not proceed with erection until corrections have been made or until compensating adjustments to structural steel work have been agreed upon with Architect.

B. Temporary Shoring and Bracing: Provide temporary shoring and bracing members with connections of sufficient strength to bear imposed loads. Remove temporary members and connections when permanent members are in place and final connections are made. Provide temporary guy lines to achieve proper alignment of structures as erection proceeds.

C. Temporary Planking: Provide temporary planking and working platforms as necessary to effectively complete work.

D. Setting Bases and Bearing Plates: Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom surface of base and bearing plates.

1. Set loose and attached base plates and bearing plates for structural members on wedges or

other adjusting devices.

2. Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with edge of base or bearing plate prior to packing with grout.
  3. Pack grout solidly between bearing surfaces and bases or plates to ensure that no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure.
  4. For proprietary grout materials, comply with manufacturer's instructions.
- E. Field Assembly: Set structural frames accurately to lines and elevations indicated. Align and adjust various members forming part of complete frame or structure before permanently fastening. Clean bearing surfaces and other surfaces that will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
- F. Level and plumb individual members of structure within specified AISC tolerances.
- G. Establish required leveling and plumbing measurements on mean operating temperature of structure. Make allowances for difference between temperature at time of erection and mean temperature at which structure will be when completed and in service.
- H. Splice members only where indicated and accepted on shop drawings.
- I. Erection Bolts: On exposed welded construction, remove erection bolts, fill holes with plug welds, and grind smooth at exposed surfaces. Each erection bolt on shop drawings shall be noted "Erection Bolt".
1. Comply with AISC Specifications for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
  2. Do not enlarge unfair holes in members by burning or by using drift pins, except in secondary bracing members. Ream holes that must be enlarged to admit bolts.
- J. Gas Cutting: Do not use gas cutting torches in field for correcting fabrication errors in primary structural framing. Cutting will be permitted only on secondary members that are not under stress, as acceptable to Architect. Finish gas-cut sections equal to a sheared appearance when permitted.
- K. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Apply paint to exposed areas using same material as used for shop painting.
1. Apply by brush or spray to provide minimum dry film thickness of 1.5 mils.

### 3.2 QUALITY CONTROL

- A. Owner will engage an independent testing and inspection agency to inspect high-strength bolted connections and welded connections and to perform tests and prepare test reports.
- B. Testing agency shall conduct and interpret tests, state in each report whether test specimens comply with requirements, and specifically state any deviations therefrom.

- C. Provide access for testing agency to places where structural steel work is being fabricated or produced so that required inspection and testing can be accomplished.
- D. Testing agency may inspect structural steel at plant before shipment.
- E. Correct deficiencies in structural steel work that inspections and laboratory test reports have indicated to be not in compliance with requirements. Perform additional tests, at Contractor's expense, as necessary to reconfirm any noncompliance of original work and to show compliance of corrected work.
- F. Field Inspections and Tests:
  - 1. Check steel as received in the field for possible shipping damage workmanship, piece making and verification of required camber.
- G. Shop-Bolted Connections:
  - 1. Inspect or test in accordance with AISC specifications.
  - 2. For bolted connections (bearing-type), all connections shall be visually observed to assure that all bolts, nuts and washers are in place and that all plies of connection material have been drawn together. All bolts shall be verified to be snug tight only.
- H. Shop Welding: Inspect and test during fabrication of structural steel assemblies, as follows:
  - 1. Certify welders and conduct inspections and tests as required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies.
  - 2. Perform visual inspection of all welds, including but not limited to fit-up, intermediate passes and final weld.
  - 3. Perform tests of welds as follows. Inspection procedures listed
    - a. Ultrasonic Inspection: ASTM E164. Perform on all full and partial penetration welds.
- I. Field-Bolted Connections:
  - 1. Inspect in accordance with AISC specifications.
  - 2. For bolted connections (bearing-type), all connections shall be visually observed to assure that all bolts, nuts and washers are in place and that all plies of connection material have been drawn together. All bolts shall be verified to be snug tight only.
  - 3. Bolts in slotted holes at expansion joints shall have nuts finger tight with threads damaged.
- J. Field Welding: Inspect and test during erection of structural steel as follows:
  - 1. Certify welders and conduct inspections and tests as required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies.
  - 2. Perform visual inspection of all welds, including but not limited to fit-up, intermediate passes and final weld.
  - 3. Perform tests of welds as follows:

- a. Ultrasonic Inspection: ASTM E164. Perform on all full and partial penetration welds.

END OF SECTION 05120.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:

- 1. Roof deck.
- 2. Composite floor deck
- 3. Noncomposite form deck.

- B. Related Sections include the following:

- 1. Division 03 Section "Cast-in-Place Concrete" for concrete fill.
- 2. Division 05 Section "Structural Steel Framing" for shop- and field-welded shear connectors.
- 3. Division 05 Section "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.
- 4. Division 09 painting Sections for repair painting of primed deck.

1.3 SUBMITTALS

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

- 1. Submit all shop drawings on three copies only unless specified otherwise in the general conditions. Two prints will be returned to the architect. All copies required by the Contractor are the responsibility of the Contractor and shall be made after reproducible is returned.

- B. Product data including manufacturer's specifications and installation instructions for each type of decking and accessories.

- 1. Provide test data for mechanical fasteners used fastening deck to supporting structures.

- C. Shop drawings showing layout and types of deck units, anchorage details, and conditions requiring closure strips, supplementary framing, sump pans, cant strips, cut openings, special jointing, and other accessories.

1.4 QUALITY ASSURANCE

- A. Codes and Standards: Comply with provisions of the following codes and standards, except as otherwise indicated:

1. American Iron and Steel Institute (AISI), "Specification for the Design of Cold-Formed Steel Structural Members."
  2. American Welding Society (AWS), D1.3 "Structural Welding Code - Sheet Steel."
  3. Steel Deck Institute (SDI), "Design Manual for Composite Decks, Form Decks and Roof Decks."
- B. Qualification of Field Welding: Use qualified welding processes and welding operators in accordance with "Welder Qualification" procedures of AWS.
1. Welded decking in place is subject to inspection and testing. General Contractor will bear expense of removing and replacing portions of decking for testing purposes if welds are found to be unsatisfactory. Remove work found to be defective and replace with new acceptable work.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the work include but are not limited to the following:
1. Bowman Metal Deck Div., Cyclops Corp.
  2. Consolidated Systems, Inc.
  3. Epic Metals Corp.
  4. Marlyn Steel Products, Inc.
  5. H. H. Robertson Co.
  6. Roll Form Products, Inc.
  7. Roof Deck, Inc.
  8. United Steel Deck, Inc.
  9. Vulcraft Div., Nucor Corp.
  10. Wheeling Corrugating Co.

#### 2.2 MATERIALS

- A. Steel for Galvanized Metal Deck Units: ASTM A 446, grade as required to comply with SDI specifications.
- B. Miscellaneous Steel Shapes: ASTM A 36.
- C. Sheet Metal Accessories: ASTM A 526, commercial quality, galvanized.
- D. Galvanizing: ASTM A 525, G60.

- E. Galvanizing Repair: Where galvanized surfaces are damaged, prepare surfaces and repair in accordance with procedures specified in ASTM A 780.

## 2.3 PRODUCTS

### A. ROOF DECK.

1. Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 30, and with the following: SEE PLAN
2. Galvanized Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade **33**, **G60** zinc coating.
3. Deck Profile: SEE PLAN
4. Profile Depth: SEE PLAN
5. Design Uncoated-Steel Thickness: SEE PLAN
6. Span Condition: Triple span or more.
7. Side Laps: Overlapped or butted over support at contractor's option

### B. COMPOSITE STEEL FLOOR DECK.

Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with "SDI Specifications and Commentary for Composite Steel Floor Deck," in SDI Publication No. 30, with the minimum section properties indicated, and with the following:

8. Prime-Painted Steel Sheet: ASTM A 1008/A 1008M, Structural Steel (SS), Grade **33 (230)** minimum, with top surface phosphatized and unpainted and underside surface shop primed with manufacturers' standard [**gray**] [**or**] [**white**] baked-on, rust-inhibitive primer.
9. Galvanized Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade **33 (230)**, zinc coating.
10. Galvanized and Shop-Primed Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade **33 (230)**, zinc coating; with unpainted top surface and cleaned and pretreated bottom surface primed with manufacturer's standard [**gray**] [**white**] baked-on, rust-inhibitive primer.
11. Profile Depth: **2 inches (51 mm)**.
12. Design Uncoated-Steel Thickness: **0.0295 inch (0.75 mm)**.
13. Span Condition: **Simple span**.

### C. NONCOMPOSITE STEEL FLOOR DECK.

Noncomposite Steel Form Deck: Fabricate ribbed-steel sheet noncomposite form-deck panels to comply with "SDI Specifications and Commentary for Noncomposite Steel Form Deck," in SDI Publication No. 30, with the minimum section properties indicated, and with the following:

14. Uncoated Steel Sheet: ASTM A 1008/A 1008M, Structural Steel (SS), Grade **33 (230)** minimum.

15. Prime-Painted Steel Sheet: ASTM A 1008/A 1008M, Structural Steel (SS), Grade **33 (230)** minimum, with [ **top and**] underside surface shop primed with manufacturer's standard baked-on, rust-inhibitive primer.
  - a. Color: **Manufacturer's standard**
16. Galvanized Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade **33 (230)** zinc coating.
17. Galvanized and Shop-Primed Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade **33 (230)** zinc coating; cleaned, pretreated, and primed with manufacturer's standard baked-on, rust-inhibitive primer.
  - a. Color: **Manufacturer's standard**
18. Profile Depth: **9/16 inch (14 mm)**
19. Design Uncoated-Steel Thickness: **0.0149 inch (0.38 mm)**.
20. Span Condition: **Triple span or more.**
21. Side Laps: **Overlapped or interlocking seam at Contractor's option.**

#### .2.4 ACCESSORIES:

- A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.
- C. Mechanical Fasteners: Corrosion-resistant self-drilling, self-threading screws.
- D. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
- E. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi of same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 30 for overhang and slab depth.
- F. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.
- G. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, 0.0598 inch thick, with factory-punched hole of 3/8-inch minimum diameter.
- H. Shear Connectors: ASTM A 108, Grades 1010 through 1020 headed stud type, cold-finished carbon steel, AWS D1.1, Type B, with arc shields.
- I. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035, with dry film containing a minimum of 94 percent zinc dust by weight.
- J. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.



## PART 2 - EXECUTION

### 2.1 EXAMINATION

- A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

### 2.2 INSTALLATION, GENERAL

- A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 30, manufacturer's written instructions, and requirements in this Section.
- B. Install temporary shoring before placing deck panels, if required to meet deflection limitations.
- C. Locate deck bundles to prevent overloading of supporting members.
- D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
  - 1. Align cellular deck panels over full length of cell runs and align cells at ends of abutting panels.
- E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.
- H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.
- I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

### 2.3 ROOF DECK INSTALLATION

- A. Fasten roof-deck panels to steel supporting members AS INDICATED IN DRAWINGS:
  - 1. Anchor Diameter: SEE PLAN.
  - 2. Screw Spacing: SEE PLAN
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps as noted on drawings. Fasten perimeter edges of at intervals not exceeding 12" and as follows:
  - 1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws or 5/8" diameter puddle welds as indicated on drawings.

- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches with end joints as follows:
  - 1. End Joints: Lapped 2 inches minimum.
- D. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. mechanically fasten to substrate to provide a complete deck installation.
  - 1. Weld cover plates at changes in direction of roof-deck panels, unless otherwise indicated.

## 2.4 FLOOR-DECK INSTALLATION

- A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:
  - 1. Weld Diameter: **5/8 inch (16 mm)**, nominal.
  - 2. Weld Spacing: Weld edge ribs of panels at each support. Space additional welds an average of **12 inches (305 mm)** apart, but not more than **18 inches (457 mm)** apart.
  - 3. Weld Spacing: Space and locate welds as indicated.
  - 4. Weld Washers: Install weld washers at each weld location.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of half of the span or **36 inches (910 mm)**, and as follows:
  - 1. Mechanically fasten with self-drilling, **No. 10 (4.8-mm-)** diameter or larger, carbon-steel screws.
  - 2. Mechanically clinch or button punch.
  - 3. Fasten with a minimum of **1-1/2-inch- (38-mm-)** long welds.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of **1-1/2 inches (38 mm)**, with end joints as follows:
  - 1. End Joints: **Lapped or butted at Contractor's option.**
- D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations, unless otherwise indicated.
- E. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.
- F. Electrified Cellular Floor Deck: Install cellular floor system with deck assembled from [**all-cellular units**] [**alternating cellular units with noncellular composite units**] [**units indicated**].
- G. Install piercing hanger tabs at **14 inches (355 mm)** apart in both directions, within **9 inches (228 mm)** of walls at ends, and not more than **12 inches (305 mm)** from walls at sides, unless otherwise indicated.

## 2.5 FIELD QUALITY CONTROL

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

## 2.6 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

## STEEL DECK SUBMITTAL CHECKLIST

*This submittal checklist must be provided with all steel deck packages that are to be submitted to Structural Design Group. Absence of a properly completed checklist may result in the return of the submittal unchecked or as revise and resubmit.*

<b>STEEL DECK SHOP DRAWINGS AND CALCULATIONS</b>		
<b>Included?</b>	<b>Description</b>	<b>Location in project documentation where this requirement is located.</b>
<input type="checkbox"/>	Submit all shop drawings on one reproducible print and two reproductions only.	General Notes - Section 2.0 Spec Section 05310, Part I, Subsection 1.3
<input type="checkbox"/>	Contract documents not used for shop drawing, including erection plans or details	Spec Section 05310, Part I, Subsection 1.3
<input type="checkbox"/>	Resubmitted shop drawings have all revised items clouded or identified.	Spec Section 05310, Part I, Subsection 1.3
<input type="checkbox"/>	Any requested information, clarifications, requests for approvals, modifications, etc. as listed in Spec Section 05310, Part I, Subsection 1.3 are included on the checklist.	Spec Section 05310, Part I, Subsection 1.3
<b>QUESTIONS, ETC. PER SECTION 05310, PART I, SUBSECTION 1.3</b>		

END OF SECTION 05 310

## SECTION 05400 - COLD-FORMED METAL FRAMING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes Design and or Build work of the following:
  - 1. Exterior load-bearing wall framing.
  - 2. Exterior non-load-bearing wall framing.
  - 3. Roof rafter framing.
- B. Related Sections include the following:
  - 1. Division 05 Section "Metal Fabrications" for masonry shelf angles and connections.
  - 2. Division 09 Section "Non-Structural Metal Framing" for interior non-load-bearing, metal-stud framing and ceiling-suspension assemblies.
  - 3. Division 09 Section "Gypsum Board Shaft Wall Assemblies" for interior non-load-bearing, metal-stud-framed, shaft-wall assemblies.
- C. The extent of cold formed metal framing is shown on the drawings, including notes, elevations and details to show basic layout and location of members, typical connections, and type of steel required.
- D. Section includes all work and supplementary items required to complete the proper installation of the pre-engineered cold formed metal framing as shown on the drawings and specified herein including headers, outriggers, supplemental rafters and incidental framing for a cold formed metal framing assembly within the extent shown on the drawings.
- E. Cold formed metal framing includes planar structural units consisting of welded, screwed or bolted connected members which are fabricated, cut and assembled prior to delivery or at the job site.

#### 1.3 REFERENCES

- A. ASTM A 780 - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
- B. ASTM A 1003 - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members.
- C. ASTM B 633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.

- D. ASTM C 955 - Standard Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases.
- E. ASTM C 1002 - Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
- F. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories.
- G. ASTM C 1513 - Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections.
- H. AISC - Steel Construction Manual.
- I. AISI - Specification for the Design of Cold-Formed Steel Structural Members; 1996.
- J. AWS D.1.3 - Structural Welding Code - Sheet Steel.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated. Design bridging and other temporary and permanent bracing for same loads as used to design cold formed metal framing plus any temporary loads and permanent loads resulting laterally bracing of members.
  - 1. Engineering Responsibility: Manufacturer's responsibilities include using a qualified professional engineer to prepare structural analysis data for cold formed metal framing. All cold formed metal framing not specifically detailed on the drawings shall be designed to resist forces indicated, by the Contractor, under the direct supervision of a professional engineer registered in the State where the project is located. Engineer/firm shall provide proof of professional liability insurance for said engineering responsibility.
    - a. Design calculations for the Cold formed metal framing designed by the Contractor shall be submitted for the files of the Architect and Engineer. Calculations shall bear the seal of a professional engineer registered in the State where the project is located. Shop drawings containing connections for which calculations have not been received will be returned unchecked as an incomplete submittal.
    - b. Engineering provided by manufacturer shall be a complete package similar to the "Works" package provided by Aegis Metal Framing or equal. Package to include at a minimum, but not limited to the following:
      - 1) Professional Engineer seal on shop drawings and calculations.
      - 2) Permanent Bracing layout diagrams with connection requirements showing bracing sections and details.
      - 3) Construction Bracing (lateral and diagonal) Layout Diagrams for bottom chord plane, web plane and top chord plane showing bracing sections and details.
      - 4) Minimize Construction Bracing by incorporating Permanent Bracing into the construction bracing where possible.
  - 2. Design Loads: As follows:
    - a. Dead Loads: Weights of materials and construction.
    - b. Roof Live Loads: 20 PSF
    - c. Snow Loads: As indicated in drawings.

- d. Wind Loads: As indicated in drawings.
  - e. Seismic Loads: As indicated in drawings.
3. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
    - a. Exterior Load-Bearing Wall Framing: Horizontal deflection of 1/600 of the wall height.
    - b. Exterior Non-Load-Bearing Framing: Horizontal deflection of 1/600 of the wall height.
    - c. Roof Rafter Framing: Horizontal deflection of 1/240 of the horizontally projected span up to ¾ inch total dead load and ¾ inch total live load.
  4. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F (67 deg C).
  5. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
    - a. Upward and downward movement of 1/2 inch (13 mm).
- B. Cold-Formed Steel Framing, General: Design according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions."
1. Headers: Design according to AISI's "Standard for Cold-Formed Steel Framing - Header Design."
  2. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

## 1.5 SUBMITTALS

- A. This project is a 'Total Design and or Build' construction delivery system and review of submittals by the Owner or his representative does not relieve the 'Design and or Build' Contractor of design duties, construction responsibility or liability for improper design, function or performance. The review by Owner is not an independent design check of final plans and methods of construction by and will not in any way relive the 'Design and or Build' contractor of sole design and construction responsibility for the successful completion and long term stability of the work.
- B. Product Data: For each type of cold-formed metal framing product and accessory indicated.
- C. Shop Drawings: Show layout, spacing, sizes, thicknesses, pitch, span, camber and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work. Shop drawings shall include all placement sequences and instructions.
  1. Submit all shop drawings on three copies only unless specified in the general conditions. Two prints will be returned to the architect. All other reproductions required by the Contractor are the responsibility of the Contractor and shall be made after reproducible is returned.



2. Architect's and Engineer's Shop Drawing Review: Review of shop drawings will be for general considerations only. Compliance with requirements for materials, fabrication, engineering, dimensions, bracing, and erection is the Contractor's responsibility.
  3. If there are questions, clarifications, modifications, or other items where information, a response, or approval is requested, such items must be written on the cover sheet to the submittal. Only indicating such items on the shop drawings or within the calculations is not sufficient. Where items are not specifically listed on the cover sheet and subsequently explicitly approved by the Structural Engineer of Record, such items are not to be considered approved or considered.
  4. For cold-formed metal framing indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation licensed to practice in the state where the project is located. Shop drawings which do not contain this information will be returned unchecked.
  5. Submittals shall additionally conform to the requirements shown on the General Notes of the project Structural Drawings.
- D. Welding certificates.
- E. Qualification Data: For professional engineer and testing agency.
- F. Product Test Reports: From a qualified testing agency, unless otherwise stated, indicating that each of the following complies with requirements, based on evaluation of comprehensive tests for current products:
1. Steel sheet.
  2. Expansion anchors.
  3. Power-actuated anchors.
  4. Mechanical fasteners.
  5. Vertical deflection clips.
  6. Horizontal drift deflection clips
  7. Miscellaneous structural clips and accessories.
- G. Research/Evaluation Reports: For cold-formed metal framing.

## 1.6 QUALITY ASSURANCE

- A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.
- B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.
- C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E 329 to conduct the testing indicated.
- D. Product Tests: Mill certificates or data from a qualified independent testing agency, or in-house testing with calibrated test equipment indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, ductility, and metallic-coating thickness.

- E. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."
- F. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing - General Provisions."
  - 1. Comply with AISI's "Standard for Cold-Formed Steel Framing - Header Design."
- G. Comply with AISI's "Standard for Cold-Formed Steel Framing - Prescriptive Method for One and Two Family Dwellings."
- H. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

#### 1.7 FABRICATOR'S QUALIFICATIONS

- A. Cold formed metal framing shall be designed, fabricated, and erected by a firm which has a record including a minimum of five years of successfully designing, fabricating, and erecting cold formed metal framing assemblies similar to scope required and which practices a quality control program. Fabricators shall additionally be qualified with at least one year experience in using Building Information Modeling (BIM) from inception to producing shop drawings.
- B. Fabricators who wish to qualify for approval under this Section of the specification shall submit evidence of compliance with this specification no later than ten (10) days prior to the bid date. Only those fabricators approved in writing by the Architect prior to the bid date will be accepted.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.
- C. Do not store materials on structure in a manner that might cause distortion or damage to supporting structures.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering cold-formed metal framing that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide cold-formed metal framing by one of the following:
  - 1. AllSteel Products, Inc.
  - 2. California Expanded Metal Products Company.
  - 3. Clark Steel Framing.

4. Dale/Incor.
5. Dietrich Metal Framing; a Worthington Industries Company.
6. Formetal Co. Inc. (The).
7. Innovative Steel Systems.
8. MarinoWare; a division of Ware Industries.
9. Southeastern Stud & Components, Inc.
10. Steel Construction Systems.
11. Steeler, Inc.
12. Super Stud Building Products, Inc.
13. United Metal Products, Inc.

## 2.2 MATERIALS

- A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
  1. Grade: Minimum of Grade 33 or as required by structural performance.
  2. Coating: G60 (Z180).
- B. Steel Sheet for Vertical Deflection or Drift Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:
  1. Grade: 50 (340), Class 1 or 2 or as required by structural performance.
  2. Coating: G90 (Z275).

## 2.3 EXTERIOR LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
  1. Minimum Base-Metal Thickness: 0.0329 inch (0.84 mm).
  2. Minimum Flange Width: 1-5/8 inches (41 mm).
  3. Section Properties: as required by structural performance.
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, and as follows:
  1. Minimum Base-Metal Thickness: 0.0329 inch (0.84 mm) or matching steel studs.
  2. Minimum Flange Width: 1-1/4 inches (32 mm).
  3. Section Properties: as required by structural performance.
- C. Steel Box or Back-to-Back Headers: Manufacturer's standard C-shapes used to form header beams, of web depths indicated, punched, with stiffened flanges, and as follows:
  1. Minimum Base-Metal Thickness: 18ga
  2. Minimum Flange Width: 1-5/8 inches (41 mm).
  3. Section Properties: as required by structural performance.
- D. Steel Double-L Headers: Manufacturer's standard L-shapes used to form header beams, of web depths indicated, and as follows:
  1. Minimum Base-Metal Thickness: 18 ga
  2. Top Flange Width: 1-5/8 inches (41 mm).

3. Section Properties: as required by structural performance.

## 2.4 EXTERIOR NON-LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
  1. Minimum Base-Metal Thickness: 0.0329 inch (0.84 mm).
  2. Minimum Flange Width: 1-5/8 inches (41 mm).
  3. Section Properties: as required by structural performance.
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
  1. Minimum Base-Metal Thickness: 18 ga or matching steel studs.
  2. Minimum Flange Width: 1-1/4 inches (32 mm)].
  3. Section Properties: as required by structural performance.
- C. Vertical Deflection Clips: Manufacturer's standard bypass or head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
  1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Dietrich Metal Framing; a Worthington Industries Company.
    - b. MarinoWare, a division of Ware Industries.
    - c. SCAFECO Corporation
    - d. The Steel Network, Inc.
- D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal and lateral loads and transfer them to the primary structure, and as follows:
  1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Dietrich Metal Framing; a Worthington Industries Company.
    - b. MarinoWare, a division of Ware Industries.
    - c. SCAFECO Corporation
    - d. The Steel Network, Inc.
  3. Minimum Base-Metal Thickness: 0.0428 inch (1.09 mm).
  4. Flange Width: 1 inch (25 mm) plus the design gap for 1-story structures and 1 inch (25 mm) plus twice the design gap for other applications.

- E. Contractors' Option Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.
  - 1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal and lateral loads and transfer them to the primary structure, and as follows:
    - a. Minimum Base-Metal Thickness: 0.0428 inch (1.09 mm).
    - b. Flange Width: 1 inch (25 mm) plus the design gap for 1-story structures and 1 inch (25 mm) plus twice the design gap for other applications.
  - 2. Inner Track: Of web depth indicated, and as follows:
    - a. Minimum Base-Metal Thickness: 0.0428 inch (1.09 mm).
    - b. Flange Width: outer deflection track flange width plus 1 inch (25 mm).
- F. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure.

## 2.5 ROOF-RAFTER FRAMING

- A. Steel Rafters: Manufacturer's standard C-shaped steel sections, of web depths indicated, unpunched, with stiffened flanges, and as follows:
  - 1. Minimum Base-Metal Thickness: 18 ga.
  - 2. Flange Width: 1-5/8 inches (41 mm) minimum.
  - 3. Section Properties: as required by structural performance.
- B. Built-up Members: Built-up members of manufacturer's standard C-shaped steel section, with stiffened flanges, nested into a U-shaped steel section rafter track, with unstiffened flanges; unpunched; of web depths indicated; and as follows:
  - 1. Minimum Base-Metal Thickness: 0.0329 inch (0.84 mm) or Matching steel rafters.
  - 2. Flange Width: 1-5/8 inches (41 mm), minimum.

## 2.6 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.
- B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
  - 1. Supplementary framing.
  - 2. Bracing, bridging, and solid blocking.
  - 3. Web stiffeners.
  - 4. Anchor clips.
  - 5. End clips.
  - 6. Foundation clips.
  - 7. Gusset plates.
  - 8. Stud kickers, knee braces, and girts.
  - 9. Rafter hangers and end closures.
  - 10. Hole reinforcing plates.

11. Backer plates.

## 2.7 ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.
- B. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel hex-headed bolts and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.
- C. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.
- D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.
- E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.
  - 1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.
- F. Welding Electrodes: Comply with AWS standards.

## 2.8 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: SSPC-Paint 20 or ASTM A 780.
- B. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.
- C. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107, with fluid consistency and 30-minute working time.
- D. Shims: Load bearing, high-density multimonomer plastic, nonleaching.
- E. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch (6.4 mm) thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

## 2.9 FABRICATION

- A. Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
  - 1. Fabricate framing assemblies using jigs or templates.

2. Cut framing members by sawing or shearing; do not torch cut.
  3. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
    - a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    - b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.
  4. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to Shop Drawings.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.
- C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:
1. Spacing: Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
  2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch (3 mm).
- D. Cold formed metal framing to be fabricated at the fabricator's shop in the largest sections possible to transport and erect.
- E. All cold formed metal framing shall be fabricated and erected in strict accordance with the current printed instructions of the approved subcontractor or fabricator.
- F. All cold formed metal framing components shall be straight and true prior to fabrication. Flattening or straightening of components, when necessary, shall be accomplished in a manner so as to not damage the component.
- G. All cold formed metal framing components shall be cut neatly to fit snugly against adjacent members.
- H. No splices will be allowed in cold formed metal framing except as authorized in writing by the Architect or as shown on the approved shop drawings.
- I. Framing components shall be field or shop fabricated and joined to one another by means of welding or through the use of screws.
- J. Completed cold formed metal framing shall be free from twists, bends, or open joints with all members straight and true to line.
- K. Welds must be thoroughly cleaned and wire brushed and primed and painted with a high zinc content paint capable of providing an equal or greater degree of protection than the original G-60 galvanized coating.
- L. Bridging: Fabricate horizontal or diagonal type bridging for cold formed metal framing as required to prevent buckling of members where sheathing applied to the cold formed metal framing members is not present or is not adequate to brace the cold formed metal framing member. Bridging shall transfer all forces to the roof diaphragm.

- M. End Anchorage: Fabricate end anchorages to secure cold formed metal framing to adjacent construction.
- N. Fabricate all clips, angles, henways and other miscellaneous pieces necessary to attach cold formed metal framing to the substructure or to attach other components within this section to one another.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.
  - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Structural Adequacy: Contractor shall prepare the structure to insure proper and adequate structural support for the materials specified.
- B. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.
- C. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that are required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.
- D. Install load bearing shims or grout between the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or rafter locations to ensure a uniform bearing surface on supporting concrete or masonry construction.
- E. Install sealer gaskets to isolate the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or rafter locations.

#### 3.3 INSTALLATION, GENERAL

- A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions" and to manufacturer's written instructions unless more stringent requirements are indicated.
- C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
  - 1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch (1.6 mm).



- D. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.
  - 1. Cut framing members by sawing or shearing; do not torch cut.
  - 2. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
    - a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    - b. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.
- E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
- F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- G. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.
- H. Install insulation, specified in Division 07 Section "Thermal Insulation," in built-up exterior framing members, such as headers, sills, boxed rafters, and multiple studs at openings, that are inaccessible on completion of framing work.
- I. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.
- J. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:
  - 1. Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

#### 3.4 EXTERIOR LOAD-BEARING WALL INSTALLATION

- A. Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at spacings as follows:
  - 1. Anchor Spacing: To match stud spacing.
- B. Squarely seat studs against top and bottom tracks with gap not exceeding of 1/8 inch (3 mm) between the end of wall framing member and the web of track. Fasten both flanges of studs to top and bottom tracks. Space studs as follows:
  - 1. Stud Spacing: 16 inches (406 mm).
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar configurations.

- D. Align studs vertically where floor framing interrupts wall-framing continuity. Where studs cannot be aligned, continuously reinforce track to transfer loads.
- E. Align floor and roof framing over studs. Where framing cannot be aligned, continuously reinforce track to transfer loads.
- F. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure as indicated.
- G. Install headers over wall openings wider than stud spacing. Locate headers above openings as indicated. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.
  - 1. Frame wall openings with not less than a double stud at each jamb of frame as indicated on Shop Drawings. Fasten jamb members together to uniformly distribute loads.
  - 2. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.
- H. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.
  - 1. If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in each case, considering weight or load resulting from item supported.
- I. Install horizontal bridging in stud system, spaced a minimum of 48 inches (1220 mm) apart or as required by structural performance. Fasten at each stud intersection.
  - 1. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs with a minimum of 2 screws into each flange of the clip angle for framing members up to 6 inches (150 mm) deep.
  - 2. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
  - 3. Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
- J. Install steel sheet diagonal bracing straps to both stud flanges, terminate at and fasten to reinforced top and bottom tracks. Fasten clip-angle connectors to multiple studs at ends of bracing and anchor to structure.
- K. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

### 3.5 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.
- B. Fasten both flanges of studs to top and bottom track, unless otherwise indicated. Space studs as follows:

1. Stud Spacing: 16 inches (406 mm).
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
1. Install single-leg deflection tracks and anchor to building structure.
  2. Install double deep-leg deflection tracks and anchor outer track to building structure.
  3. Connect vertical deflection clips to bypassing or infill studs and anchor to building structure.
  4. Connect drift clips to cold formed metal framing and anchor to building structure.
- E. Install horizontal bridging in wall studs, spaced in rows but not more than 48 inches (1220 mm) apart or as required by structural performance. Fasten at each stud intersection.
1. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches (305 mm) of single deflection track. Install a combination of flat, taut, steel sheet straps of width and thickness indicated and stud or stud-track solid blocking of width and thickness matching studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
    - a. Install solid blocking at 96-inch (2440-mm) centers.
  2. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
  3. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
  4. Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
- F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable wall-framing system.

### 3.6 ROOF RAFTER INSTALLATION

- A. Install perimeter rafter track sized to match rafters. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated on Shop Drawings.
- B. Install rafter bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten rafters to both flanges of rafter track.
1. Install rafters over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm).
  2. Reinforce ends and bearing points of rafters with web stiffeners, end clips, rafter hangers, steel clip angles, or steel-stud sections as indicated on Shop Drawings.
- C. Space rafters not more than 2 inches (51 mm) from abutting walls, and as follows:
1. Rafter Spacing: 24 to 48 inches or as required by structural performance.

- D. Frame openings with built-up rafter headers consisting of rafter and rafter track, nesting rafter, or another combination of connected rafters if indicated.
- E. Install rafter reinforcement at interior supports with single, short length of rafter section located directly over interior support, with lapped rafters of equal length to rafter reinforcement.
  - 1. Install web stiffeners to transfer axial loads of walls above.
- F. Install bridging at intervals as required by structural performance. Fasten bridging at each rafter intersection as follows:
  - 1. Bridging: Rafter-track solid blocking of width and thickness indicated, secured to rafter webs.
  - 2. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and rafter-track solid blocking of width and thickness indicated. Fasten flat straps to bottom flange of rafters and secure solid blocking to rafter webs.
- G. Secure rafters to load-bearing interior walls to prevent lateral movement of bottom flange.
- H. Install miscellaneous rafter framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable rafter-framing assembly.

### 3.7 FIELD QUALITY CONTROL

- A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports per Specification Section 01410.
- B. Field and shop welds will be subject to testing and inspecting.
- C. Testing agency will report test results promptly and in writing to Contractor and Architect.
- D. Remove and replace work where test results indicate that it does not comply with specified requirements.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- F. Architect reserves the right, at any time before final acceptance, to reject material not complying with specified requirements regardless of when testing agency completed inspection, observation or testing.

### 3.8 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 054000

1.0 - GENERAL

- 1.1 Scope  
Furnish and install all miscellaneous metals as indicated on drawings, including that shown only on Architectural Drawings, and/or as specified.
- 1.2 Submittals  
Submit shop drawings for approvals.
- 1.3 Applicable Standards  
Fabrication and erection, except as specified otherwise, shall be in accordance with American Institute of Steel Construction (AISC) Specifications for the Design, Fabrication and Erection of Structural Steel for Building.
- 1.4 Qualification  
Manufacturer's names, models, or catalog numbers, referred to herein are intended to show the type, quality and intent of items required. Products of other manufacturers equal or better in quality, similar in design are acceptable subject to the Architect's approval.
- 1.5 Substitutions  
Substitutions of sections or modifications of details shall be submitted with the shop drawings for approval. Approved substitutions, modifications, and necessary changes in related portions of the work shall be coordinated by the contractor and shall be accomplished as no additional cost.

2.0 - PRODUCTS

- 2.1 General Materials
- A. Metals shall be free from defects impairing strength, durability, or appearance and of the best commercial quality for the purposes specified. All materials shall be new materials and shall have structural properties to sustain safely or withstand strains or stressed to which normally subjected. All exposed fastenings shall be of same material, color and finish as the metal to which applied unless otherwise shown.
- B. Provide all accessories such as anchors, hangers, belts, toggle bolts, expansion bolts, rods, shelf angles, clip angles, shims, connections, stiffeners, reinforcements, screws, etc., required for proper complete fabrication, assembly and installation of all miscellaneous steel, metal work and masonry. Bolts, screws, expansion bolts, toggle bolts, etc, shall be brass, bronze, stainless steel or aluminum when used with these metals.
- C. Steel lintels and miscellaneous structural shapes where called for shall be of shapes, lengths and weights, as shown and detailed on the drawings, spanning openings where so indicated, shall be complete with bolts, anchors, etc., for building in. Lintels shall not have less than eight (8") inch bearing upon masonry.
- D. Galvanized steel shall be hot-dipped galvanized in accordance with the Standard Specifications of the American Hot-Dip Galvanizing Association. Galvanizing shall be done after fabrication.
- E. All materials shall be well formed to shape and size with sharp lines. Conceal fasteners where practical. Thickness of metals and details of assembly and

supports shall give ample strength.

- F. Welding shall conform to American Welding Society's Standard Code for Arc and Gas Welding in Building Construction. Welding shall be continuous along entire area of contact, except where tack welding is specifically shown or specified. Tack welding will not be permitted on exposed surface. Grind all exposed welds smooth.

## 2.2 Painting and Protective Coating

- A. Thoroughly clean off all miscellaneous metal, using power tool cleaning to remove all dirt, grease, rust, and scale and foreign matter.
- B. Treat only concealed galvanized metal with galvanized metal primer as per manufacturer's directions before painting. Exposed galvanized metal to be primed and finished under Painting Section.
- C. Unless otherwise specified, paint all metal items, including concealed galvanized metal, one shop coat of Red or Grey oxide zinc chromate TT-P-636-C. Surfaces inaccessible after assembly shall be painted before assembly. Work paint thoroughly into joints, etc. Do not paint bronze, aluminum or stainless steel.
- D. Insulate faces of all metals in contact with different metals, wood, masonry, and/or concrete; give each contact surface one coat approved alkali-resistant bituminous paint. Let both surfaces dry before installing metals.

## 2.3 Miscellaneous Metal Items

The following items are intended as a guide to such work in this project and do not necessarily limit the scope of this section.

- A. All structural shapes indicated and/or required.
- B. Miscellaneous Steel Lintels. Provide miscellaneous steel lintels indicated on Architectural and/or Structural Drawings or as required. All miscellaneous steel lintels are subject to structural engineer's review and approval.
- C. Interior and Exterior Round Member Stair And Ramp Handrail, Guardrails and Brackets as indicated and detailed. Handrail to be 3 ft. min.
- D. Metal Ladders - Provide steel ladders where indicated of 3/8" x 2-1/2" steel bar stringers spaced 20" o.c. with 3/4" square bar rungs set at 45 degrees and welded to stringer 12" o.c. Anchor ladder to masonry with clip angles or bent plates designed to hold rungs 8" from wall. Space anchors not more than 5'-0" o.c. Prime paint under this Section. At each non-caged ladder over 14 ft. in height shall be provided with a climbing safety system equal to VI-GO Ladder Climbing Safety System as manufactured by Miller by Sperrian. (See Elevator Pit and Roof Access Ladders.)
- E. Downspout Boots shall be equal to Jay R Smith MFG. Co. (Smith Industries) special downspout boots. Cast Iron Body with 3" Bronze Access Plug and Strap with 5/16" Dia. Cast Holes for flat head bolts, Typical. 5 x 4 Size.
- F. Roof Hatches: Fabricate roof hatches with insulated double-wall lids and insulated single-wall curb frame with integral deck mounting flange and lid frame counterflashing. Fabricate with welded corner joints. Provide continuous weathertight perimeter gasketing and equip with corrosion-resistant or hot-dip galvanized hardware. Manufacturer - Bilco Company . Type and Size: Single-leaf

lid, 30 by 36 inches. Curb and Lid Material: Aluminum sheet, 0.090 inch thick. Finish: Mill. Maintain a minimum curb height of 12 inches above finished roof surface. Curb height must be adjusted to thickness of roof insulation with a minimum base flashing height recommended by roofing membrane manufacturer.

- G. Ship's Ladder shall be as indicated for 125 lbs./sq. ft. line load capacity steel construction. Threads and risers of slip retardant perforated steel plate. Stringers 10" channel at 8.4 lbs./ft. and as indicated. Provide all channels, angles, closures, clips and anchors as required. Prime under this Section.
- H. Expansion Joint Systems (As Indicated and/or as required)
1. Floor to floor expansion joint system shall be flush type as approved equal to Model GFT - RFX as manufactured by C/S System Corporation or Model TMB Series as manufactured by Nystrom.
    - a. Floor to floor expansion joints shall be provided with a 2 hr. fire barrier component as approved equal to ARe-Flex®, Between floor series as manufactured by C/S Systems Corporation.
  2. Wall to Wall expansion joint system (As Indicated and/or as required)
    - a. Shall be surface mount type as approved equal to Wall-to-Wall Joint Systems. Basis-of-Design Product: Construction Specialties, Inc. Model SFW. Type: Vertical cover plate. Exposed Metal: Aluminum. Finish: Class II, clear anodic.
    - b. Fire-Resistance Rating: Provide joint system and fire-barrier assembly with a rating not less than that of adjacent construction. Typical: Wall to wall expansion joints shall be provided with a 2 hr. fire barrier component as approved equal to "Re-Flex" by Construction Services or "Pyro-Flex" by MM Systems Corporation.
    - c. Moisture Barrier – Manufacturer's Standard

### 3.0 - EXECUTION

#### 3.1 Fabrication

- A. Verify measurements in field for work fabricated to fit job conditions.
- B. Fabricate form work true to detail with clean, straight, sharply defined profiles. Iron shall have smooth finished surfaces unless indicated otherwise. Shearing and punching shall leave clean, true lines and surfaces.
- C. Fastenings shall be concealed where practical. Thickness of metal and details of assembly and supports shall give ample strength and stiffness. Joints exposed to the weather shall be formed to exclude water. Provide holes and connections for the work of other trades.
- D. Joints shall be rigid at adjoining sections for a strong assembly. Weld or rivet permanent connections. Welds shall be continuous and finished flush and smooth on surfaces that will be exposed after installation. Do not use screws or bolts where it can be avoided; where screws or bolts are used, the heads shall be countersunk, screwed up tight and threads nicked to prevent loosening. Unexposed welded joints may be continuous or spot welded as required. Remove weld spatter from adjacent surfaces.

#### 3.2 Installation

- A. Erect work in thorough, first class manner with mechanics experienced in the erection of iron work.



- B. Work shall be strong, secure, and adequate for the purpose intended.
- C. Schedule delivery of items to be built into the masonry so as not to delay the progress of the work and to coordinate for proper installation.
- D. Place and properly secure to form work items such as anchors, sleeves, and inserts which are to be cast in concrete.

END OF SECTION

1.0 - GENERAL

1.1 Scope

The work under this section consists of all rough and finish carpentry work.

1.2 General

- A. Rough carpentry shall generally include all rough framing, furring, grounds, bucks, blocking and such other wood work as required.
- B. Finish carpentry shall include all interior and/or exterior finish and/or trim as indicated.
- C. Carpentry shall also include all temporary bracing, shoring and centering as required for the support or protection of the work.

1.3 Cooperation With Other Trades

The work under this section includes the necessary cutting and patching required for the proper installation of work of other trades. Work which is to be built in by others shall be accurately positioned and properly built in to secure the work of this section. Temporary centering, bracing, and shoring shall be provided as required for the support and protection of masonry work during construction.

1.4 Delivery and Storage

Lumber and other materials specified herein shall be delivered, handled, and stored in order to prevent damage and absorption of excess moisture. Lumber shall be stored in such a manner as to insure proper ventilation and protection from the weather.

2.0 - PRODUCTS

2.1 Lumber

- A. All dimensional lumber used under this section shall be thoroughly dried No. 2 Southern Yellow Pine or No. 2 Douglas Fir of sizes, shapes and lengths required. Moisture content shall not exceed 19% at time of installation.
- B. All wood shall be sound, flat, straight, well-seasoned, thoroughly dry and free from structural defects. Warped or twisted wood shall not be used.
- C. Lumber grades shall conform to the grading rules of the manufacturer's association under whose rules the lumber is produced. All lumber shall be grade-marked.

2.2 Interior Woodwork

- A. Lumber used for painted interior woodwork, unless otherwise indicated, shall be one of the following:
  - Fir - Coast or Inland Douglas White.
  - Pine - Ponderosa, SouthernGrade of lumber used shall be second grade for paint finish.
- B. All interior plywood to be painted shall be Paint Grade Fir or Natural Birch.
- C. All interior woodwork and plywood to be stained or finished natural shall be Premium Grade Select White Birch or Select Red Oak as indicated. Veneer shall be rotary cut. Semi-exposed parts, as defined by AWI, of natural or stained

casework shall be Natural Birch.

D. Lumber shall be kiln dried with an average moisture content of 6% to 11%.

2.3 Plywood

- A. Each panel of softwood plywood shall be identified with the DFPA grade trademark of the American Plywood Association and shall meet the requirements of Product Standard PS 1-66 for Softwood Plywood Construction and Industrial. All plywood which has any edge or surface permanently exposed to the weather shall be of the exterior type.
- B. Plywood sheathing and/or decking shall be DFPA Standard with exterior glue, thickness as shown on the drawings or required for the intended use.
- C. Duraply plywood to be exterior grade with sheet plastic facing.
- D. Particle board shall be U.S. Plywood Corp. "Novoply". Weyerhaeuser Company "Timberland" or approved equal of thickness shown. Factory sanded and sealed or filled, 2 sides.

2.4 Plastic Laminate

- A. Plastic laminate shall be Nevamar, Wilson-Art or Formica, 1/16" thick. Color and pattern shall be as selected.
- B. Backing sheet shall be high pressure laminate, .020" minimum thickness.
- C. The adhesive shall be that recommended by the manufacturer of the laminated plastic used.

2.5 Wood Treatment

- A. Lumber in contact with concrete or masonry, including roof blocking, cants and nailers and/or as indicated, shall be pressure preservative treated in accordance with American Wood Preservers Institute Standard No. LP-2. Creosote, oil or similar materials which bleed shall not be used.
- B. Lumber for blocking and furring, located within interior concealed spaces shall be non-combustible. Treatment shall be equal to "Flame-Proof" by Osmose Wood Preservative; "Non-Con" by Koppers or approved equal. Lumber shall be UL certification marked.

2.6 Fastening Devices

Nails, screws, bolts, anchors, washers, clips, shields, power actuated devices and other rough hardware shall be of the sizes and types indicated on the drawings or as required to adequately anchor all members. Anchors for nailing strips and blocking shall have nuts and washers countersunk and bolts cut off flush with the top of the wood nailer.

2.7 Cabinet Hardware - Contractor shall furnish hardware equal to that as manufactured by Stanley, as hereinafter specified. All hardware to have finish to match room hardware.

Flush Doors # 1584

Lipped Doors # 1585

Drawer Guides - Grant # 300; Catches # 41

Adjustable Shelf Standards - Knape & Vogt # 255 with # 256 shelf supports.

Pull Handles # 4484 with # 4487 Bases, yellow or white metal to match room hardware color.

2.8 Temporary Closures

Provide batten doors with locks at all exterior openings. Appropriate protection against weather and danger of life shall be maintained throughout the job.

3.0 - EXECUTION

3.1 Installation

- A. All work shall be installed plumb and true, and secured in place with proper fastenings so as to make rigid and firm.
- B. The work of this section shall be performed in the best practice relating to the trade so as to carry out the intent of the drawings and to properly accommodate the work of all trades.
- C. Cut ends or faces of all treated wood shall be brushed treated with preservative.

END OF SECTION

## SECTION 06176-METAL-PLATE-CONNECTED WOOD TRUSSES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Wood roof trusses.
  - 2. Wood truss bracing.
  - 3. Metal truss accessories.
- B. Related Sections include the following:
  - 1. Division 2 Section "Termite Control" for site application of borate treatment to wood trusses.
  - 2. Division 6 Section "Sheathing" for roof sheathing and subflooring.
- C. Allowances: Provide wood truss bracing under the Metal-Plate-Connected Truss Bracing Allowance as specified in Division 1 Section "Allowances."

#### 1.3 DEFINITIONS

- A. Metal-Plate-Connected Wood Trusses: Planar structural units consisting of metal-plate-connected members fabricated from dimension lumber and cut and assembled before delivery to Project site.
- B. TPI: Truss Plate Institute, Inc.
- C. Lumber grading agencies, and the abbreviations used to reference them, include the following:
  - 1. NeLMA: Northeastern Lumber Manufacturers' Association.
  - 2. NLGA: National Lumber Grades Authority.
  - 3.
  - 4. SPIB: The Southern Pine Inspection Bureau.
  - 5. WCLIB: West Coast Lumber Inspection Bureau.
  - 6. WWPA: Western Wood Products Association.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide metal-plate-connected wood trusses capable of withstanding design loads within limits and under conditions indicated. Comply with requirements in TPI 1 unless more stringent requirements are specified below.

1. Design Loads: As indicated on General Notes of Structural Drawings.
  2. Maximum Deflection Under Design Loads: As indicated on General Notes of Structural Drawings.
- B. Design trusses for loads indicated on drawings plus concentrated loads hung from or supported on trusses. Refer to mechanical, electrical and plumbing drawings and specifications for loading information and location. Loading as required by other subcontractors, such as fire protection, shall be coordinated by the General Contractor

#### 1.5 SUBMITTALS

- A. Submit all shop drawings on one reproducible print and two copies only. The reproducible print will be returned. All other reproductions required by the Contractor are the responsibility of the Contractor and shall be made after reproducible is returned.
1. Architect's and Engineer's Shop Drawing Review: Review of shop drawings will be for general considerations only. Compliance with requirements for materials, fabrication, engineering, dimensions, bracing, and erection is the Contractor's responsibility.
- B. If there are questions, clarifications, modifications, or other items where information, a response, or approval is requested, such items must be written on the cover sheet to the submittal. Only indicating such items on the shop drawings or within the calculations is not sufficient. Where items are not specifically listed on the cover sheet and subsequently explicitly approved by the Structural Engineer of Record, such items are not to be considered approved or considered.
- C. Product Data: For fire-retardant treated lumber, metal-plate connectors, metal truss accessories, and fasteners.
1. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
  2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to truss fabricator.
  3. Include copies of warranties from chemical treatment manufacturers for each type of treatment.
- D. Shop Drawings: **Prepared by or under the supervision of a qualified professional engineer.** Show fabrication and installation details for trusses. All designs shall bear the name and seal of a Structural Engineer licensed to practice in the state where the project is located. Shop drawings which do not contain this information will be returned unchecked
1. Show location, pitch, span, camber, configuration, and spacing for each type of truss required.
  2. Indicate sizes, stress grades, and species of lumber.
  3. Indicate locations of permanent bracing required to prevent buckling of individual truss members due to design loads.
  4. Indicate type, size, material, finish, design values, orientation, and location of metal connector plates.
  5. Show splice details and bearing details.
  6. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
  7. Submit stamped design analysis and test reports indicating loading, section properties, allowable stress, stress diagrams and calculations, and similar information needed for analysis and to insure trusses comply with requirements.

8. Submittals shall additionally conform to the requirements shown on the General Notes of the project Structural Drawings.
  9. Show all bearing and anchorage details.
  10. Specify and detail all supplemental strapping, bracing clips and other accessories required for proper installation and permanent member bracing.
  11. Shop drawings shall include all placement sequences and instructions.
- E. Product Certificates: For metal-plate-connected wood trusses, signed by officer of truss fabricating firm.
- F. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:
1. Fire-retardant-treated wood.

#### 1.6 QUALITY ASSURANCE

- A. Metal Connector-Plate Manufacturer Qualifications: A manufacturer that is a member of TPI and that complies with quality-control procedures in TPI 1 for manufacture of connector plates.
1. Manufacturer's responsibilities include providing professional engineering services needed to assume engineering responsibility.
  2. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
- B. Fabricator Qualifications: Shop that participates in a recognized quality-assurance program that complies with quality-control procedures in TPI 1 and that involves third-party inspection by an independent testing and inspecting agency acceptable to Architect and authorities having jurisdiction.
- C. Source Limitations for Connector Plates: Obtain metal connector plates from a single manufacturer.
- D. Comply with applicable requirements and recommendations of the following publications:
1. TPI 1, "National Design Standard for Metal Plate Connected Wood Truss Construction."
  2. TPI DSB, "Recommended Design Specification for Temporary Bracing of Metal Plate Connected Wood Trusses."
  3. TPI HIB, "Commentary and Recommendations for Handling, Installing & Bracing Metal Plate Connected Wood Trusses."
- E. Wood Structural Design Standard: Comply with applicable requirements in AF&PA's "National Design Specifications for Wood Construction" and its "Supplement."

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Handle and store trusses to comply with recommendations of TPI HIB, "Commentary and Recommendations for Handling, Installing & Bracing Metal Plate Connected Wood Trusses."
1. Store trusses flat, off of ground, and adequately supported to prevent lateral bending.
  2. Protect trusses from weather by covering with waterproof sheeting, securely anchored.
  3. Provide for air circulation around stacks and under coverings.

- B. Inspect trusses showing discoloration, corrosion, or other evidence of deterioration. Discard and replace trusses that are damaged or defective.

## 1.8 COORDINATION

- A. Time delivery and erection of trusses to avoid extended on-site storage and to avoid delaying progress of other trades whose work must follow erection of trusses.

## PART 2 - PRODUCTS

### 2.1 DIMENSION LUMBER

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
  - 1. Factory mark each piece of lumber with grade stamp of grading agency.
  - 2. For exposed lumber indicated to receive a stained or natural finish, omit grade stamp and provide certificates of grade compliance issued by grading agency.
  - 3. Provide dressed lumber, S4S.
  - 4. Provide dry lumber with 19 percent maximum moisture content at time of dressing.
- B. Grade and Species: Provide visually graded dimension lumber for truss chord and web members, of not less than the following grade and the following species:
  - 1. Grade for Chord Members: No. 2.
  - 2. Grade for Web Members: Construction, Stud, or No. 3.
  - 3. Species: Southern pine; SPIB.
- C. Permanent Bracing: Provide wood bracing that complies with requirements for miscellaneous lumber in Division 6 Section Rough Carpentry.

### 2.2 METAL CONNECTOR PLATES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Alpine Engineered Products, Inc.
  - 2. Cherokee Metal Products, Inc.; Masengill Machinery Company.
  - 3. CompuTrus, Inc.
  - 4. Eagle Metal Products.
  - 5. Jager Building Systems, Inc.
  - 6. MiTek Industries, Inc.; a subsidiary of Berkshire Hathaway Inc.
  - 7. Robbins Engineering, Inc.
  - 8. TEE-LOK Corporation; a subsidiary of Berkshire Hathaway Inc.
  - 9. Truswal Systems Corporation.



- C. General: Fabricate connector plates to comply with TPI 1.
- D. Hot-Dip Galvanized Steel Sheet: ASTM A 653/A 653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G60 coating designation; and not less than 0.036 inch thick.
  - 1. Use for interior locations where stainless steel is not indicated.

## 2.3 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Lag Bolts: ASME B18.2.1.
- F. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.
- G. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
  - 1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
  - 2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2.

## 2.4 METAL TRUSS ACCESSORIES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- C. Basis-of-Design Products: Subject to compliance with requirements, provide products indicated on Drawings or comparable products by one of the following:
  - 1. Cleveland Steel Specialty Co.
  - 2. Harlen Metal Products, Inc.
  - 3. KC Metals Products, Inc.
  - 4. Simpson Strong-Tie Co., Inc.
  - 5. Southeastern Metals Manufacturing Co., Inc.
  - 6. USP Structural Connectors.

- D. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, that meet or exceed those of basis-of-design products. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.
- E. Galvanized Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 coating designation.
  - 1. Use for interior locations where stainless steel is not indicated.
- F. Roof Truss Bracing/Spacers: U-shaped channels, 1-1/2 inches wide by 1 inch deep by 0.040 inch thick, made to fit between 2 adjacent trusses and accurately space them apart, and with tabs having metal teeth for fastening to trusses.

## 2.5 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: SSPC-Paint 20, with dry film containing a minimum of 94 percent zinc dust by weight.

## 2.6 FABRICATION

- A. Cut truss members to accurate lengths, angles, and sizes to produce close-fitting joints.
- B. Fabricate metal connector plates to sizes, configurations, thicknesses, and anchorage details required to withstand design loads for types of joint designs indicated.
- C. Assemble truss members in design configuration indicated; use jigs or other means to ensure uniformity and accuracy of assembly with joints closely fitted to comply with tolerances in TPI 1. Position members to produce design camber indicated.
  - 1. Fabricate wood trusses within manufacturing tolerances in TPI 1.
- D. Connect truss members by metal connector plates located and securely embedded simultaneously in both sides of wood members by air or hydraulic press.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install wood trusses only after supporting construction is in place and is braced and secured.
- B. If trusses are delivered to Project site in more than one piece, assemble trusses before installing.
- C. Hoist trusses in place by lifting equipment suited to sizes and types of trusses required, exercising care not to damage truss members or joints by out-of-plane bending or other causes.
- D. Install and brace trusses according to TPI recommendations and as indicated.
- E. Install trusses plumb, square, and true to line and securely fasten to supporting construction.

- F. Space trusses as indicated; adjust and align trusses in location before permanently fastening.
- G. Anchor trusses securely at bearing points; use metal truss tie-downs or floor truss hangers as applicable. Install fasteners through each fastener hole in truss accessories according to manufacturer's fastening schedules and written instructions.
- H. Securely connect each truss ply required for forming built-up girder trusses.
  - 1. Anchor trusses to girder trusses as indicated.
- I. Install and fasten permanent bracing during truss erection and before construction loads are applied. Anchor ends of permanent bracing where terminating at walls or beams.
  - 1. Install bracing to comply with Division 6 Section Rough Carpentry.
- J. Install wood trusses within installation tolerances in TPI 1.
- K. Do not cut or remove truss members.
- L. Replace wood trusses that are damaged or do not meet requirements.
  - 1. Do not alter trusses in field.

### 3.2 REPAIRS AND PROTECTION

- A. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- B. Repair damaged galvanized coatings on exposed surfaces with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- C. Protective Coating: Clean and prepare exposed surfaces of metal connector plates. Brush apply primer, when part of coating system, and one coat of protective coating.
  - 1. Apply materials to provide minimum dry film thickness recommended by coating system manufacturer.

END OF SECTION 06176END OF SECTION 06176

1.0 - GENERAL

1.1 Scope

- A. The work under this section consists of all finish carpentry, millwork and related items.
- B. Millwork shall be defined as follows: "All exterior and interior woodwork exposed to view in the finished building, except lumber yard or specialty items. All exposed wood, plywood, hard plastic and wood doors are included."
- C. All millwork shall be produced by the same source of supply to coordinate matching of materials.

1.2 Submittals

- A. Shop drawings shall be furnished on all millwork to the architect for approval prior to fabrication. These drawings to show size, arrangement, type of material, connections and relationship to adjacent work.
- B. All shop drawings shall show species of woods and the manufacturer's name for all manufactured items.
- C. When required, contractor shall submit a sample unit as requested.
- D. Submit samples of decorative laminate colors, patterns, and textures for semi-exposed materials for architect's selection. Samples of other materials or hardware shall be available if requested.

1.3 Applicable Standards

- A. The Quality Standards of the American Woodwork Institute (AWI) shall apply and, by reference, are made a part of this specification.
- B. Millwork materials and workmanship not shown, specified, or normally furnished to a higher degree of quality shall conform to custom grade requirements of the AWI Quality Standards.

1.4 Delivery and Storage

- A. When all millwork items are ready for shipment to the job site, the architect shall be notified through the contractor so that either may inspect the work in the mill prior to shipment.
- B. All materials shall be inspected by the contractor's superintendent upon receipt at the job site. No faulty or damaged materials shall be received. It shall be the contractor's responsibility to produce finished items of work in first class condition.
- C. No interior millwork shall be delivered until the building has been dried out. Heat shall be required in cold or humid weather.
- D. No trim shall be delivered or placed until the areas of the building in which the trim is to be placed are thoroughly dry and ready for the installation. The building shall be enclosed and heated. Allow wood to acclimate for 7-10 days prior to installation.

## 2.0 - PRODUCTS

### 2.1 General

- A. All materials shall be of the best of their respective kinds. All materials used in finished work shall be clear, free from cracks, checks, knots and other imperfections that may interfere with the proper completion of the work and any warped or otherwise imperfect work shall be removed and replaced.
- B. All plywood shall have a grade-trademark which shall identify each panel of plywood as to type, grade and conformance to CS45 or CS122 (current issues). If use is exposed to weather or excessive moisture, plywood shall be of the exterior type. Exposed faces and faces to receive plastic laminates shall be "A" grade. Panels used for concealed cabinet parts may be C-D grade. Thickness and application details shall be as shown on drawings or required for the intended use.

### 2.2 Interior Woodwork

- A. Lumber used for painted interior woodwork, unless otherwise indicated, shall be one of the following:
  - 1. Fir - Coast or Inland Douglas White
  - 2. Pine - Ponderosa, Southern
  - 3. Redwood
  - 4. Cypress
  - 5. Yellow Poplar
  - 6. Grade of lumber used shall be second grade for paint finish, except cypress may be third grade.
- B. Hardwood: All references to hardwood shall imply stain grade oak.
- C. All interior plywood to be painted shall be Natural Birch.
- D. All interior woodwork and plywood to be stained or finished natural shall be Premium Grade Select White Birch or as specified on drawings. Veneer shall be rotary cut or as indicated on drawings or related specification sections. Semi-exposed parts, as defined by AWI, of natural or stained casework shall be Natural Birch.
- E. Lumber shall be kiln dried with an average moisture content of 6% to 11%.
- F. Particle board shall be U. S. Plywood Corp. "Novoply" Weyerhaeuser Company "Timblend", or approved equal of thickness shown. Factory sanded or sealed or filled, 2 sides.

### 2.3 Plastic Laminate

- A. Plastic laminate shall be Nevamar, Wilson-Art, Formica, Laminart, Arborite, Pionite, 1/16" thick. See Finish Legend and Schedule for color selections.
- B. Backing sheet shall be high pressure laminate, .020" minimum thickness. Plastic laminate to be used on all interior open shelves. Melamine is not acceptable unless it matches the selected plastic laminate.
- C. The adhesive shall be that recommended by the manufacturer of the laminated plastic used.

- D. Edging Materials:
1. 1mm PVC banding, machine applied; match laminate as scheduled.
  2. 3mm PVC banding, machine applied and machine profiled to 1/8 inch radius; match laminate as scheduled

2.4 Rough Hardware

All exposed bolts or other anchors shall be chrome-plated brass.

2.5 Finish Hardware

Furnish and install all finish hardware for millwork items including, but not necessarily limited to, cabinet door and drawer pulls and latches, adjustable shelf standards and brackets, and hardware for doors less than 1-3/8" thick. Hardware finish shall match room door hardware finish.

2.6 Thickness of Members

All thicknesses shall be in accordance with the maximum possible dressed size from standard lumber. If widths or thicknesses are not available in hardwood, gluing may be used on widths over 5-1/4" or thicknesses over 1-1/6".

2.7 Workmanship

- A. All exposed surfaces and edges shall be finished smooth and be free of saw cuts, marks or defacement. All joints shall be accurately and neatly made and fit.
- B. End grain shall be concealed. Exposed edges of plywood shall present a finish the same as the finished sides.
- C. Work shall be scribed and fit to other finished surfaces in a careful manner. Should other work be damaged or disturbed, it shall be made good at the expense of this contractor.
- D. Work shall be assembled at the mill insofar as is practicable and delivered ready for erection. When necessary to cut and fit on job, the material shall be made up with ample allowance for cutting.
- E. This contractor shall verify all measurements at the building and shall examine all adjoining work on which his work is dependent.
- F. Millwork shall be executed in accordance with the approved shop drawings, the workmanship shall be of first quality and the construction of all parts shall be of the best current practice. The work shall be assembled so as to hold together with close joints, fastenings shall be concealed, and all work shall be properly and firmly backed and blocked as required. Provision shall be made for expansion and shrinkage.
- G. Exposed surfaces shall be machine-sanded to an even, smooth surface, nails set, ready for finishing or pre-finishing when noted. All woodwork shall be dry, clean, and smooth before any finishing materials are applied. All nail holes, cuts, cracks and other defects shall be treated so as to be unnoticeable.
- H. All wood surfaces to be set against masonry and/or concealed after erection shall be given a heavy coat of sealer. All woodwork to have paint finish shall be primed under the PAINTING SECTION.
- I. All transparent finished (i.e., stained) woodwork shall be shop finished by Millwork Contractor.

- J. All caulking to match laminate or stain color.
- K. All millwork/casework cabinets in contact with finish floor shall receive scheduled base.

2.8 Carpentry and Millwork Items

- A. The following millwork items are intended to guide such work in this project and do not necessarily limit the scope of this section.
- B. Where not otherwise specified, shelving, cabinet work and millwork of all types shall conform with requirements of Premium Grade of "Quality Standards of the Architectural Woodwork Industry" (Architectural Woodwork Institute).
- C. Wood Base and Shoe Mould - Shall be as detailed on drawings. Base shoe mould lengths to be maximized wherever possible. Wood scraps and remnants used for base material is NOT acceptable. Minimum 8' lengths.

2.9 Materials and Construction

- A. MDF (Medium Density Fiberboard)  
Shall be equal to Premier7 MDF, Plus Grade. MDF is to be shop finished by Millwork Contractor with a transparent stain. The actual surface of the MDF is to be visible through the stain color. Stain colors are to match paint selections indicated on drawings. Millwork Contractor to provide stain samples to Architect for approval prior to fabrication.
- B. Panels - End panels, shelves, bottoms and partitions of 3/4" Birch plywood, "Good" grade on all surfaces or plastic laminate covered particle board as approved. All other surfaces may be A grade fir plywood. All edges exposed to sight shall be self edged and sanded smooth and flush.
- C. Doors - Construction of 3/4" Birch plywood, "Good" grade or plastic laminate covered particle board as approved. All edges shall be self edge.
- D. Drawers - Front identical to doors above. Back minimum of 1/2" A-A Grade fir plywood. Sides of solid hardwood of sound grade. Bottoms of 1/4" plywood or 1/4" brown welded fiber board. Front and back connection shall be rigid type. Bottoms shall be let into front, back and sides approximately 1/4 of an inch. Drawer interiors to be Melamine.
- E. Backs - Backs shall be a minimum of 1/4" plywood or 1/4" brown welded fiber board. Open to view 1/4" Birch plywood. All open-to-view backs are to receive plastic laminate.
- F. Adjustable Shelves - 3/4" thick for maximum spans of 30". 1-1/8" thick for maximum spans of 42". All open-to-view shelves are to receive plastic laminate.
- G. Cabinet Base - Cabinet Base and tall units shall have a site-built toe base constructed of 3/4-inch (minimum) lumber unless otherwise shown on the drawings. Base is 96mm (nominal 4 inch) high unless otherwise indicated on the drawings. Particle board is not acceptable.
- H. Finishes - Tops, edges, and backsplashes and any other areas noted shall be plastic laminate covered.
- I. Cabinet Hardware - Contractor shall furnish hardware equal to that as

manufactured by Stanley, as hereinafter specified. All hardware to be Brushed Chrome, unless indicated otherwise on drawings.

**Pull Handles -**

4" wire pull, brushed chrome finish. Two pulls on drawers over 30" wide.

**Drawer Guides -**

Regular, knee space and pencil: 100-pound load rated epoxy coated steel, bottom corner mounted with smooth and quiet nylon rollers. Positive stop both directions with self-closing feature. Paper storage, 150-pound load rated epoxy coated steel slides.

File: Full extension, 150-pound load rated epoxy coated steel, bottom corner mounted with smooth and quiet nylon rollers. Positive stop both directions with self-closing feature.

Door Hinges - Five knuckle, epoxy powder coated, institutional grade, 2-3/4 inch overlay type with hospital tip. 0.095 inch thick. ANSI-BHMA standard A156.9, Grade 1.

Doors 48 inches and over in height have 3 hinges per door.

Magnetic door catch with maximum 5 pound pull provided, attached with screws and slotted for adjustment.

1. Finish to be selected by Architect.

### 3.0 - EXECUTION

#### 3.1 Shop Assembly

When it is possible, all items of millwork which can be carried into the building through doorways or windows shall be shop assembled. When it is impractical to shop assemble the entire item in one piece, it shall be shop assembled in sections and perfectly fitted in place on the job by thoroughly experienced and competent mechanics. Where job joining requires gluing, it shall be done by the same method used in the Shop.

#### 3.2 Installation

- A. All finish carpentry and millwork of every sort shall be put up plumb or level, and straight and true. Trim put up with proper grounds and firmly secured. All work fitted and scribed to other work in a careful manner as not to injure the surface in any way. All nailing shall be blind wherever possible, but where not possible, the nailing driven and set so as to be not visible in the finish.
- B. All trim to be free from defects impairing durability or fitness for receiving finish. All trim properly sanded at mill and hand sanded at the job.
- C. Finished surfaces of interior millwork, detailed or scheduled to be painted, shall be left ready for treatment by the painter. The jointing and framing of all members of the finished millwork shall be executed in accordance with the best and latest recognized mill practice.
- D. This contractor shall cooperate with contractors for other trades with which his work comes in contact.

#### 3.3 Finish Hardware

- A. Install items of hardware furnished under FINISH HARDWARE SECTION.



- B. Hardware shall be accurately fitted and securely attached, without damage to metal or woodwork, and care shall be taken to not mar or injure any work.
- C. Hardware shall be protected as approved or removed for painting.
- D. Upon completion of the work, hardware shall be demonstrated to work freely, keys shall be fitted into their respective locks and upon acceptance of the work, all keys shall be tagged and delivered to the Owner.
- E. All open -to- view shelves are to receive heavy duty, double cleated adjustable standard hardware.

END OF SECTION

1.0 - GENERAL

1.1 Summary

- A. Section Includes:
1. Provide a complete vapor-protective, composite sheet membrane waterproofing system.
  2. Work includes all applicable sealants, waterstops and waterproofing flashings needed to ensure a complete waterproof and vapor-protective membrane system for buried concrete and masonry components.
- B. Related Work:  
Documents affecting work of the Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions and Sections in Division 1.

1.2 Submittals

- A. Comply with Specification Section 01350.
- B. Product Data:
1. Materials list of items proposed to be provided under this Section.
  2. Manufacturer's specifications and other data needed to provide compliance with the specified requirements.
  3. Shop drawings and/or catalog illustrations in sufficient detail to show installation and interface of the work of this Section with the work of adjacent trades.
  4. Manufacturer's current recommended installation procedures which, when reviewed by Architect, will become the basis for accepting or rejecting actual installation procedures used on the Work.
  5. Written documentation of applicator's qualifications, including reference projects of similar scope and complexity, with current phone contacts of Architects and Owners for verification.
- C. Mock-Up:
1. Prior to installation, prepare a sample panel of the work of this Section at a location on the job site where approved by the Architect.
  2. Make the sample panel in dimensions approved by the Architect and with one panel for each of the various types of installation.
  3. Show all aspects of the work of this Section to the quality specified.
  4. Make necessary adjustments in the sample panel(s) and secure the Architect's approval.
  5. The sample panel(s), when approved by the Architect, will be used as a datum point for comparison with the remainder of the work of this Section for the purpose of acceptance or rejection.
  6. Upon approval of the Architect, the sample panel(s) may become actual part of the installation required for this Work.

1.3 Quality Assurance

- A. Use adequate numbers of skilled workmen thoroughly trained and experienced in the necessary crafts and completely familiar with the specified requirements and methods needed for proper performance of the work of this Section.

- B. Application qualifications:
    - 1. Applicator shall have at least three years' experience in installing materials of types specified and shall have successfully completed at least three projects of similar scope and complexity.
    - 2. Applicator shall designate a single individual as project foreman who shall be on site at all times during installation.
  - C. Convene a pre-installation job site conference three weeks prior to commencing work of this Section:
    - 1. Secure attendance by the Architect, Contractor, Applicator and authorized representatives of the vapor-protective waterproofing system manufacturer and interfacing trades.
    - 2. Examine drawings and specifications affecting work of this Section, verify all conditions, review installation procedures and coordinate scheduling with interfacing portions of the Work.
- 1.4 Delivery, Storage and Handling
- A. Deliver materials to job site in manufacturer's unopened containers with all labels intact and legible at all times.
  - B. Maintain the products in a dry condition during delivery, storage, handling, installation and concealment.
- 1.5 Substrate Conditions
- A. Provide applicator with substrates that are free of standing water, dirt and debris, loose material, voids and protrusions or deformations which may inhibit application or performance of waterproofing.
    - 1. Where work of this Section will be installed on earth retaining system, fill gaps and voids in earth retaining system to conform with waterproofing manufacturer's requirements; remove nails in wood lagging.
    - 2. Where work of this Section will be installed on concrete and/or masonry, provide substrates that are free of voids deeper than 3/8" and free of surface protrusions more than 1/4" above the surface.
    - 3. Where work of this Section will be installed on concrete footings or mud slab, provide smooth finish to surfaces scheduled to receive the vapor-protective waterproofing.
    - 4. Where work of this Section will include bentonite waterstop strips, provide smooth concrete surfaces as required for installation.
    - 5. Rigidly install penetrations of vapor-protective waterproofing for detailing procedures.
  - B. Groundwater:
    - 1. Where work of this Section will encounter groundwater, provide waterproofing manufacturer with sufficient groundwater samples taken from Project at logged locations for manufacturer's laboratory analysis.
    - 2. Manufacturer shall provide written report confirming laboratory testing with regard to suitability of waterproofing system for installation in Project conditions.
- 1.6 Warranty
- A. Deliver to the Architect signed copies of the following written warranties against defective materials and workmanship for a period of Five Years following date of completion. Warrant that installed waterproofing system shall be free of defects including waterproofing failure resulting from substrate cracking up to 1/8 inch.

- B. Warranties shall include:
1. Manufacturer's standard five-year warranty covering materials.
  2. Applicator's standard five-year warranty covering workmanship.

## 2.0 - PRODUCTS

### 2.1 General

A. General:

1. Provide a complete envelope from finish grade to below of dual-waterproofing, vapor-protective, composite sheet membrane system composed of high-density polyethylene having a sodium-bentonite face with a protective laminate layer of spun polypropylene designed for buried concrete or masonry construction having the following attributes.

a. Acceptable products:

1. Paramount Paraseal LG
2. Paramount Paraseal GM

2. Clay-Tite Waterproofing Membrane System by W.R. Meadows - Sealtite is also a pre-approved Waterproofing System. Use as recommended by Manufacturer.

B. Membrane Properties:

Equal to Paramount Paraseal LG for use on buried vertical and horizontal surfaces such as backfilled foundation and retaining walls and below slab or mud slab with bentonite-side down:

1. Puncture resistance 169 lbs. ASTM E 154
2. Tensile strength 4,000 psi ASTM D412
3. Water vapor permance 0.03 perms ASTM E96
4. Percent elongation 700 percent ASTM D638, Type 4 Dumbbell
5. Resistance to hydrostatic head 150 feet ASTM D751
6. Warranted crack-bridging capability 1/8 inch

- C. Membrane Waterproofing required at substrate surfaces at areas of stone masonry provide Fluid-Applied, Elastomeric Coal-Tar Free Waterproofing such as TREMproof 201/60R or pre-approved equal.

### 2.2 Accessories

- A. For installation at horizontal-to-vertical junctures, provide Paramount Paragranular loose bentonite granules in weatherproof 50 lb. bags and capable of swelling to occupy a minimum volume of 17 ml when 2 grams are dispersed into deionized water.
- B. For detailing vertical junctures and penetrations, provide Paramount Paramastic non-hydrated expandable mastic of trowelable consistency containing not less than 55 percent high swelling Wyoming sodium-bentonite.
- C. Provide the following fasteners as needed:
1. Case-hardened steel nail with fluted shank having a minimum 1" length and a minimum 1" diameter cap for use on green concrete and masonry substrates.
  2. Powder shot steel pin having a minimum 3/4" diameter washer for use on

concrete substrates.

3. Steel staples approved by membrane manufacturer for use according to Project conditions.
- D. Provide the following seam tapes as needed:
1. Paramount Permanent Seam Tape reinforced, rubberized-asphaltic waterproofing seam tape 4" wide by 60 mils thick for simple lap sealing of membrane.
  2. Paramount Para JT Tape non-reinforced, adhesive tape of partially cross-linked polymeric elastomers 2" wide by 1/8" thick for molding form-fit seals around difficult contours and for integral seam seals within overlaps.
- E. Provide Paramount Paraterm Bar extruded aluminum bar with upper flange to receive sealant for terminations at grade line and on parapet walls.
- F. Provide Vulkem 116/227 Sealant one- or two-part, gun-grade polyurethane sealant for completing termination seals and other sealing recommended by manufacturer.
- G. Provide Vulkem 101/102 Elastomeric Flashing 100 percent solids polyurethane, liquid-applied, elastomeric waterproofing flashing.
- H. Provide Paramount Parastick 'N' Dry pressure sensitive, double-sided tape laminate of bentonite sandwiched between a netting and non-woven fabric for wrapping through-concrete imbeds and other detailing.
- I. Provide Paramount Superstop flexible, reinforced, bentonite-laminate waterstop strips 1/2 " by 1" by 20'-0" with pressure-sensitive adhesive backing for sealing static cold joints in concrete.
- J. Provide Paramount Paraprimer versatile adhesive bonding agent formulated for use with tapes and pressure-sensitive waterproofing accessories.
- K. Provide Paramount Paradrain composite drainage mats composed of rot resistant non-woven filter fabric on high-density polyethylene drainage core.
- L. Provide base sheet of minimum 6 mil polyethylene sheet for use as hydration barrier.
- M. Provide protection course as recommended by the waterproofing system manufacturer.

### 2.3 Other Materials

Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor and approved by the vapor-protective waterproofing system manufacturer as compatible, subject to review of the Architect.

## 3.0 - EXECUTION

### 3.1 Surface Conditions

- A. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section and to prevent damage to installed waterproofing.
- B. Applicator shall examine the areas and conditions under which work of this Section will be performed.
1. Verify conformance with manufacturer's requirements.
  2. Report unsatisfactory conditions in writing to the Architect.
  3. Do not proceed until unsatisfactory conditions are corrected.

### 3.2 Preparation

- A. General: Surface preparation and detailing procedures shall be in accordance with this Specification and Drawings. Comply with waterproofing system manufacturer's instructions except where more stringent requirements are indicated or specified.
- B. Lay out project to determine and anticipate conditions prior to start of work.
- C. Note termination and penetration conditions to determine methods for creating a waterproof and vapor-protective envelope. Verify that where below-grade waterproofing extends to grade, other waterproofing provides for substrate continuing above grade.

### 3.3 Installation

- A. General: Install waterproofing system in accordance with manufacturer's instructions, recommendations and specific project instructions as applies to the Work.
  - 1. Coves: Form 2" coves with granular bentonite at horizontal-to-vertical junctures such as footings and horizontal shelves; form 2" coves with sealant, elastomeric flashing or non-reinforced tape at vertical inside corners, under ledges and at penetrations.
  - 2. Place membrane in manner that assures minimum handling; fit closely to and seal around inlets, outlets and other penetrations; press membrane tight to corner surfaces and securely fasten.
  - 3. Priming: Prime concrete, masonry and metal surfaces with substrate primer immediately prior to application of tapes and pressure-sensitive waterproofing accessories. Prime membrane surfaces immediately prior to application of tapes as required for a tight seal.
  - 4. Taping: Tape seams closely following membrane placement and immediately roll-press using 2" wide hand-held seam roller to affect a tight seal.
  - 5. Gradeline terminations: Terminate membrane system with termination bar finished off with bead of sealant or terminate to elastomeric flashing using reinforced seam tape.
  - 6. Construction joints: Protect static construction joints in concrete with flexible, reinforced, bentonite-laminate waterstop strips; install to suitable hardened concrete surface prior to subsequent concrete placement.
  - 7. Coordinate with gymnasium equipment for floor sleeves and electrical control boxes and provide waterproofing membrane system to encompass thickened slab areas for such equipment as required.
- B. Below Slab Installation: Bentonite-side down use Paraseal LG Membrane:
  - 1. Install polyethylene base sheets with edges lapped 5" over stable, smoothed and compacted subgrade or mud slab; trim base sheet away from penetrations and terminations.
  - 2. Install membrane bentonite-side down with edges lapped 3" minimum over polyethylene base sheets; position membrane sheets to stagger end laps 12"; tape seams with reinforced seam tape and roll-press to affect a vapor tight seal.
  - 3. Install vapor-protective waterproofing to wrap footings and grade beams where shown on Drawings.

4. Turn membrane up 6" minimum along bottom edges of slabs, wrapped footings and wrapped grade beams. Install double layer of membrane along bottom edges of slabs, wrapped footings and wrapped grade beams extending 6" minimum from edges in each direction. Avoid overlaps coinciding between layers. Provide for tie-in of subsequent membrane installation.
  5. Install membrane across top surfaces of unwrapped footings or mud slab and turn up 4" minimum onto vertical faces of concrete walls and columns. Terminate leading edges with continuous seam tape and continuous waterstop strip in accordance with manufacturer's recommendations to affect a vapor tight seal.
  6. Install vapor-protective waterproofing to overlap 4" minimum onto top surfaces of unwrapped grade beams and carry to extend indicated on Drawings. Terminate leading edges with continuous seam tape and continuous waterstop strip in accordance with manufacturer's recommendations to affect a vapor tight seal.
  7. Waterproof penetrations in accordance with manufacturer's recommendations.
  8. Verify membrane is protected from damage caused by rebar and support chairs.
  9. Inspect and repair damaged material immediately; before concrete placement, manufacturer's representative must inspect the system and issue to the Architect a report of acceptable installation.
- C. Backfilled Wall Installation: Paraseal LG Membrane:
1. Install membrane sheets in vertical or horizontal lifts with HDPE-side facing applicator to prepared surfaces conforming to manufacturer's requirements.
    - a. Vertical orientation: Securely fasten membrane 12" on center along top edge with sheet extending onto footing surfaces and overlapping below-slab membrane 6"; install subsequent membrane sheets to overlap previous sheets 1-1/2" minimum; securely fasten membrane 24" on center through both sheets at overlaps; securely fasten 18" on center to tops of footing surfaces and horizontal shelves; tape seams with reinforced seam tape and roll-press to affect a vapor tight seal.
    - b. Horizontal orientation: Start membrane at lowest portion of wall; securely fasten membrane 24" on center along top edge with sheet extending onto footing surfaces and overlapping under slab membrane 6"; install subsequent membrane sheets to overlap previous sheets minimum 1-1/2" in shingle fashion with staggered end laps; securely fasten membrane 24" on center through both sheets at overlaps; securely fasten 18" on center to tops of footing surfaces and horizontal shelves; tape seams with reinforced seam tape and roll-press to effect a vapor tight seal.
  2. Waterproof penetrations in accordance with manufacturer's recommendations.
- D. Blindside Wall Installation: Paraseal GM-LG Membrane:
1. Ensure that vertical surfaces to receive waterproofing system conform to manufacturer's requirements as applicable to the earth retaining system employed prior to commencing installation.
  2. Install waterproofing membrane starter-strip with bentonite-side facing

applicator to vertical surfaces of earth retaining system prior to placement of concrete footings or foundation mat slab.

3. Prepare all vertical inside corners that occur along the earth retaining system by fastening a minimum 12" wide strip of membrane with bentonite-side facing applicator pressed tight into corner; securely fasten along both edges 24" on center.
  4. Remove bentonite from face of membrane inside overlaps, extending 2" in from lap leading edges, by removing factory installed edge tape or by scraping; install membrane sheets vertically with bentonite-side facing installer and mechanically fasten along lap edges cleaned of bentonite at 24" on center; restrict fasteners to lap edges cleaned of bentonite.
  5. Wipe clean HDPE surfaces inside overlaps just prior to contacting with tape using lint free white cloths soaked in solvent; install non-reinforced integral seam tape to HDPE surfaces cleaned of bentonite along lap edges strictly aligning the adhesive mass on membrane leading edge, not behind it, covering completely all mechanical fasteners; roll-press seam tape into place prior to removal of the release-paper backing.
  6. Install subsequent membrane sheets to overlap previous sheets 4"; remove release-paper backing from seam tape within overlaps and roll-press membrane sheets together to affect a vapor tight seal.
  7. Verify which penetrations must be accessed after concrete placement for completion of waterproofing detail treatment and ensure that sufficient access to membrane is provided within a formed boxout; verify which penetrations will not be accessed after concrete placement for completion of waterproofing detail treatment and effect final detailing procedures prior to erection of concrete formwork or shotcreting/guniting; seal all penetrations in accordance with manufacturer's current procedures as required to seal against both water and vapor.
  8. Protect vapor-protective waterproofing system from excessive rain.
  9. Inspect and repair damages to vapor-protective waterproofing system immediately prior to erection of concrete formwork or shotcreting/guniting; ensure that concrete directly contacts membrane.
  10. Complete waterproofing details and terminations at gradeline coordinating with other trades.
- E. Drainage Mat Installation:  
Install drainage mat units where finish floor is below grade according to manufacturer's installation instructions as shown in installation manuals. Extend drainage to brake grade with positive fall.

END OF SECTION



1.0 - GENERAL

1.1 Section Includes

- A. Surface preparation.
- B. Application of a solvent type liquid applied dampproofing membrane.

**Note:** This product shall not be installed until adjacent roof construction has been dried-in. CMU walls must be dry on both sides before application.

1.2 Related Sections

- A. Section 03300 - Cast-in-Place Concrete.

1.3 References

- A. Spray or Brush-on dampproofing coating
  - 1. ASTM D4479-00 - Standard Specification for Asphalt Roof Coatings - Asbestos-Free.
- B. Trowel applied dampproofing coating
  - 1. ASTM D4586-00 - Standard Specification for Asphalt Roof Cement, Asbestos-Free.

1.4 Submittals

- A. Comply with Section 01350 - Submittal Procedures.
- B. Submit manufacturer's product data and application instructions.

1.5 Delivery, Storage, and Handling

- A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
- B. Store materials in a clean dry area in accordance with manufacturer's instructions.
- C. Store at temperatures of 40°F (5°C) and above to facilitate handling.
- D. Do not store at temperatures above 90°F (32°C) for extended periods.
- E. Keep away from sparks and flames.
- F. Protect materials during handling and application to prevent damage or contamination.

1.6 Environmental Requirements

- A. Product not intended for uses subject to abuse or permanent exposure to the elements.
- B. Do not apply membrane when air or surface temperatures are below 35°F (2°C).
- C. Do not apply to frozen concrete.
- D. Do not apply when rain is imminent.

## 2.0 - PRODUCTS

### 2.1 Manufacturer

- A. W.R. Meadows, Inc or pre- approved manufacturer with similar solvent based products.

### 2.2 Materials

- A. Spray applied solvent dampproofing should be an asbestos-free, non-fibered asphalt compound that meets the U.S. EPA Architectural Coatings Rule requirements for VOC content.
  - 1. Spray-Mastic by W.R. Meadows.
- B. Brush applied solvent dampproofing should be an asbestos-free, fibered, asphalt compound that meets the U.S. EPA Architectural Coatings Rule requirements for VOC content. For use to protect exterior below-grade masonry walls.
  - 1. Semi-Mastic by W.R. Meadows.
- C. Trowel applied solvent dampproofing should be a heavy bodied, asbestos-free fibered, asphalt compound that meets the U.S. EPA Architectural Coatings Rule requirements for VOC content. For exterior below grade masonry wall surface application.
  - 1. Trowel-Mastic by W.R. Meadows.

### 2.3 Accessories

- A. Waterproofing Protection Course: Protection Course.
- B. Rolled Matrix Drainage System: Mel-Drain™ Rolled Matrix Drainage System.

## 3.0 - EXECUTION

### 3.1 Examination

- A. Examine surfaces to receive membrane. Notify Architect if surfaces are not acceptable. Do not begin surface preparation or application until unacceptable conditions have been corrected.

### 3.2 Surface Preparation

- A. Protect adjacent surfaces not designated to receive dampproofing.
- B. Clean and prepare surfaces to receive dampproofing in accordance with manufacturer's instructions.
- C. Do not apply dampproofing to surfaces unacceptable to manufacturer.
- D. Concrete surfaces must be clean, smooth and free of standing water.
- E. Patch all holes and voids and smooth out any surface misalignments.

### 3.3 Application

- A. Apply dampproofing in accordance with manufacturer's instructions.
- B. Ensure accessory materials are compatible with membrane and approved by membrane manufacturer.

3.4 Protection

- A. Protect membrane on vertical and horizontal applications with immediate application of protection course, if no drainage system is used, or rolled matrix drainage system.
- B. Backfill within 24-48 hours using care to avoid damaging the dampproofing.

END OF SECTION

1.0 - GENERAL

- 1.1 Scope  
The work under this section consists of all building insulation except rigid roof insulation.
- 1.2 Submittals  
Submit samples of all materials hereinafter specified for approval.
- 1.3 Protection  
All thermal insulation shall be maintained dry throughout construction. Wet insulation shall be rejected.

2.0 - PRODUCTS

2.1 Material

- A. 1. Primary: FSK Thermal insulation shall be batt, or blanket type having a vapor barrier on one face which shall be extended to form a 1" flange to comply with requirements of International Building Code. ASTM - C665 Type III, Class A and ASTM E - 84. The insulating material shall be fire and decay-proof, moisture-resistant mineral or glass wool specifically designed for use in insulating batts. Vapor barrier side laps shall be lapped and taped over support members. Vapor barrier materials shall be FSK foil-type and also comply with requirements for a ceiling return air plenum regardless.
2. Supplemental: Unfaced Thermal insulation shall be allowed provided it is coupled with a layer of FSK faced insulation to achieve the total required r-value and shall be batt, or blanket type to comply with requirements of International Building Code. ASTM - C665 Type III, Class A and ASTM E-84. The insulating material shall be fire and decay-proof, moisture-resistant mineral or glass wool specifically designed for use in insulating batts.

Thermal Resistance Values (R) as follows:

R-30 9" - 10"  
R-22 7"  
R-19 6" - 6-1/2"  
R-11 3-1/2" - 4"

- B. Unfaced Thermal insulation shall be batt, or blanket type to comply with requirements of International Building Code. ASTM - C665 Type III, Class A and ASTM E - 84. The insulating material shall be fire and decay-proof, moisture-resistant mineral or glass wool specifically designed for use in insulating batts.

Thermal Resistance Values (R) as follows:

R-30 9" - 10"  
R-22 7"  
R-19 6" - 6-1/2"  
R-11 3-1/2" - 4"

- C. Masonry Foam Fill Insulation shall be approved equal to:
1. Core Foam Masonry Foam Insulation by cfiFOAM.
  2. Other Pre-approved manufacturers:
    - a. Applegate C Foam Insulation by Applegate R Foam, Inc.
    - b. Core-Fill 500 by Tailored Chemical Products, Inc.
  3. Minimum Product Performance Standards
    - a. Fire-Resistance Ratings: Foam shall neither add to nor detract from fire-resistance ratings of insulated fire-resistance rated CMU walls per prevailing building codes.
    - b. Surface Burning Characteristics: Class A per ASTM E84; Flame Spread Index  $\leq 25$ ; Smoke Developed Index  $\leq 450$ .
    - c. Thermal Resistance: R-4.6/inch @ 75°F per either ASTM C518 or ASTM C177
    - d. Potential Heat:  $\leq 100$  Btu/lb. when tested per NFPA 259 (ASTM D5865).
  4. Installation Guidelines
    - a. Fill all open cells and voids in hollow concrete masonry walls where shown on the drawings.
    - b. The foam insulation shall be pressure injected through a series of 5/8" to 7/8" diameter holes drilled to access each column of block cells e.g. 8" o/c beginning approximately four (4) feet above the finished floor.
    - c. Repeat this procedure at 10' to 16' intervals above the first horizontal row of holes (or as needed) until the empty core cells are completely filled.
    - d. In walls where horizontal bond beams occur, repeat the procedure above the bond beams to assure insulating the entire wall.
    - e. If "Hi-Flow" nozzles by cfiFOAM, Inc. are used, foam may be injected at up to twenty (20) foot vertical intervals.
    - f. Patch holes with mortar and score to resemble adjacent surfaces. Insulation shall not be injected into wet walls.
  5. Quality Assurance
    - a. Manufacturing Standards; Provide insulation from a single approved source. Product components shall be of the same brand from the same approved source arriving at the site either pre-mixed according to the manufacturer's printed instructions or in unopened factory sealed containers.
    - b. Installer Qualifications for Foamed-In-Place Masonry Insulation:
      - 1.) Engage an authorized contract installer who has been trained, authorized and equipped by the product manufacturer.
    - c. At the Architect's request, the Installer shall provide infrared scanned images of the work prepared by a "Block Wall Scan IR" or equivalent trained IR technician to confirm that empty core cells are filled with foam insulation.
      - 1.) Insulation voids shall be foamed at no added cost to the Owner.
- D. Rigid thermal insulation shall be 1" thick by 16" wide for cavity walls and 24" wide if indicated for slabs. The insulating material shall have a minimum compressive strength of 25 psi and maximum water vapor transmission rate of 1.1 perm-inch and shall conform to ASTM C578, Type III-IV, R-value/inch @ 75 degrees F 5.0. Adhesive, in cavities, shall be equal to Styrofoam brand mastic #7 or #11 as distributed by Dow. All joints shall be taped.
- E. Rigid thermal insulated sheathing shall be 3/4" thick x 48" wide foil faced vapor

barrier material with minimum compressive strength of 25 psi and maximum water vapor transmission rate of .03 perm-inch.

- F. Sound Attenuation Batt Insulation shall be 3-1/2" thick fiberglass insulation with a Noise Reduction coefficient of 1.05. Equal to Owens Corning.
- G. Air/Vapor Barrier - Basis of Design: Spunbonded polyolefin, non-woven, non-perforated barrier equal to Dupont Tyvek Commercial Wrap, Class A and related assembly components. All seams, edges and penetrations shall be taped and sealed per manufacturer's recommendations.
  - 1. Shall be allowed as a substitution and similar to FSK facing material. As such this material would be used in conjunction with unfaced insulation and shall be provided continuous and attached to applicable framing members. All seams, edges and penetrations shall be taped and sealed per manufacturer's recommendations.

### 3.0 - EXECUTION

#### 3.1 Installation

- A. Thermal Insulating material shall be laid tight and installed so as to avoid gaps and settlement. All voids, offsets, and bends shall be completely filled. R values shall be provided as indicated in single layer or multiple layers totaling the "R" value indicated. If multiple layers are used to meet total "R" value indicated, layers must be provided perpendicular to one another. The layer closest to the conditioned space must be provided with FSK facing on the interior face where visible for an Inspection.

Insulation shall be laid tight and continuous over all areas where indicated.

- B. Masonry foam fill insulation shall be provided at all exterior wall assemblies and where indicated to thoroughly fill CMU cells and voids continuous from bottom to top of exterior and applicable masonry walls. Install in accordance with manufacturer's printed recommendations and procedures.
- C. Rigid thermal insulation
  - 1. Walls - Adhere insulation to walls in a horizontal position, closely butted and with vertical joints staggered. Provide joint mastic and joint tape to the foam and apply in accordance with manufacturer's recommendations.
  - 2. Floor Slab - Lay insulation on vapor barrier butted end to end at full perimeter of exterior walls.

Backfill against insulation with fill and gravel.
  - 3. During storage and insulation, observe good fire safety practices, including job site housekeeping.
  - 4. If adhesive is required, use mastic for bonding foam board to non-absorbent surfaces such as dense concrete, metal, brick, glass, and paint.
- D. Rigid thermal insulated sheathing shall be placed on stud system and secured in accordance with manufacturer's recommendations and specifications.  
(NOTE: Use 4 x 8 x 3/4" plywood sheathing at all corners and wall openings.)
- E. Sound Attenuation Batt Insulation shall be placed on ceiling or stud system and secured and sealed in accordance with manufacturer's recommendations and specifications. Place around or over mechanical equipment rooms, toilet rooms, window in-fill spaces, and other areas as indicated.

- F. Mesh, shall be provided for supporting overhead horizontal insulation and attached to applicable framing members as required, not to exceed 16" o.c. Mesh material shall be provided to maximize width as project conditions permit. Mesh fabric shall be steel wire type with nominal 2" grid. Continuous metal straps at 16" o.c. shall be an acceptable substitute.
  
- G. Air/Vapor Barrier - Shall be allowed as a substitution and similar to FSK facing material. As such this material would be used in conjunction with unfaced insulation and shall be provided continuous and attached to applicable framing members. All seams, edges and penetrations shall be taped and sealed per manufacturer's recommendations. Basis of Design: Spunbonded polyolefin, non-woven, non-perforated barrier equal to Dupont Tyvek Commercial Wrap, Class A and related assembly components.

END OF SECTION

1.0 - GENERAL

1.1 Summary

- A. Section includes: Factory-formed metal panels, including flashing and accessories.  
Metal panel includes: Wall Panels
- B. Related Sections: Section(s) related to this section include:
  - 1. Flashing and Trim: Division 7 Flashing and Sheet Metal Section.
  - 2. Sealants: Division 7 Joint Sealers Sections.

1.2 References

- A. American Society for Testing and Materials (ASTM):
- B. Underwriters Laboratories (UL Classified Tests):
- C. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):
  - 1. SMACNA Architectural Sheet Metal Manual

1.3 System Description

- A. Performance Requirements: Provide sheet metal wall panels that have been manufactured, fabricated and installed to withstand structural and thermal movement, wind loading and weather exposure to maintain manufacturer's performance criteria without defects, damage, failure of infiltration of water.
  - 1. Wind-Uplift: Wall panel assembly shall comply with UL Classification 580 for UL Classified 90 rated assemblies
  - 2. Static Air Infiltration: Completed wall system shall have a maximum of .06 cfm/sf with 6.24 kPa air pressure differential as per ASTM E283/1680.
  - 3. Water Infiltration: No evidence of water penetration at an inward static air pressure differential of not less than 6.24 psf (43 kPa) and not more than 12.0 psf (83 kPa) as per ASTM E331/1646.

1.4 Submittals

- A. General: Submit listed submittals in accordance with *Conditions of the Contract* and Division 1 Submittal Procedures Section.
  - 1. Product Data: Submit product data, including manufacturer's specification data product sheet, for specified products.
- B. Shop Drawings:
  - 1. Submit complete shop drawings and erection details, approved by the metal panel manufacturer, to the architect for review. Do not proceed with manufacturer of wall panel materials prior to review of shop drawings and field verification of all dimensions. Do not use drawings prepared by the architect for shop or erection drawings.
  - 2. Shop drawings show elevations, methods of erection, and flashing details.
- C. Performance Tests:
  - 1. Submit certified test results by a recognized testing laboratory in accordance with specified test methods for each panel system.



- D. Samples: Submit selection and verification samples for finishes, colors and textures.
- E. Quality Assurance Submittals: Submit the following:
  - 1. Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and physical requirements.
  - 2. Manufacturer's Instructions: Manufacturer's installation instructions.
- F. Closeout Submittals: Submit the following:
  - 1. Operation and Maintenance Date: Operation and maintenance date for installed products in accordance with Division 1 Closeout Submittals, Maintenance Data and Operation Data Section. Include methods for maintaining installed products and precautions against cleaning materials and methods detrimental to finishes and performance.
  - 2. Project Warranty: Warranty documents specified herein.
  - 3. Manufacturer's warranty: Submit, for owners acceptance, manufacturer's 20-year non-prorated warranty covering a PAC-CLAD finish, including color, fade, chalking and film integrity. Manufacturer's warranty is in addition to and not limited of, other rights the owner may have under the contract documents.  
  
Warranty Period: 20 years commencing on Date of Substantial Completion.
  - 4. Record Documents: Project record documents for installed materials in accordance with Division 1 Closeout Submittals, Project Record Documents Section.

#### 1.5 Quality Assurance

- A. Installer Qualifications: Installer experienced in performing work of this section who has specialized in the installation of work similar to that required for this project.
- B. Sheet Metal Industry Standard: Comply with Sheet Metal and Air Conditioning Contractors National Association (SMACNA) *Architectural Sheet Metal Manual*.
- C. Pre-Installation Meetings: Conduct pre-installation meeting to verify project requirements, substrate conditions, Manufacturer's installation instructions and manufacturer's warranty requirements. Comply with Division 1 Coordination, Project Meetings Section.

#### 1.6 Delivery, Storage and Handling

- A. General: Comply with Division 1 Product Requirements Sections.
  - 1. Ordering: Comply with manufacturer's ordering instructions and lead-time requirements to avoid construction delays.
- B. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact. Identify fabricated components with UL 90 Classified label where appropriate.

- C. Storage and Protection: Store materials protected from exposure to harmful conditions. Store material in dry, above ground location.
  - 1. Stack prefinished material to prevent twisting, bending, abrasion, scratching and denting. Elevate one end of each skid to allow for moisture to run off.
  - 2. Prevent contact with material that may cause corrosion, discoloration or staining.
  - 3. Do not expose to direct sunlight or extreme heat trim material with factory applied strippable film.

#### 1.7 Project Conditions

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

#### 1.8 Warranty

- A. Project Warranty: Refer to *Conditions of the Contract* for project warranty provisions.
- B. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's 20-year nonprorated warranty covering PAC-CLAD finish, including color, fade, chalking and Film integrity executed by authorized company official. Manufacturer's warranty is in addition to and not a limitation of, other rights Owner may have under the Contract Documents.

Warranty Period: 20 years commencing on Date of Substantial Completion.

### 2.0 - PRODUCTS

#### 2.1 Sheet Metal Wall Panels

- A. Manufacturer: Petersen Aluminum Corporation or other manufacturers as submitted and prior approved to meet specifications. Comply with Section 01360 – Product Substitutions.
- B. Wall Panels:
  - 1. Type: Reveal Panel
  - 2. Material: 24 ga G-90 Hot dipped Galvanized Steel
  - 3. Panel Dimension: 18 in. o.c.
  - 4. Texture: Smooth
- C. Panel Finish:
  - 1. Panel Topside: PAC-CLAD finish color selected from Petersen Aluminum Corp. standard colors: To be selected by Architect.
  - 2. Panel Underside: Polyester washcoat with dry film thickness of 0.3 mils.
- D. Flashing and Trim: Manufacturer's standard flashing and trim profiles, factory formed, gauge as recommended by manufacturer, color and finish to match metal wall panels.

## 2.2 Related Materials

- A. General: Coordinate use of related materials.

## 2.3 Fabrication

- A. General:
1. Continuous Length: Fabricate panels 55' (16.2 m) and less in one continuous length.
  2. Trim and Flashings: Fabricate trim and flashings from same material as wall Panel system material.
  3. Portable Roll Former: Panels fabricated by portable roll former shall not be approved.

## 2.4 Finishes

- A. Factory Applied Finish:
1. Topside: Full-strength fluoropolymer (70% Kynar® 500 or Hylar® resin) system of 1.0 mil (.025 mm) total dry film thickness.
  2. Underside: Wash coat of 0.3 - 0.4 mil dry film thickness.
  3. Texture: Smooth texture, dull matte specular gloss 25 - 35% at 60°
  4. Protective film: Strippable vinyl film applied during panel fabrication and finishing.

## 3.0 - EXECUTION

### 3.1 Manufacturer's Instructions

- A. Compliance: Comply with manufacturer's product data, recommendations and installations instructions for substrate verification, preparation requirements and installation.
1. Strippable Film: Remove manufacturer's protective film, if any, from surfaces of wall panels.

### 3.2 Examination

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

### 3.3 Preparation

- A. Coordination: Coordinate metal wall panels with other Work (drainage, flashing and trim, copings, walls) and other adjoining work to provide a non-corrosive and leak-proof installation.
- B. Dissimilar Metals: Prevent galvanic action of dissimilar metals.

### 3.4 Installation

- A. General: Install metal wall panels to profiles, patterns and drainage indicated and required for leak-proof installation. Provide for structural and thermal movement at work. Seal joints for leak-proof installation.
1. Seams: Provide uniform, neat seams.
  2. Fasteners: Conceal fasteners where possible in exposed work.

Cover and seal fasteners and anchors for watertight and leak-proof installation.

3. Sealant-Type Joints: Provide sealant-type joint where indicated. Form joints to conceal sealant. Comply with Division 7 Joint Sealants Section for Sealant installation.

3.5 Field Quality Requirements

- A. Manufacturer's Field Services: Use recommendations and inspection of product installation in accordance with manufacturer's instructions.

3.6 Cleaning

- A. Cleaning: Remove temporary coverings and protection of adjacent work areas. Repair or replace damaged installed products. Clean installed products in accordance with manufacturer's instructions prior to owner's acceptance. Remove construction debris from project site and legally dispose of debris.

3.7 Protection

- A. Protection: Protect installed product from damage during construction.

END OF SECTION

## SECTION 07540 – THERMOPLASTIC POLYOLEFIN (TPO) ROOFING SYSTEM

### 1.0 - GENERAL

#### 1.1 Description

- A. The work of this section consists of providing TPO Adhered Roofing System as outlined below:
  - 1. Apply the Adhered Roofing System in conjunction with the indicated roof Insulation.

#### 1.2 Scope Of Work

- A. Provide all labor, material, tools, equipment, and supervision necessary to complete the installation of the .060" thick minimum (white, gray or tan color as selected by Architect) reinforced TPO (Thermoplastic Polyolefin) reinforced membrane Adhered Roofing System including flashings and insulation as specified herein and as indicated on the drawings in accordance with the manufacturer's most current specifications and details to meet performance criteria specified herein.
- B. The roofing contractor shall be fully knowledgeable of all requirements of the contract documents and shall make themselves aware of all job site conditions that will affect their work.
- C. The roofing contractor shall confirm all given information and advise the Architect, prior to bid, of any conflicts that will affect their cost proposal.
- D. Any contractor who intends to submit a bid using a roofing system other than the approved manufacturers must submit for pre-approval in writing ten (10) days prior to the bid date. Comply and submit in accordance with Section 01360.

#### 1.3 Related Sections

- A. Section 07621 – Sheet Metal Work Flashing and Trim
- B. Section 10428 – Roof Information Plaque

#### 1.4 Submittals

- A. Prior to starting work, the roofing contractor must submit the following:
  - 1. Shop drawings showing layout, details of construction and identification of materials.
  - 2. A sample of the manufacturer's Membrane System Warranty.
  - 3. Submit a letter of certification from the manufacturer which certifies the roofing contractor is authorized to install the manufacturer's roofing system and lists foremen who have received training from the manufacturer along with the dates training was received.
  - 4. Attachment pattern for insulation and membrane to comply with wind zone requirements.
- B. Upon completion of the installed work, submit copies of the manufacturer's final inspection to the Architect prior to the issuance of the manufacturer's warranty.

- C. Manufacturer Certificates: Signed by manufacturer certifying that roof panels comply with performance requirements specified in "Performance Requirements" Article.
1. Submit evidence of meeting performance requirements.
  2. Submit signed approval of project drawings and specifications meeting manufacturer's requirements for specified manufacturer's warranties.
  3. Submit evidence of Installer/contractor meeting requirements for specified warranties.
  4. Contractor to register roofing project with the manufacturer prior to the pre-roofing conference and prior to submitting shop drawings. As part of the submittals package, copy of the acknowledgement of the manufacturer is required.

**Note: Copy of Acknowledgement Letter from manufacturer that project has been registered shall be included with submittals and prior to pre-roofing conference.**

A **minimum** of three (3) field inspections shall be made by a technical (non-sales) representative of the Roofing System Manufacturer at start, mid-way and upon completion of the work. Written reports shall be made and copies of these reports must be submitted to the Architect within 3 days of the inspections. These inspections must be made by a manufacturer's representative employed by the manufacturer. Notify Architect 72 hours prior to inspections.

#### 1.5 Product Delivery, Storage and Handling

- A. Deliver materials to the job site in the manufacturer's original, unopened containers or wrappings with the manufacturer's name, brand name and installation instructions intact and legible. Deliver in sufficient quantity to permit work to continue without interruption.
- B. Comply with the manufacturer's written instructions for proper material storage.
1. Store membrane in the original undisturbed plastic wrap in a cool, shaded area. Membrane that has been exposed to the elements for approximately 7 days must be prepared with Commercial Innovations Weathered Membrane Cleaner (or other Manufacturer's recommended product) prior to hot air welding.
  2. Store curable materials (adhesives and sealants) between 60F and 80F in dry areas protected from water and direct sunlight. If exposed to lower temperature, restore to 60F minimum temperature before using.
  3. Store materials containing solvents in dry, well ventilated spaces with proper fire and safety precautions. Keep lids on tight. Use before expiration of their shelf life.
- C. Insulation must be on pallets, off the ground and tightly covered with waterproof protective materials.
- D. Any materials which are found to be damaged shall be removed and replaced at the contractor's expense.

#### 1.6 Work Sequence

- A. Schedule and execute work to prevent leaks and excessive traffic on completed roof sections. Care should be exercised to provide protection for the interior of the building and to ensure water does not flow beneath any completed sections

of the membrane system.

- B. Do not disrupt activities in occupied spaces.

1.7 Site Conditions

- A. If discrepancies are discovered between the actual conditions and those noted on the drawings, immediately notify the Architect in writing. Necessary steps shall be taken to make the building watertight until the discrepancies are resolved.

1.8 Pre-Roofing Conference

- A. Pre-Installation Roofing Conference: Convene a pre-roofing conference approximately two (2) weeks before scheduled commencement of roofing system installation and associated work.

**Require attendance of installer of each component of associated roofing work, Contractor, Architect, Owner, Alabama Construction Management, roofing system manufacturer's representative, and other representatives directly concerned with performance of the Work, including (where applicable) Owner's insurers, testing agencies and governing authorities. Objectives of conference include:**

1. Review foreseeable methods and procedures related to roofing work, including set up and mobilization areas for stored material and work area.
  2. Review roofing system requirements (drawings, specifications and other contract documents).
  3. Review required submittals both completed and yet to be completed.
  4. Review construction schedule related to roofing work and verify availability of materials, installer's personnel, equipment and facilities needed to make progress and avoid delays.
  5. Review required inspection, testing, certifying and material usage accounting procedures.
  6. Discuss weather and forecasted weather conditions and procedures for coping with unfavorable conditions, including possibility of temporary roofing (if not mandatory requirement).
  7. Record discussion of conference including decisions and agreements (or disagreements) reached and furnish copy of record to each party attending. If substantial disagreements exist at conclusion of conference, determine how disagreements will be resolved and set date for reconvening conference.
- B. The Architect will record the proceedings and distribute them to the participants for record.
  - C. The intent of the conference is to resolve issues affecting the installation and performance of roofing work. Do not proceed with roofing work until such issues are resolved to the satisfaction of the Owner and Architect.
  - D. **The Representative for the Roofing Materials Manufacturer shall bring a copy of the warranty(ies) for the roofing material(s) for comparison to the warranty(ies) specified. This sample warranty is required to be job specific, covering all requirements, per the specifications. If the sample warranty is**

**not provided as required, the conference will be voided, an inspection fee will be issued, and it will have to be rescheduled.**

1.9 Job Site Protection

- A. The roofing contractor shall adequately protect building, paved areas, service drives, lawn, shrubs, trees, etc. from damage while performing the required work. Provide canvas, boards and sheet metal (properly secured) as necessary for protection and remove protection material at completion. The contractor shall repair or be responsible for costs to repair all property damaged during the roofing application. **Do not store roofing materials on the roof.**
- B. During the roofing contractor's performance of the work, the owner will continue to occupy the existing adjacent building. The contractor shall take precautions to prevent the spread of dust and debris, particularly where such material may sift into the building. The roofing contractor shall provide labor and materials to construct, maintain and remove necessary, temporary enclosures to prevent dust or debris in the construction area(s) from entering the remainder of the building.
- C. Do not overload any portion of the building, by either use of or placement of equipment, storage of debris, or storage of materials.
- D. Protect against fire and flame spread. Maintain proper and adequate fire extinguishers.
- E. Take precautions to prevent drains from clogging during the roofing application. Remove debris at the completion of each day's work and clean drains, if required. At completion, test drains to ensure the system is free running and drains are watertight. Remove strainers and plug drains in areas where work is in progress. Install flags or other telltales on plugs. Remove plugs each night and screen drain.
- F. Store moisture susceptible materials above ground and protect with waterproof coverings.
- G. Remove all traces of piled bulk material and return the job site to its original condition upon completion of the work.

1.10 Safety

- A. The contractor shall be fully responsible for all means and methods as they relate to safety and shall comply with all applicable local, state and federal requirements that are safety related. Safety shall be the responsibility of the contractor. All related personnel shall be instructed daily to be mindful of the full time requirement to maintain a safe environment for the facility's occupants including staff, visitors, workers and the occurrence of the general public on or near the site.

1.11 Workmanship

- A. Applicators installing new roof, flashing and related work shall be factory trained and approved by the manufacturer they are representing.
- B. All work shall be of highest quality and in strict accordance with the manufacturer's published specifications and to the Owner's satisfaction.



- C. There shall be a supervisor on the job site at all times while work is in progress.
- D. The contractor shall be responsible for weathertightness under this section.

1.12 Quality Assurance and Performance Requirements

- A. The membrane roofing system must achieve a UL Class A and FM1-90 or higher rating. (No exceptions). Provide additional materials or higher quality to meet FM-I-90 and wind speed requirements of 120 mph or higher (Risk Category 3) and Severe Hail (SH) requirements. (No exclusions for hail less than 2")
- B. Unless otherwise noted in this specification, the roofing contractor must strictly comply with the manufacturer's current specifications and details.
- C. The roofing system must be installed by an applicator authorized and trained by the manufacturer in compliance with shop drawings as approved by the manufacturer.
- D. All roofing materials shall be new and provided by same source as required to comply with manufacturer's system warranty.
- E. Provide adequate number of experienced workmen regularly engaged in this type of work who are skilled in the application techniques of the materials specified including operation of hot air welding equipment and power supply. Provide at least one thoroughly trained and an experienced superintendent on the job at all times roofing work is in progress.
- F. There shall be no deviations made from this specification or the approved shop drawings without the prior written approval of the Architect. Any deviation from the manufacturer's installation procedures must be supported by a written certification on the manufacturer's letterhead and presented for the Architect's consideration.
- G. Upon completion of the installation, the applicator shall arrange for an inspection to be made by a technical representative of the membrane manufacturer in order to determine whether or not corrective work will be required before the warranty will be issued. Notify the Architect seventy-two (72) hours prior to the manufacturer's final inspection.
- H. FMG Listing: Provide roofing membrane, base flashings, and component materials that meet the requirements in FMG 4450 and FMG 4470 as part of a membrane roofing system and that are listed in FMG's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FMG markings.
  - 1. Fire/Windstorm Classification: UL Class A – FM 1-90 (120 mph wind speed minimum) Risk Category 3
  - 2. Hail Resistance: Severe Hail (SH) (No exclusions for 2" hail)
- I. Membrane Roofing System must meet or exceed impact resistance requirements of IBC 2021 Section 1504.7 and Wind Speed Requirements as applicable to the Zone where the Building is located as required by the IBC 2021 Edition.
- J. Certification of Roofing System  
Contractor(s), Roofing Material Manufacturer, and Roofing Material Manufacturer's Field Inspector shall each execute the Certification of Roofing

System, a copy of which immediately follows this Section.

- K. Product must meet Testing requirements of ASTM D5019, "Standard Specification for Reinforced Non-Vulcanized Polymeric Sheet Used in Roofing Membrane"

1.13 Job Conditions and Special Handling

- A. Material Safety Data Sheets (MSDS) must be on location at all times during the transportation, storage and application of materials.
- B. When positioning membrane sheets, exercise care to locate all field splices away from low spots and out of drain sumps. All field splices should be shingled to prevent bucking of water.
- C. When loading materials onto the roof, the Authorized Roofing Applicator must comply with the requirements of the Owner/Architect to prevent overloading and possible disturbance to the building structure.
- D. Proceed with roofing work only when weather conditions are in compliance with the manufacturer's recommended limitations, and when conditions will permit the work to proceed in accordance with the manufacturer's requirements and recommendations.
- E. Proceed with work so new roofing materials are not subject to construction traffic. When necessary, new roof sections shall be protected and inspected upon completion for possible damage.
- F. Provide protection, such as 3/4-inch-thick plywood, for all roof areas exposed to traffic during construction. Plywood must be smooth and free of fasteners and splinters. Remove debris and loose fasteners promptly.
- G. The surface on which the insulation or roofing membrane is to be applied shall be clean, smooth, dry, and free of projections or contaminants that would prevent proper application of or be incompatible with the new installation, such as fins, sharp edges, foreign materials, oil and grease.
- H. New roofing installation shall be complete and weather tight at the end of each work day.
- I. Contaminants such as grease, fats and oils shall not be allowed to come in direct contact with the roofing membrane.

1.14 Warranty

- A. Provide manufacturer's special 20 year weathertightness No Dollar Limit (NDL) Roofing System Warranty. Hail Resistance: Severe Hail (SH) (No exclusions for 2" hail)
- B. Pro-rated System Warranties shall not be accepted.
- C. The roof and associated work shall be guaranteed by the General Contractor against leaks from faulty or defective materials and workmanship for a period of five (5) years, starting on the date of acceptance of the project by the Owner.

- D. **Manufacturer's roofing guarantees shall contain language regarding the governing of the guarantee by the State of Alabama, otherwise amend the requirement and state that the Laws of the State of Alabama shall govern all such guarantees.**
- E. Roofing Installers Warranty: Submit roofing Installer's warranty on Installers letterhead, signed by Installer, covering all work of this contract, including incidental items, for the following warranty period:
- Warranty Period: Five (5) years from date of Substantial Completion.
- F. State of Alabama General Contractor's Roof Guarantee: Covering Work of this Section, including all components of the roofing system for the following warranty period:
- Warranty Period: Five (5) years from date of Substantial Completion.
- G. All warranties shall be dated within 30 days of substantial completion.
- H. **The Representative for the Roofing Materials Manufacturer shall bring a copy of the warranty(ies) for the roofing material(s) for comparison to the warranty(ies) specified. This sample warranty is required to be job specific, covering all requirements, per the specifications. If the sample warranty is not provided as required, the conference will be voided, an inspection fee will be issued, and it will have to be rescheduled.**

## 2.0 - PRODUCTS

### 2.1 General

- A. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.
1. Carlisle SynTec, Incorporated. (60 mil)
  2. Johns Manville (60 mil)
  3. Commercial Innovations, Inc (SealTite) (60 mil)
  4. Versico Roofing System (TPO - Versiweld - 60 mil)
- B. All products (including insulation, fasteners, fastening plates and edgings) must be manufactured and supplied by the roofing system manufacturer and covered by the system warranty.

### 2.2 Membrane

Provide 60 mil min. thick reinforced TPO (Thermoplastic Polyolefin) membrane as needed to complete the roofing system. Membrane thickness over the reinforcing scrim (top-ply thickness) shall be nominal 15 mil thick. Color to be selected by Architect.

### 2.3 Insulation/Underlayment

- A. When applicable, insulation shall be installed in multiple layers. The first and second layers of insulation shall be mechanically fastened to the substrate in accordance with the manufacturer's published specifications.

- B. Insulation shall be as indicated.
- C. Coverboard (SecuRock, Densdeck, ½" SecurShield HD ISO)

#### 2.4 Adhesives and Cleaners

- A. All products shall be provided from approved manufacturer and specifically formulated for the roofing system specified herein.
  - 1. Bonding Adhesive
  - 2. Edge Sealant
  - 3. Sealer: Water Cut-Off Mastic (as recommended by roofing manufacturer)
  - 4. Pocket Sealant: TPO Molded Pocket Sealant (as recommended by roofing manufacturer)
  - 5. Membrane Cleaner

#### 2.5 Fasteners and Plates

- A. To be used for mechanical attachment of insulation and to provide additional membrane securement:
  - 1. Pre-Assembled Fasteners: A pre-assembled 3" diameter Plastic Plate and standard Phillips head fastener used for insulation attachment into steel or wood decks. Installed using Olympic Fastening Tools.
  - 2. CI Term Bar Nail-Ins: A 1-1/4" long expansion anchor with a zinc plated steel drive pin used for fastening the Termination Bar or Seam Fastening Plates to concrete, brick, or block walls.
  - 3. Seam Fastening Plates: a 2 inch diameter metal plate used for additional membrane securement.
  - 4. Insulation Fastening Plates: a nominal 3 inch diameter plastic or metal plate used for insulation attachment.

#### 2.6 Metal Edging and Membrane Terminations

Termination Bar: 1 inch wide and .098-inch-thick extruded aluminum bar pre-punched 6 inches on center; incorporates a sealant ledge to support Lap Sealant and provide increased stability for membrane terminations.

#### 2.7 Other Materials

Metal Flashing, specified under Section 07621.

### 3.0 - EXECUTION

#### 3.1 General

- A. Comply with the manufacturer's published instructions for the installation of the membrane roofing system including proper substrate preparation, job site considerations and weather restrictions.
- B. Position sheets to accommodate contours of the roof deck and shingle splices to avoid bucking water.

### 3.2 Insulation Placement and Attachment

- A. Install insulation or membrane underlayment over the substrate with boards butted tightly together with no joints or gaps greater than 1/4 inch. Stagger joints horizontally and vertically if multiple layers are provided.
- B. Secure insulation to the substrate with the required insulation adhesive and manufacturer's specification to meet wind zone requirements (FM I-90) and 120 MPH wind speed at roof level.

### 3.3 Membrane Placement and Attachment

- A. Position membrane over the acceptable substrate. Fold membrane sheet back lengthwise (onto itself) so half the underside of the membrane is exposed.
- B. Apply Bonding Adhesive in accordance with the manufacturer's published instructions, to the exposed underside of the membrane and the corresponding substrate area. Do not apply Bonding Adhesive along the splice edge of the membrane to be hot air welded over the adjoining sheet. Allow the adhesive to dry until it is tacky but will not string or stick to a dry finger touch.
  - 1. Roll the coated membrane into the coated substrate while avoiding wrinkles. Brush down the bonded section of the membrane sheet immediately after rolling the membrane into the adhesive with a soft bristle push broom to achieve maximum contact.
  - 2. Fold back the unbonded half of the sheet lengthwise and repeat the bonding procedures.
- C. Position adjoining sheets to allow a minimum overlap of 2 inches.
- D. Hot air weld the membrane sheets using the Automatic Hot Air Welding Machine or Hot Air Hand Welder in accordance with the manufacturer's hot air welding procedures.
- E. Pull the membrane back along the welded splice so the entire underside of the membrane is exposed once the Hot Air Weld has been completed.
- F. Apply Bonding Adhesive to the exposed underside of the membrane sheet and the substrate.
- G. Allow adhesive to dry until tacky and roll the membrane into the substrate and brush down the bonded section with a bristle broom following the procedure noted above.
- H. Continue to install adjoining membrane sheets in the same manner, overlapping edges a minimum of 2 inches and complete the bonding procedures as stated previously.

### 3.4 Membrane Splicing/Hot Air Welding Procedures

- A. Hot air weld the membrane using an Automatic Hot Air Welding Machine or Hot Air Hand Welder in accordance with the manufacturer's specifications. At all splice intersections, roll the seam with a silicone roller to ensure a continuous hot air welded seam. (Note: When using .060" thick membrane, all splice intersections shall be overlaid with non-reinforced flashing)

- B. Probe all seams once the hot air welds have thoroughly cooled (approximately 30 minutes).
- C. Repair all seam deficiencies the same day they are discovered.
- D. Apply Cut Edge Sealant on all cut edges of reinforced membrane (where the scrim reinforcement is exposed) after seam probing is complete. Cut Edge Sealant is not required on vertical splices.

### 3.5 Flashing

- A. Flashing of parapets, curbs, expansion joints and other parts of the roof must be performed using reinforced membrane. Non-reinforced membrane can be used for flashing pipe penetrations, Sealant Pockets, and scuppers, as well as inside and outside corners, when the use of pre-molded accessories is not feasible.
- B. Follow manufacturer's typical flashing procedures for all wall, curb, and penetration flashing including metal edging/coping and roof drain applications.

### 3.6 Walkways

- A. Install walkways at all traffic concentration points (such as roof hatches, access doors, rooftop ladders, etc.) and all locations as identified on the specifier's drawing.
- B. Hot air weld walkway pads to the membrane in accordance with the manufacturer's specifications.

### 3.7 Daily Seal

- A. On phased roofing, when the completion of flashings and terminations is not achieved by the end of the work day, a daily seal must be performed to temporarily close the membrane to prevent water infiltration.
- B. Complete an acceptable membrane seal in accordance with the manufacturer's requirements.

### 3.8 Clean Up

- A. Perform daily clean up to collect all wrappings, empty containers, paper, and other debris from the project site. Upon completion, all debris must be disposed of in a legally acceptable manner.
- B. Prior to the manufacturer's inspection for warranty, the applicator must perform a pre-inspection to review all work and to verify all flashing has been completed as well as the application of all caulking.

END OF SECTION

**CERTIFICATION OF ROOFING SYSTEM**

**Project:** \_\_\_\_\_

**Architect's Job No:** \_\_\_\_\_ **Building Commission's Project No.** \_\_\_\_\_

**Owner:** \_\_\_\_\_

**General Contractor:** \_\_\_\_\_

**Roofing Subcontractor:** \_\_\_\_\_

**Roofing Material Manufacturer:** \_\_\_\_\_

**Roofing Material Manufacturer's Inspector:** \_\_\_\_\_

The undersigned Contractors, Manufacturer Representative and Inspector do hereby state that the Roofing System for the Project identified above has been provided in compliance with all Codes specified and as required by Local and State of Alabama laws and regulations and has been provided in compliance with the specified Performance Requirements.

**SIGNATURES**

**General Contractor:** \_\_\_\_\_  
Signature Printed Name

**Roofing Subcontractor:** \_\_\_\_\_  
Signature Printed Name

The Roofing Material Manufacturer further states that the Roofing System Provided by Manufacturer to the Roofing Contractor complies with International Building Code 2015 for the County that Roofing System has been installed.

**Roofing Material Manufacturer:** \_\_\_\_\_  
Signature Printed Name

The Roofing Material Manufacturer's Field Inspector certifies that he/she has made field inspections in the proper number and sequence to assure Roofing Material Manufacturer that the Roofing System supplied has been installed to comply with Manufacturer's installation requirements as well as the 2015 IBC.

**Roofing Material Manufacturer's Inspector:** \_\_\_\_\_  
Signature Printed Name

AND

STANDING SEAM ROOF  
SHEET METAL SYSTEM - SECTION 07610  
(Complete System)

1.0 - GENERAL

1.1 Scope

Section includes a complete Architectural Standing Seam Metal Roofing System with preformed and pre-finished standing seam metal roofing panels, underlayment, fasteners, clips, perimeter and penetration flashings, roof curbs, cap flashing, closures, sealant, gutters, downspouts, seam caps, trim, vapor barriers, expansion joint covers, soffit system and miscellaneous accessories required to provide the entire roofing and sheet metal assemblies complete and weathertight as intended by contract documents.

1.2 Related Sections

- A. Section 06100 - Rough Carpentry
- B. Section 07910 - Caulking and Sealants
- C. Mechanical/Plumbing - See Drawings
- D. Electrical - See Drawings

1.3 References

- A. American Iron and Steel Institute (AISI), Specification for the Design of Cold-Formed Steel Structural Members, (August, 1986).
- B. American Institute of Steel Construction (AISC) Manual of Steel Construction, (Current Edition).
- C. American Society for Testing and Materials (ASTM):
  - 1. A446: Specification for Steel Sheet Zinc-Coated (Galvanized) by the Hot-Dip Process, structural (physical) property.
  - 2. A525: Standard Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
  - 3. A792: Specification for Steel Sheet, Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
  - 4. E283: Test Method for Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors.
  - 5. E331: Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
- D. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):
  - 1. 1987 Architectural Sheet Metal Manual.
- E. Underwriter's Laboratories (UL) Building Materials Directory:
  - 1. UL 580: Tests for Wind Uplift Resistance of Roof Materials.

1.4 Quality Assurance

- A. Prior to starting work, the roofing contractor must submit the following:
  - 1. Shop drawings showing layout, details of construction and identification of materials.
  - 2. A sample of the manufacturer's Membrane System Warranty.
  - 3. Submit a letter of certification from the manufacturer which certifies the roofing contractor is authorized to install the manufacturer's roofing system and lists foremen who have received training from the manufacturer along with the dates training was received.
  - 4. Attachment pattern for insulation and membrane to comply with wind zone



requirements.

- B. Upon completion of the installed work, submit copies of the manufacturer's final inspection to the Architect prior to the issuance of the manufacturer's warranty.
- C. Manufacturer Certificates: Signed by manufacturer certifying that roof panels comply with performance requirements specified in "Performance Requirements" Article.
  - 1. Submit evidence of meeting performance requirements.
  - 2. Submit signed approval of project drawings and specifications meeting manufacturer's requirements for specified manufacturer's warranties.
  - 3. Submit evidence of Installer/contractor meeting requirements for specified warranties.
  - 4. Contractor to register roofing project with the manufacturer prior to the pre-roofing conference and prior to submitting shop drawings. As part of the submittals package, copy of the acknowledgement of the manufacturer is required.
- D. Manufacturer Qualifications:  
Provide primary roofing material products from a single source including under layments all produced by a single manufacturer. Provide secondary products only as recommended by manufacturer of primary products for use with roofing system specified.
- E. Installer's Qualifications: Installer / sub-contractor must be currently in the primary business of roofing with not less than (5) five consecutive years of recorded successful experience with roofing systems comparable to that of this project under the same company name and be **authorized by the roofing material manufacturer as trained and approved for installation** of such roofing materials indicated for this project. Joint ventures shall not be allowed.
- F. A full-time field supervisor or foreman with minimum of (5) years of experience in a roofing supervisory role, having performed on projects of comparable scope and type shall be required to be on site at all times during roofing work.
- G. The Roofing Contractor shall be responsible for weathertightness of the entire roofing system.
- H. The Roofing Contractor shall inspect and accept condition of the roof deck and components of mechanical penetrations prior to installation of the roofing system.

**Note: Copy of Acknowledgement Letter from manufacturer that project has been registered shall be included with submittals and prior to pre-roofing conference.**

A **minimum** of three (3) field inspections shall be made by a technical (non sales) representative of the Roofing System Manufacturer at start, mid-way and upon completion of the work. Written reports shall be made and copies of these reports must be submitted to the Architect within 3 days of the inspections. These inspections must be made by a manufacturer's representative employed by the manufacturer. Notify Architect 72 hours prior to inspections.

**The Representative for the Roofing Materials Manufacturer shall bring a copy of the warranty(ies) for the roofing material(s) for comparison to the warranty(ies) specified. This sample warranty is required to be job specific, covering all requirements, per the specifications. If the sample warranty is not provided as required, the conference will be voided, an inspection fee will be issued, and it will have to be rescheduled.**

1.5 Pre-Roofing Conference:

1.0 - GENERAL

1.1 Scope

Section includes a complete Architectural Standing Seam Metal Roofing System with preformed and pre-finished standing seam metal roofing panels, underlayment, fasteners, clips, perimeter and penetration flashings, roof curbs, cap flashing, closures, sealant, gutters, downspouts, seam caps, trim, vapor barriers, expansion joint covers, soffit system and miscellaneous accessories required to provide the entire roofing and sheet metal assemblies complete and weathertight as intended by contract documents.

1.2 Related Sections

- A. Section 06100 - Rough Carpentry
- B. Section 07910 - Caulking and Sealants
- C. Mechanical/Plumbing - See Drawings
- D. Electrical - See Drawings

1.3 References

- A. American Iron and Steel Institute (AISI), Specification for the Design of Cold-Formed Steel Structural Members, (August, 1986).
- B. American Institute of Steel Construction (AISC) Manual of Steel Construction, (Current Edition).
- C. American Society for Testing and Materials (ASTM):
  - 1. A446: Specification for Steel Sheet Zinc-Coated (Galvanized) by the Hot-Dip Process, structural (physical) property.
  - 2. A525: Standard Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
  - 3. A792: Specification for Steel Sheet, Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
  - 4. E283: Test Method for Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors.
  - 5. E331: Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
- D. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):
  - 1. 1987 Architectural Sheet Metal Manual.
- E. Underwriter's Laboratories (UL) Building Materials Directory:
  - 1. UL 580: Tests for Wind Uplift Resistance of Roof Materials.

1.4 Quality Assurance

- A. Prior to starting work, the roofing contractor must submit the following:
  - 1. Shop drawings showing layout, details of construction and identification of materials.
  - 2. A sample of the manufacturer's Membrane System Warranty.
  - 3. Submit a letter of certification from the manufacturer which certifies the roofing contractor is authorized to install the manufacturer's roofing system and lists foremen who have received training from the manufacturer along with the dates training was received.
  - 4. Attachment pattern for insulation and membrane to comply with wind zone

requirements.

- B. Upon completion of the installed work, submit copies of the manufacturer's final inspection to the Architect prior to the issuance of the manufacturer's warranty.
- C. **Manufacturer Certificates:** Signed by manufacturer certifying that roof panels comply with performance requirements specified in "Performance Requirements" Article.
  - 1. Submit evidence of meeting performance requirements.
  - 2. Submit signed approval of project drawings and specifications meeting manufacturer's requirements for specified manufacturer's warranties.
  - 3. Submit evidence of Installer/contractor meeting requirements for specified warranties.
  - 4. Contractor to register roofing project with the manufacturer prior to the pre-roofing conference and prior to submitting shop drawings. As part of the submittals package, copy of the acknowledgement of the manufacturer is required.
- D. **Manufacturer Qualifications:**  
Provide primary roofing material products from a single source including under layments all produced by a single manufacturer. Provide secondary products only as recommended by manufacturer of primary products for use with roofing system specified.
- E. **Installer's Qualifications:** Installer / sub-contractor must be currently in the primary business of roofing with not less than (5) five consecutive years of recorded successful experience with roofing systems comparable to that of this project under the same company name and be **authorized by the roofing material manufacturer as trained and approved for installation** of such roofing materials indicated for this project. Joint ventures shall not be allowed.
- F. A full-time field supervisor or foreman with minimum of (5) years of experience in a roofing supervisory role, having performed on projects of comparable scope and type shall be required to be on site at all times during roofing work.
- G. The Roofing Contractor shall be responsible for weathertightness of the entire roofing system.
- H. The Roofing Contractor shall inspect and accept condition of the roof deck and components of mechanical penetrations prior to installation of the roofing system.

**Note: Copy of Acknowledgement Letter from manufacturer that project has been registered shall be included with submittals and prior to pre-roofing conference.**

A **minimum** of three (3) field inspections shall be made by a technical (non sales) representative of the Roofing System Manufacturer at start, mid-way and upon completion of the work. Written reports shall be made and copies of these reports must be submitted to the Architect within 3 days of the inspections. These inspections must be made by a manufacturer's representative employed by the manufacturer. Notify Architect 72 hours prior to inspections.

**The Representative for the Roofing Materials Manufacturer shall bring a copy of the warranty(ies) for the roofing material(s) for comparison to the warranty(ies) specified. This sample warranty is required to be job specific, covering all requirements, per the specifications. If the sample warranty is not provided as required, the conference will be voided, an inspection fee will be issued, and it will have to be rescheduled.**

1.5 Pre-Roofing Conference:

- A. Prior to roof deck installation, a required Pre-Roofing Conference shall be held as scheduled by Architect upon request by the Contractor. Required attendees include the Owner, Architect, DCM Inspector, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing including installers of roof accessories and roof-mounted equipment. Comply with requirements in Division 1.
- B. Immediately prior the Roofing installation work, the General Contractor shall hold a subcontractors pre-installation meeting at the site to review matters discussed at the State required Pre-Roofing Conference, methods and procedures related to roofing system including, but not limited to, the following:
  - 1. Review methods and procedures related to roofing installation, including manufacturer's written instructions and warranty requirements.
  - 2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
  - 3. Examine and accept deck substrate conditions for compliance with requirements, including flatness and fastening.
  - 4. Review structural loading limitations of roof deck during and after roofing.
  - 5. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
  - 6. Review governing regulations and requirements for insurance and certificates if applicable.
  - 7. Review temporary protection requirements for roofing system during and after installation.
  - 8. Review roof observation and repair procedures.

1.6 System Description

- A. Design Requirements:
  - 1. Architectural Standing Seam Metal Roofing System with continuous, one-piece, preformed, pre-finished, mechanically-seamed, single length roof pans, concealed attachment cleats and other components required for specific project conditions. Sheet steel shall conform to ASTM A792.
  - 2. Formed pre-finished sheet metal flashing, trim, roof drainage systems, curbs, soffit system, etc. to withstand wind loads, structural movement, thermal movement, and exposure to weather without failing, rattling, leaking, fastener disengagement or allowing water infiltration to building interior. Comply with recommendations in FMG Loss Prevention Data Sheet 1-49:
  - 3. Manufacturer is responsible for providing evidence acceptable to Architect that Manufacturer's specified roof system is capable of meeting thermal, wind uplift and performance requirements specified and as required by all local codes and 2015 International Building Code.
- B. Thermal Movement:
  - 1. Completed sheet metal system shall be capable of withstanding expansion and contraction of components cause by changes in temperature without

buckling, producing excess stress on structure, anchors or fasteners, or reducing performance ability.

2. Interface between sheet metal component panels and concealed expansion clip shall provide for applicable thermal movement in each direction along the longitudinal direction.
3. Location and sizes of metal roofing rigid connectors shall be project specific as indicated an Engineer's (registered in the State of Alabama) certification and located on shop drawings.
4. Temperature Change Range: 120 degrees F ambient; 180 degrees F material surfaces.

C. Uniform Wind Load Capacity:

1. Design Loads (Roof Panels and Clips): Pressures are normal to roof surface in accordance with ANSI A58.1. Where load tests are required to certify performance, factor of safety shall be 2.5 on panel buckling or on clip-to-panel connections. For Wind Loads, an allowable increase factor of 4/3 may be employed (this results in net factors of safety of 1.875 on panel bending or clip failure from wind loads). Factor of safety for panel capacity of Live Loads shall be 2.0. Minimum wind speed 120 mph.
2. Roof Panel Clip Requirements: Connection of panel anchor clips to substructure or roof deck system shall be designed to resist loads developed by pressures with proper regard for prying forces and/or bending due to eccentric loading. Performance shall be evaluated at extreme positions of thermal movement. A 1/3 increase in allowable load is permitted for wind pressures. Allowable stresses for design shall be in accordance with specifications in AISI "Cold Formed Steel Design Manual", factor of safety on testing of connections shall be 2.5. Clips shall be double anchored through the deck to prevent rotation.
3. Installed roof system shall carry positive uniform design loads with maximum system deflection of L/180 as measured at rib (web) of panel. Comply with UL 580 / Uplift Rating UL 90. Minimum wind speed 120 mph.

D. Performance Requirements:

1. Underwriter's Laboratories, Inc., (UL), Wind Uplift Resistance Classification For Roof Assembly shall be Class 90, as installed, pursuant to Construction Number 312, 312 with batt insulation, 335, 335-modified, or 403, as defined by UL 580. Certified statements from manufacturer without proper UL Classification will not be acceptable.
2. Completed metal roof system shall have maximum static pressure air infiltration of 0.066 cfm/square feet of roof area with 6.24 psf air pressure differential when tested in accordance with ASTM E283.
3. No uncontrolled water penetration (dynamic pressure), other than condensation, when exposed to dynamic rain at 6.24 psf differential static pressure for not less than five minutes duration, when tested in accordance with ASTM E 1646
4. Calculated pull-out capacities for fasteners shall be certified by registered professional Engineer in the State of Alabama as selected by Owner. Minimum safety factor for anchoring fasteners into metal shall be 2.35. Minimum safety factor for anchoring fasteners into concrete shall be 4.0.
5. Installation shall comply with requirements of: FM I-90, FM Fire/windstorm

Classification 1A-90 and FM Severe Hail and 2015 International Building Code Hail Impact and Windspeed. No exclusions for Hail under 2".

6. Entire roofing system and sheet metal assemblies are to be provided in detail for weathertightness under peak weather conditions.

E. Certification of Roofing System

Contractor(s), Roofing Material Manufacturer, and Roofing Material Manufacturer's Field Inspector shall each execute the Certification of Roofing System, a copy of which immediately follows this Section.

1. This certification endorsement by the manufacturer shall assure the Owner/Architect that the materials supplied for this project are in compliance with materials and performances as specified in this section.
2. Field Inspector shall further stipulate by signing the certification that he has inspected the project as required and has found no unresolved issues with installation of the manufacturer's materials as supplied.

1.7 Submittals

A. Shop Drawings: Architectural details show design concept and relationship of roof and sheet metal system to other conditions. It is the responsibility of the Installer to prepare detailed shop drawings that adapt the indicated roof and sheet metal assemblies and configuration to conditions of this Project and specified requirements. Shop drawings shall be reviewed by manufacturer's Technical Department before submittal to Architect. Installer shall recommend and make any detail modifications required by manufacturer to ensure a proper and weathertight system.

1. Show roofing and sheet metal system with flashings and accessories in plan, elevation, sections and details for each type of product indicated.
2. Include metal thicknesses and finishes, panel lengths, joining details, anchorage details, flashings and special fabrication provisions for termination and penetrations. Also indicate attachment locations, thermal expansion provisions, and special supports. Submittal shall include manufacturer's written comments, all fastener descriptions and spacing, sealant description and locations, bend radii, metal thicknesses, dimensions of individual components and profiles, and other pertinent information.
3. Indicate relationships with adjacent and interfacing work.
4. Distinguish between factory and field assembly work.
5. Submit erection drawings showing proposed sequence of laying panels. Provide manufacturer's instructions for storage, handling and installation, and their standard construction details for conditions on the Project.
6. Submit documentation that system attachment will meet UL-90 rating for resistance to wind uplift loads.

B. Product Data: Submit manufacturer's detailed material and system description, sealant and closure installation instructions, engineering performance data, and specifications.

C. Submit a sample 16 sq inch (min.) chip of each type of actual material color, complete with factory finish. Architect shall select from industry standard Energy Star Colors.

- D. Quality Control Submittals:
1. Design Calculations:
    - a. Submit design calculations sealed by registered Engineer in the State of Alabama indicating compliance with specified performance criteria and certified fastener pullout calculations. Indicate fastener types, spacings and number required for each clip. Pullout calculations shall be for panel clips.
    - b. Empirical calculations for roof panel and clip-to-panel performance will not be accepted.
  2. Test Reports:
    - a. Submit reports from independent testing laboratory that bears stamp of Alabama registered Engineer (P.E.) to certify compliance with specified performance criteria.
    - b. Each prequalified manufacturer shall provide complete and current data for specified roof system as follows:
      - 1) Thermal cycle testing of metal roof panels and panel clips as specified.
      - 2) Uniform ultimate wind uplift load capacity test for metal roof panels as specified.
      - 3) Ultimate pull-out capacity for panel clips, tested as specified.
      - 4) UL 90 Classification test data as specified.
      - 5) Static air infiltration resistance test data as specified.
      - 6) Water penetration test data as specified.
      - 7) Fastener pull-out calculations as specified.
- E. Submit a sample of Manufacturer's warranties.

1.8 Installer/Manufacturer Quality Assurance

- A. Manufacturer: Company specializing in Architectural Sheet Metal Products with fifteen (15) years minimum experience. Being listed as prequalified manufacturer does not release manufacturer from providing complete, current and acceptable test data for each performance, thermal, and wind load requirement specified for specific profile proposed.
- B. Comply with SMACNA's "Architectural Sheet Metal Manual, 6<sup>th</sup> Edition." Any clarifications will be in accordance with this standard. Conform to dimensions and profiles shown unless more stringent requirements are indicated.
- C. No product substitutions shall be permitted without meeting specifications. Substitutions shall be submitted 10 days prior to bid date and acceptance put forth in an addendum. **No substitutions shall be made after the bid date.**
- D. Installer shall be responsible for material and labor in the form of a single source contract. Split contracts are not acceptable.
- E. Installer Qualifications:
  1. Installer must be an Authorized Installer or Licensee, acceptable to roof system manufacturer for the complete finished sheet metal package. Manufacturer will determine initial acceptability of installer's qualifications for specified roof systems.
  2. Installer's primary business must be the installation of roofing systems.

3. Installer must have minimum of five (5) years of experience installing preformed metal roofing systems.
  4. Installer must have successfully completed minimum of five (5) significant installations of preformed metal roofing systems, including installation of long, field-formed panels. Submit complete description of each previous project, including name and phone numbers of representatives of the Owner, Architect, Manufacturer and Contractor.
  5. Submit name and resume' of installer's proposed job superintendent, including list of similar projects completed by superintendent.
  6. Installer must execute 100% of metal roof system installation with installer's own employees.
- F. Pre-installation Conference: Conduct required coordination meetings / conferences to comply with requirements of this section and Division 1
- G. Manufacturer's Twenty (20) Year Watertightness Warranty:
1. General Contractor shall send drawings to manufacturer for review before bid date to ascertain compliance of materials for accurate bidding purposes.
  2. Installer, immediately upon award of bid, shall request application from manufacturer for manufacturer's Twenty (20) Year NDL or equivalent watertightness warranty.
  3. Installer shall complete application forms and return to manufacturer with shop drawings for review and approval well in advance of installation date.
  4. After completion of project, installer shall submit letter of certification from manufacturer that roof installation is in accordance with approved shop drawings and manufacturer's requirements, and that entire roof installation will be issued specified Twenty (20) Year watertightness warranty.

1.9 Delivery, Storage and Handling

- A. Deliver pre-fabricated accessories to Project site in manufacturer's unopened containers.
- B. Protect components during shipment, storage, handling and erection from mechanical abuse, stains, discoloration and corrosion.
- C. Provide protective interleaving between contact areas of exposed surfaces to prevent abrasion during shipping storage and handling.
- D. Store materials off ground, providing for drainage, under cover providing for air circulation, and protected from wind movement, foreign material contamination, mechanical damage, cement, lime or other corrosive substances.
- E. Handle materials to prevent damage to surfaces, edges and ends of roofing sheets and sheet metal items. Damaged material shall be rejected and removed from site.
- F. Protect from wind-related damage. Provide on-site storage, or other acceptable protection prior to installation.
- G. Examine materials upon delivery. Reject and remove physically damaged, stained or marred material from Project site.



- H. Panels with strippable film must not be stored in the open where exposed to the sun. Strippable film shall be removed only immediately before installation.

1.10 Site Conditions

- A. Determine that work of other trades will not hamper or conflict with necessary fabrication and storage requirements for preformed metal roofing system.
- B. Protection:
  - 1. Provide protection or avoid traffic on completed roof surfaces.
  - 2. Do not overload roof structure with stored materials.
  - 3. Do not support roof-mounted equipment directly on roofing system.
- C. Determine that work of other trades which penetrate roof or is to be made watertight by roof is in place and accepted prior to installation of roofing system. Actual roof penetration shall be located and provided under this section.

1.11 Scheduling

- A. Coordinate staging and setup area required for field fabrication equipment provided by metal roofing manufacturer.
- B. Provide temporary equipment (cranes, hoists, forklifts) as required.

1.12 Warranties

- A. Provide Manufacturer's Premium NDL or manufacturer's equivalent Twenty (20) Year Weathertightness Roofing System Warranty fully executed, fully in force and dated within (30) days of project Substantial Completion. Sample warranty and outline of warranty program shall be submitted and approved prior to Pre-Installation Conference. NOTE: Entire source of material and labor shall be the sole responsibility of one Subcontractor. Split contracts are not acceptable. Warranty shall state:
  - 1. Warranty shall be limited to the value of the installed roof assembly, signed by manufacturer of primary roofing materials and his authorized installer, agreeing to replace/repair defective materials and workmanship as required to maintain roofing system in watertight condition with No Dollar Limit (NDL).
  - 2. Warranty shall not exclude any conditions such as flashing, interior gutters, curbs, penetrations, etc., which are an integral part of the roofing system.
  - 3. Warranty shall include manufacturer approval of shop drawings and at least two (2) job site technical inspections by the manufacturer's field representative.
  - 4. **All warranties shall contain language acknowledging the governing laws shall be according to the laws of the State of Alabama. Manufacturer's roofing guarantees (or warranties) which contain language regarding the governing of the guarantee (or warranty) by any state other than the State of Alabama, must be amended to exclude such language, and substituting the requirement that the Laws of the State of Alabama shall govern all such guarantees (or warranties).**
- B. Provide Manufacturer's Premium (20) year Sheet Metal Finish Warranty stating:
  - 1. Architectural coating finish will be Free of fading or color change in excess of 2 NBS units as measured per ASTM D 2244-68.

2. Architectural coating finish will not chalk in excess of numerical rating of 8 when measured in accordance with standard procedures specified in ASTM D 659-74.
  3. Architectural coating finish will not peel, crack, chip or exhibit any other mechanical failure of paint to adhere to the substrate.
- C. Furnish General Contractor's Five (5) Year Roofing Warranty in compliance with State of Alabama DCM General Roofing Guarantee. All sheet metal flashings, trim and components provided under this section shall be covered under the State of Alabama DCM General Contractor's Roofing Warranty.
  - D. The Subcontractor shall guarantee in writing all sheet metal roofing work and flashings to remain free from leaks, loosening, excessive buckling, failure to stay in place, and similar defects of materials and workmanship for a period of five (5) years from the date of acceptance of the work.
  - E. **The Representative for the Roofing Materials Manufacturer shall bring a copy of the warranty(ies) for the roofing material(s) for comparison to the warranty(ies) specified. This sample warranty is required to be job specific, covering all requirements, per the specifications. If the sample warranty is not provided as required, the conference will be voided, an inspection fee will be issued, and it will have to be rescheduled.**

## 2.0 - PRODUCTS

### 2.1 Architectural Standing Seam Metal Roofing System

- A. Panels shall be pre-finished factory formed 16" wide with 2" high vertical ribs and intermediate symmetrical striations. Vertical side ribs shall be provided continuous to lap, seal and interconnect with adjoining adjacent panels by means of mechanical seaming.
- B. Attachment shall be provided by means of double fastened concealed clips at side laps to allow free thermal movement of roof panels over structure within regional temperature ranges.
- C. Provide all accessories as required for a complete weathertight system to meet UL I-90 ratings including, but not limited to: clips, cleats, pressure plates and sealant tape. Attachment shall be provided to withstand negative loading.
- D. Comply with ASTM E 1514
- E. Panels shall be continuous full length, no end laps.
- F. Exposed fasteners are not acceptable at eaves, valleys, or anywhere else contiguous to concealed fastener standing seam systems.
- G. Substitutions shall fully comply with specified requirements and will be considered by submittal ten (10) days prior to bid date with applicable technical information and sample watertightness warranty.
- H. Concealed Continuous Inner Rib:
  1. Standing seam metal roof shall be fastened to framing members with concealed anchorage.
  2. Concealed anchorage shall accommodate panel movement in each direction longitudinally to adequately accommodate temperature differential and panel movement for this Project.

3. Manufacturer shall design fastener device and spacing of fasteners to maintain required wind uplift resistance at connection.

I. Closures:

Ridge and hip closures shall be factory fabricated from 24 gauge sheet metal matching roof panels. Hip closures shall be field cut. Ridge closures are to be die-formed to match panel configuration.

J. Approved Manufacturers: AIM, Inc. - Architectural Integrated Metals, Inc. , MBCI Morin, ACI Metal Roofing Systems , and Peterson Aluminum (Pac Clad) providing that products meet or exceed these specifications. Other Manufacturers must submit product information in compliance with Section 01360 at least 10 days prior to bid. Other approved manufacturers will be included in Addendum.

## 2.2 Underlayment

A. Self-Adhering, Elastomeric Sheet: 30 to 40 mils thick minimum, asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer according to application. After installation of underlayment there should be a Maximum exposure of 60 days regardless if manufacturer's product allows for extended exposure.

## 2.3 Rigid Roof Insulation

A. Provide a 1 " thick layer of polyisocyanurate rigid roof insulation over structural deck system. Stagger joints. Attach as recommended by manufacturer to comply with FM 1-90 and 120 mph wind speed and wind uplift requirements.

## 2.4 Roof Drainage Accessories

A. Gutters: Fabricate from pre-finished 24 gauge metallic-coated steel to profile indicated, complete with sealed / profiled end pieces, sealed outlet tubes, and other accessories as required. Fabricate in minimum 120-inch- long sections.

1. Gutter Straps: fabricated from 16-gauge galvanized steel, 1 ¼" width, spaced at 30" centers.

2. Gutter Accessories: Fabricate expansion-joint covers, outlet tubes, ends and other gutter accessories from same metal as gutters.

3. Gutter Style: As Indicated on Drawings

4. Expansion Joints: 50 feet o.c. maximum

B. Downspouts: Provide sealed outlet tube at connection to gutter. Fabricate rectangular downspouts from pre-finished 24 gauge metallic-coated steel complete with mitered elbows. Furnish with anchored metal hangers, formed from same material as downspouts.

1. Hangers: Hemmed edges 1 ¼ inch width.

2. Provide one precast concrete splash block or downspout boot as indicated with each downspout.

## 2.5 Sheet Materials

A. Finished steel sheet material shall be 24 gauge Pre-finished Galvalume (Aluminum-zinc alloy-coated steel – "Hot Dipped Process") per ASTM A792/A792M-97a

B. Unfinished steel sheet metal materials shall be Galvalume ASTM 792-86, AZ 55, "Satin Finish.

C. Finished materials shall be provided with 70% Kynar 500 Fluorocarbon coating, applied by the manufacturer on a Continuous Coil Coating Line, with a top side dry

film thickness of 0.70 to 0.90 mil over 0.25 to 0.35 mil prime coat, to provide a total dry film thickness of 0.95 to 1.25 mil. Bottom side shall be coated with primer with a dry film thickness of 0.25 mil. Finish shall conform to all tests for adhesion, flexibility and longevity as specified by the Kynar 500 finish supplier. Color as selected by Architect.

- D. Removable film shall be applied to the top side of the painted coil to protect the finish during fabrication, shipping and field handling. This strippable film shall be removed immediately before installation.
- E. Soffit System Material: Aluminum Sheet Coil-coated sheet, ASTM B 209, alloy, 032 inch nominal thickness with temper as required to suit forming operation and structural performances required. Note: only the soffit system shall be of aluminum materials.

## 2.6 Accessory Materials

- A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation.
- B. Fasteners:
  - 1. Concealed fasteners for standing seam roofing system shall be 300 series alloy stainless steel pancake head, size and spacing per manufacturer's recommendation for installation over rigid insulation/metal deck, to attach to 24 gauge clips spaced per manufacturer's recommendation to comply with FM1-90/ 120 mph wind speed.
  - 2. Miscellaneous fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.
    - a. Exposed Fasteners: Heads matching color of sheet metal by means factory-applied coating.
    - b. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws with hex head washer gasket.
    - c. Blind Fasteners: Exposed rivets shall be self-plugging type minimum 3/16" diameter 300 series alloy high-strength stainless-steel with stainless-steel stems.
    - d. Exposed Rivets:  
Exposed rivets shall be self-plugging type minimum 3/16" diameter 300 series alloy stainless steel with stainless steel stems.
- C. Sealants:
  - 1. Standing Seam Sealant: Factory applied extruded vinyl weather seal.
  - 2. Flashing Sealant: shall be approved equal to Tremco Spectrum 1.
  - 3. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.
  - 4. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
  - 5. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, heavy bodied for hooked-type expansion joints with limited movement.

## 2.7 Fabrication

### A. Preformed Roofing Metal Panels:

1. Prefinished 24 gauge, Grade C G-90 galvanized steel panel shall conform to ASTM A446 within acceptable tolerances of ASTM A525 of continuous field formed full lengths.
2. Panels shall have minimum 2" vertical rib height, spaced at 16" o.c.
3. Panels shall be designed as true standing seam shape, requiring no trapezoidal foam closures, plugs or fillers at eaves.
4. Standing seams shall mechanically interlock with concealed anchorage to prevent entrance or passage of water.
5. Seams shall allow anchorage to resist negative loading and allow expansion and contraction of panels due to thermal changes.
6. Integral snap seams which are not mechanically seamed are not acceptable.
7. Standing seams shall contain a factory applied Extruded Vinyl Weather Seal with the continuous inner rib system to prevent siphoning of moisture through the sidejoint seam (vinyl not available with intermittent clip system).
8. Panels shall be fabricated in continuous lengths as required. No horizontal endlap joints shall be permitted in roof panel lengths. Panels shall be full length from peak to eave as indicated.
9. Transverse or endlap seams will not be permitted.
10. Design panels to use concealed fasteners. Exposed fasteners in roofing pans will not be permitted.
11. Standing seam must prevent water capillary action, or otherwise prevent water infiltration.
12. Examine panels as they are formed to ensure panels are being formed within acceptable tolerances.

### B. Flashing and Trim:

1. General: Custom / Shop fabricate sheet metal flashing and trim to comply with recommendations of SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of work indicated. Field verify measurements for accurate fit before shop fabrication.
2. Fabricate roofing and related sheet metal work in accordance with accepted shop drawings, manufacturer's recommendations and applicable standards.
3. Provide flashings in minimum 10'-0" sections except as otherwise noted. Form flashing using single pieces for full width. Provide shop fabricated, mitered and joined corners.

4. All exposed adjacent flashing, ridge, and valleys shall be of the same material and finish as the roof panels.
5. All flashings, hem exposed edges on underside 1/4 inch.
6. All roof penetrations shall be flashed by Metal Roofing Contractor/Installer. All circular roof penetrations shall be made of a one piece construction from an EPDM membrane with aluminum base. Roof curbs shall be furnished by Mechanical Contractor and upon acceptance, installed by Roofing Contractor/Installer.
7. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that indicated for each application.
8. Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks with exposed edges folded back to form hems.
9. Sheet Metal Accessory Seams: Fabricate nonmoving seams for accessories with soldered flat-lock seams.
10. Sealed Joints: Form non-expansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA recommendations.
11. Expansion Provisions: Where lapped or bayonet-type expansion provisions in the Work cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with elastomeric sealant concealed within joints.
12. Conceal fasteners and expansion provisions where possible on exposed sheet metal flashing and trim,
13. Concealed cleats: galvanized 20-gauge
14. Equipment support flashing, expansion joint covers, counterflashing, flashing receivers, eave and rake flashing: pre-finished 24-gauge

### 3.0 - EXECUTION

#### 3.1 Inspection

- A. Examine alignment, attachment and placement of building roof structure and substrates before proceeding with installation of preformed metal materials. Substrate to be within 1/4" to true in 20 feet.
- B. Examine roof deck before starting installation. Deck must be clear, clean and smooth, free of depressions, waves or projections, dry and must remain dry and free of ice and snow, after roofing application commences.
- C. Structural support such as diagonal bracing and connections shall be tightened in place before work can proceed.
- D. Field check dimensions and check support alignment with taut string or wire. Support misalignment will cause panel to oil can.
- E. Do not proceed with installation until conditions are satisfactory. Notify Architect in writing of unsatisfactory conditions. Commencement of installation of the metal panels indicates acceptance of all roof structure conditions.

### 3.2 Installation

#### A. General Installation Requirements:

1. Install roofing and flashings in accordance with accepted shop drawings and manufacturer's product data, within specified tolerances. Minimum standards shall be as established by Sheet Metal & Air Conditioning Contractors' National Association, Inc. (SMACNA) and National Roofing Contractors Association (NRCA).
2. Separate dissimilar metals and masonry or concrete from metals with bituminous coating. Use fasteners with gasket where required to prevent corrosive action between fastener, substrate and panels.
3. Limit exposed fasteners to extent indicated on shop drawings.
4. Anchorage shall allow for temperature expansion and contraction movement without stress or elongation of panels, clips or anchors. Attach clips to structural substrate using fasteners of size and spacing as determined by manufacturer's design analysis to resist specified uplift and thermal movement forces.
5. Coordinate flashing and sheet metal work to provide weathertight conditions at roof terminations. Fabricate and install in accordance with manufacturer's recommendations, accepted shop drawings and applicable standards.
6. Torch cutting or cutting with abrasive tools of sheet metal including roofing, flashing and trim is not permitted.
7. Bed flanges in coating of elastomeric sealant where required for waterproof performance.
8. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal..
9. Install sheet metal flashing and trim in strait line and level indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and elastomeric sealant.
10. Use fasteners of sizes that will penetrate substrate not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.
11. Underlayment: Where installing metal flashing directly on substrates, install a slip sheet of elastomeric underlayment. After installation, underlayment shall not be exposed in excess of 60 days.

#### B. Preformed Standing Seam Metal Roof Panels:

1. Fasten concealed anchorage with fasteners as recommended by manufacturer and at spacings as required for wind uplift.
2. Verify with manufacturer locations of fixed connections and expansion connections.
3. Install starter and edge trim before installing roof panels.
4. Remove protective strippable film immediately prior to installation of roof panels.
5. Install panels to either Continuous Rib or Clips per manufacturer's details.

6. Seam Panel sidelaps using power-driven Seamer as recommended by manufacturer to ensure watertightness.
7. Erect metal roofing with lines, planes, rises and angles sharp and true, and plane surfaces free from objectionable wave, warp, dents, buckle or other physical defects with minimum oil canning.
8. Do not allow traffic on completed roof. If required, provide cushioned walk boards.
9. Protect installed roof panels and trim from damage caused by adjacent construction until completion of installation.
10. Remove and replace any panels or components which are damaged beyond successful repair.

C. Flashing:

1. Provide fascias, soffits, vents and/or coping to shape indicated and/or recommendations for installation of work where not specifically detailed in shop drawings. Set sheet metal items level, strait lined and plumb.
2. Provide concealed fasteners and provisions for expansion wherever possible.
3. Fold back edges of concealed side of exposed edge to form ½" hem.
4. Secure to wood with screws.
5. Seal flashing and trim joints with elastomeric sealant as required for watertight construction.
6. Reglet Flashing: Saw-cut reglets a minimum of one (1") inch deep by one quarter (¼") inch wide into masonry substrate/wall and Insert metal flashings into reglets, anchor with fasteners and wedges and seal joints thoroughly.
7. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.
8. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten
9. Provide breakaway type expansion joint system as indicated above 4 hour walls of same material and finish as roof panels.
10. Set metal already partly formed in place and fasten by means of cleats. Use cleats to keep laps closed when face width exceeds 8".

D. Roof Drainage and Accessories:

1. General: Provide gutters, down pipes and scuppers to shapes indicated and/or required. Systems shall include all items sized as necessary to carry off water to splash blocks or into boots. Install sheet metal roof drainage items to produce complete roof drainage system according to



SMACNA recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.

2. Gutters: Join sections with riveted and soldered joints or with lapped joints sealed with elastomeric sealant. Provide for thermal expansion. Attach gutters at eave or fascia to firmly anchored straps maximum 30 inches on center. Provide end closures and seal watertight with sealant. Slope to downspouts.
  - a. Front top elevation of gutter shall be installed minimum 1" below front top elevation of low point roof edge attached with loosely lock straps to front gutter bend and anchor to roof edge.
  - b. Install gutter with joints not exceeding 50 feet on center to allow for linear expansion with expansion joint caps.
3. Downspouts: Join sections with 1-1/2-inch (38-mm) telescoping joints. Provide fastener straps designed to hold downspouts securely 1 inch away from walls; locate fastener straps at top and bottom and between approximately 48" inches o.c..
  - a. Provide elbows at base of downspout to direct water away from building.
  - b. Connect downspouts to underground drainage system where indicated with transition fittings.
4. Expansion-Joint Covers: Install expansion-joint covers where indicated or required to adhere with profiles indicated. Lap joints a minimum of 4 inches (100 mm) in direction of water flow.
5. Down pipe straps shall be 20 gauge metal hangers, 1-1/2" wide anchored into wall each side of down pipe. Straps shall be minimum 8'-0" apart with minimum two per pipe.
6. Provide prefabricated downspout outlet tubes at gutter/downspout intersection for attachment. Seal thoroughly.
7. Provide prefinished rain water diverters at all valley/gutter intersections.

E. Soffit System:

1. General: Install Pre-finished Aluminum Soffit System according to Manufacturers standard instruction to thoroughly eliminate gaps, openings and adhere to design intentions as indicated on the drawings.
  - a. Span soffit panels perpendicular to building face
  - b. Attach to prevent wind damage and allow thermal movement with color matching fasteners.
  - c. Install to conceal cut edges
  - d. Touch-up as required to match exposed finish

3.3 Field Quality Control

A. Tolerances:

1. Applicable erection tolerances: Maximum variation from true planes or lines shall be 1/4" in 20'-0", 3/8" in 40'-0" or more.
2. Roof structure and roof system are designed for minimum roof slope of 1/2:12 (refer to roof plans for areas and slope).

B. Manufacturer's Twenty (20) Year Weathertightness Warranty Field Inspections:

1. The manufacturer's factory technician shall inspect the installer's work during the course of the metal roof construction:
    - a. First, upon completion of underlayment and trim installation and prior to panel installation.
    - b. Second, at the conclusion of the panel installation.
  2. The factory technician is to review all details with the Subcontractor's designated superintendent for conformance to the approved shop drawings and the requirements of the weathertightness warranty. Any corrections shall be the responsibility of the installer.
- C. Damaged or deteriorated sheet metal material beyond minor repair, shall be subject to rejection and replacement as determined by the Architect.
- D. Touch-up exposed fasteners using paint furnished by roofing panel manufacturer and matching exposed panel surface finish.

#### 3.4 Cleaning

- A. Clean roof in accordance with manufacturer's recommendations.
- B. Clean exposed surfaces immediately upon installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, pieces of flashing and temporary protective film materials. Maintain in a clean condition during construction. Leave and maintain in clean condition. Touch up minor abrasions and scratches in finish per manufacturer's recommendations with touch-up paint supplied by manufacturer.
- C. To prevent rust staining and scratches on finished surfaces, immediately remove fillings produced by drilling or cutting.
- D. Promptly remove all scrap and construction debris from the site.

#### 3.5 Final Inspection

- A. Final inspection will be performed by the Architect with Department of Construction Management (DCM) Inspector. Schedule with the Architect Three (3) weeks in advance.
- B. Fully executed roof warranties must be presented at time of Final Inspection.

END OF SECTION

**CERTIFICATION OF ROOFING SYSTEM**

**Project:** \_\_\_\_\_

**Architect's Job No:** \_\_\_\_\_ **Building Commission's Project No.** \_\_\_\_\_

**Owner:** \_\_\_\_\_

**General Contractor:** \_\_\_\_\_

**Roofing Subcontractor:** \_\_\_\_\_

**Roofing Material Manufacturer:** \_\_\_\_\_

**Roofing Material Manufacturer's Inspector:** \_\_\_\_\_

The undersigned Contractors, Manufacturer Representative and Inspector do hereby state that the Roofing System for the Project identified above has been provided in compliance with all Codes specified and as required by Local and State of Alabama laws and regulations and has been provided in compliance with the specified Performance Requirements.

**SIGNATURES**

**General Contractor:** \_\_\_\_\_  
Signature Printed Name

**Roofing Subcontractor:** \_\_\_\_\_  
Signature Printed Name

The Roofing Material Manufacturer further states that the Roofing System Provided by Manufacturer to the Roofing Contractor complies with International Building Code 2015 for the County that Roofing System has been installed.

**Roofing Material Manufacturer:** \_\_\_\_\_  
Signature Printed Name

The Roofing Material Manufacturer's Field Inspector certifies that he/she has made field inspections in the proper number and sequence to assure Roofing Material Manufacturer that the Roofing System supplied has been installed to comply with Manufacturer's installation requirements as well as the 2015 IBC.

**Roofing Material Manufacturer's Inspector:** \_\_\_\_\_  
Signature Printed Name

1.0 - GENERAL

- 1.1 Scope  
The work under this section consists of thru-wall flashing.
- 1.2 Submittals  
Submit for approval all materials proposed for use under this section.

2.0 - PRODUCTS

- 2.1 Flashing (Masonry)  
Flashing shall be Polyvinyl Chloride, 30 mil (.030") waterproof sheeting equal to Wire-Bond or other pre-approved product.
- Flashing (Non-Masonry)  
Flashing shall be a self-adhering flexible membrane consisting of Elvaloy thermoplastic resin with the following physical properties:
- Tensile Strength: 2000 psi per ASTM D412  
Ultimate Elongation: 25 percent  
Shore A Hardness: 83 per ASTM D 2240  
Corners and End Dams; preformed shapes
- Acceptable Manufacturers:  
Flex Flash – as manufacture by Hohmann & Barnard, Inc. or pre-approved equal.
- Surface Adhered Membrane with Drip – as manufactured by Hyload Flashings
- DuPont Thru-Wall Flashings – as manufactured by DuPont Chemical Co.
- 2.2 Adhesive & Primers  
Adhesive & primers for bonding and splicing shall be as recommended by the manufacturer of the material used.

3.0 - EXECUTION

- 3.1 Extent  
Wall flashing shall generally be installed continuous at each floor level, over exterior wall openings, under sills, and at other locations as indicated and as required.
- 3.2 Installation
- A. All surfaces to receive the flashing shall be reasonably smooth, free from irregularities and primed as recommended by manufacturers installation instructions. On all masonry surfaces, the flashing shall be laid continuously in a fresh bed of mortar above and below. Only at non-masonry vertical surfaces shall flashing be affixed continuously with adhesive and term bar to hold flashing in place.
- B. At grade level floors, thru-wall flashing shall exit finish veneer minimum one course below finish floor and below weep holes.

END OF SECTION

1.0 - GENERAL

- 1.1 Scope  
The work under this section consists of caulking and sealants.
- 1.2 Work Included  
See the drawings for all items and places requiring caulking. Completely seal with specified caulking compound joints around door frame and frame base and window frames (inside and outside); all other openings in masonry, concrete, or precast concrete joints in or between precast concrete panels; beneath all exterior thresholds; around plumbing fixtures; all places indicated on the drawings to be caulked; and all other places where caulking is required, whether specifically shown on the drawings or not.
- 1.3 Submittals  
Submit for approval product literature and samples of all materials proposed for use. Colors to be approved in the field by the Architect to match adjacent construction color.

2.0 - PRODUCTS

- 2.1 Sealant
- A. Exterior sealant shall be a gun grade one part silicone compound. Materials shall be Tremco Spectrem 1, Dow Corning No. 790 or Pecora No. 890, color as selected.
  - B. Primer, if required, for the silicone sealant shall be a quick drying clean primer as recommended by the manufacturer of the material used.
- 2.2 Caulking
- A. Interior caulking compound shall be a paintable, one part, gun grade butyl rubber base material equal to Tremco Tremflex 834 Acrylic, Pecora BC-158 or DAP Butyl Flex or acrylic latex base caulking compound equal to Pecora AC-20 or DAP Latex Caulk.
  - B. Floor Caulking compound shall be a tintable, semi-self leveling polyurethane base equal to Tremco THC900/901. Colors shall be selected by Architect from manufacturers entire line of colors.
- 2.3 Fire Caulking  
All locations indicated and/or all penetrations or openings into fire barriers shall be sealed with fire caulk material meeting UL requirements for such application. Submit product literature indicating UL compliance for approval. All trades shall use same fire caulk product. Installer shall be certified by the manufacturer.
- 2.4 Compressible Joint Sealant  
Sealant shall be compressible polyurethane foam impregnated with polybutylene, Polytite as manufactured by Polytite Manufacturing Corporation, or other material as approved.
- 2.5 Filler  
Filler shall be polyethylene foam, polyurethane foam, untreated jute, pointing mortar or other oil-free materials subject to approval of the manufacturer of the caulking or sealant compound.

2.6 Accessories

- A. Bond breaker shall be polyethylene tape.
- B. Solvents, cleaning agents, and other accessory materials shall be as recommended by the sealant manufacturer.

3.0 - EXECUTION

3.1 Joint Preparation

- A. Joints deeper than 1/2" shall be built up to a depth of 3/8" below adjacent surfaces with approved filler material prior to applying sealant. All surfaces must be clean and dry. Any protective coating or foreign matter such as oil, dust, grease, dirt, or frost on building materials that will impair bond shall be removed. Masonry and concrete surfaces shall be sound. If required by manufacturer's instructions, apply brush coat of primer to surfaces and allow to dry before applying sealant.
- B. At the option of the applicator, the surfaces next to the joints may be masked to obtain a clean neat line. Remove tape immediately after tooling the sealant.

3.2 Application

- A. Caulking or sealant shall be used from manufacturer's original cartridge in a standard open type, hand operated caulking gun. Nozzle shall be cut to proper size to obtain a neat, smooth and uniform bead. When handling bulk material, manufacturer's instructions shall be followed.
- B. A full bead of caulking or sealant shall be applied into joint under sufficient pressure, drawing nozzle across caulking or sealant to leave a slightly concave surface. Tool with a caulking tool or soft bristled brush moistened with solvent within 10 minutes after exposure. All sealed joints shall be watertight.
- C. Joints shall be caulked before painting adjacent work. Do not paint over silicone sealant compound.
- D. Fire caulk shall be installed to comply with manufacturer's requirements, UL requirements, and requirements of authority having jurisdiction.

3.3 Clean-up

On non-porous surfaces, excess uncured caulking shall be immediately removed with a solvent moistened cloth. On porous surfaces, excess caulking should be allowed to cure overnight, then remove by lightly wire brushing or sanding. All adjacent surfaces shall be clean and free from stains.

END OF SECTION

HOLLOW METAL DOORS & FRAMES - SECTION 08110

1.0 - GENERAL

- 1.1 Scope  
Furnish and install all hollow metal doors and frames including view windows, as indicated on the drawings and herein specified.
- 1.2 Submittals
- A. Submit shop drawings for approval.
  - B. Drawings shall show a schedule of openings using architectural opening numbers, all dimensions, jamb and head conditions, construction details, preparations for hardware, gauges, and finish.
- 1.3 Templates
- A. Manufacturer shall obtain templates of all applicable hardware from the Finish Hardware Contractor and make proper provision for the installation of this hardware.
  - B. Unless otherwise specified in the hardware section of the specifications, hardware locations shall be in accordance with the recommendations of The National Builder's Hardware Association.
- 1.4 Marking and Storage  
Mark each frame for intended location. Store frames off the ground and in a manner to protect them from damage.
- 1.5 Storage
- A. Doors shall be stored in a dry, secure location to prevent exposure to weather and/or moisture.
  - B. Frames shall be stored off the ground and protected from weather until in place.

2.0 - PRODUCTS

- 2.1 Door Construction
- A. Exterior Doors: Formed up sheets not less than 16 U.S. gauge rigidly connected and reinforced inside with continuous interlocking 20-gauge hat stiffeners, spaced a maximum of 6" apart. Interior Doors: Formed up sheets not less than 18 U.S. gauge rigidly connected and reinforced inside with continuous interlocking 20-gauge hat stiffeners, spaced a maximum of 6" apart. Sound deadening material of rock wool batts, insulites or other standard recognized available sound deadening materials shall be placed between all stiffeners and plates. Honeycomb doors are not acceptable. Suitable provision shall be made to receive glass panels or louvers. Edge seams are to be continuously welded and ground smooth. Bondo seams are not acceptable.
  - B. Louvers for interior metal doors shall be of sizes and types as indicated, inverted "V" with metal frame overlapping the door face.
  - C. Louvers for exterior doors shall be of sizes and types as indicated, rainproof, 20 ga. galvanized steel. Provide No. 16 wire mesh screen at inside of louvers.
  - D. Doors and frames shall be equal to Steelcraft, Curries, Republic or approved equal.

- E. Doors shall be coordinated with thresholds specified under FINISH HARDWARE - SECTION 08710 to meet A.D.A. requirements. Doors shall be extended as required to seal against threshold.
- F. Non-full height doors such as Toilet Stall Doors shall be provided with an inverted filler cap channel at head to maintain smooth uniformity at top of door surface.
- G. Hollow metal doors shall be provided with beveled hinge and lock edges. Bevel hinge and lock door edges 1/8 inch (3 mm) in 2 inches (50 mm).
- H. Exterior door face sheets shall be galvanized steel, level A60 (ASTM A653).
- I. Hardware preparation for hollow metal doors: hinge reinforcements shall be minimum 7-gauge x 9" length.
- J. Hardware Reinforcements:
1. Hinge reinforcements for full mortise hinges: minimum 7 gage [0.180" (4.7mm)].
  2. Lock reinforcements : minimum 16 gage [0.053" (1.3mm)].
  3. Closer reinforcements : minimum 14 gage [0.067" (1.7mm)], 20" long.
  4. Galvanized doors: include Galvanized hardware reinforcements. Include Galvanized components and internal reinforcements with Galvanized doors. Close tops of exterior swing-out doors to eliminate moisture penetration. Galvanized steel top caps are permitted.
  5. Projection welded hinge and lock reinforcements to the edge of the door.
  6. Provided adequate reinforcements for other hardware as required.
- K. Glass moldings and stops (both labeled and non-labeled doors):
1. Fabricate glass trim from 24 gage [.6mm] steel conforming to:
    - a. Interior openings ASTM designation A 366 cold rolled steel.
    - b. Exterior openings ASTM designation A 924 Zinc-Iron Alloy-Coated Galvanized steel with a zinc coating of 0.06 ounces per square foot (A60) for exterior openings.
      - 1) Install trim into the door as a four-sided welded assembly with mitered, reinforced and welded corners.
      - 2) Trim: identical on both sides of the door.
      - 3) Exposed fasteners are not permitted. Labeled and non-labeled doors: use the same trim.
      - 4) Acceptable mounting methods:



- a) Fit into a formed area of the door face, not extending beyond the door face, and interlocking into the recessed area.
- b) Cap the cutout not extend more than 1/16" [1.6mm] from the door face.

L. Electrical Requirements for Doors:

General: Coordinate electrical requirements for doors and frames. Make provisions for installation of electrical items arranged so that wiring can be readily removed and replaced.

1. Doors with Electric Hinges:

- a. General: Furnish conduit raceway to permit wiring from electric door hardware.
- b. Hinge Locations: Provide electric hinge at intermediate or center location. Top or bottom electric hinge locations are not acceptable.
- c. Refer to 08710 for electrified hardware items.

2.2 Frame Construction

- A. Frames shall be of sizes as indicated, completely assembled, buck and frame formed from 14-gauge exterior, 16-gauge interior, steel with 2" face unless otherwise indicated and 5/8", minimum, integral stop. Exterior frames and interior frames at cafeteria, kitchen, locker room and shower areas shall be Galvannealed A60 (ASTM A653).
- B. Corners of frames to be mitered and continuously welded. Joints shall be pulled up tight, welded, and ground smooth with faces in correct alignment.
- C. Provide adjustable "T" type anchors, three to each jamb; welded angle clips at bottom of frames for anchorage to floor construction; detachable type metal spreaders. Jamb anchors shall be T-shaped and of the same thickness as the metal of the frames. Where "T" anchors are not feasible, provide anchors as required and/or recommended.
- D. Machine frames for attachment of hardware, including special reinforcing for extra heavy duty use, drilling, and tapping. Provide mortar tight metal dust boxes in back of lock location.
- E. Frames for sidelights shall be integral with door frames; borrowed light window frames and other openings shall be as detailed.
- F. Prepare frames for rubber silencers, three for single swing door and two for each pair of doors.
- G. Frames not extending to the floor surface shall have a closed welded jamb bottom.
- I. Electrical Requirements for Frames:
  - 1. General: Coordination all electrical requirements for doors and frames. Make provisions for installation of electrical items arranged so that wiring can be readily removed and replaced.

- a. Provide cutouts and reinforcements required for metal door frame to accept electric components.
  - b. Frame with Electrical Hinges: Weld UL listed grout guard cover box welded over center hinge reinforcing. Top or bottom hinge locations are not permitted. Contractor to reference 3.01.E, for continuous hinges.
  - c. Provide cutouts and reinforcements required to accept security system components.
  - d. Refer to 08710 for electrified hardware items.
2. Provide mortar box, welded in head of door frame at exterior frames for future door contact switch provided by Owner. Size, type, location and conduit requirements to be provided by Owner.

2.3 Labeled Assemblies

- A. All openings shall be protected by assemblies which include doors, frames, hardware, closing devices, anchorage, sills, etc. installed in accordance with NFPA Standard "FIRE DOORS and WINDOWS, NFPA 80," as per Standard Building Code.
- B. To further clarify the basic requirements and/or the correct method of labeling that will be acceptable; the labels will include, but not be limited to, the following:

1. **Labeling of Fire Doors and Frames**

All door openings in fire resistive walls and partitions requiring a rating shall be protected by assemblies which include doors, frames, hardware, closing devices, anchorage, sills, etc., installed in accordance with the National Fire Protection Association (NFPA) 80, Standard for "Fire Doors and Fire Windows" and the State Building Code.

To further clarify the basic requirements and the correct method of labeling that will be acceptable to the Division of Construction Management, the labels shall include the following:

- a. Accessibility: Each component shall bear a label located to be accessible after installation.
- b. Permanence: Each component shall bear a label of a type of material and be so attached that the life of the label and the attachment thereof can reasonably be expected to equal the life of the component to which it is attached. Labels shall be raised or embossed on metal labels or stamped into metal frames. Plastic or paper labels are unacceptable.
- c. Legibility: The label design shall be such that it can always be visible and legible and must be clean of any paint or other coverage making the label illegible.
- d. Fire Resistance: All approved labels on doors and on frames shall include thereon the fire resistance rating in hours and minutes for which the door or frame is labeled. Labels on frames with transoms or sidelights must identify that the

opening assembly includes same.

- e. Other Requirements: The labels or stamps applied to frames must be provided by a manufacturer that has been approved by a laboratory or organization to provide testing and follow-up services for fire-rated opening assemblies.

- 2. Other Requirements - As directed by the approved laboratory or organization providing testing and follow-up services and labeling.

#### 2.4 Finish

- A. Metal doors and frames shall be thoroughly cleaned of dirt, grease, and impurities and shall be bonderized and finished with one coat of baked-on primer ready to receive finish paint.
- B. Primer shall be manufacturer's standard in accordance with ASTM B117.  
**Do not prime paint labels.**
- C. Final painting as specified and applied under Painting Section.

### 3.0 - EXECUTION

#### 3.1 Installation

- A. **BITUMINOUS COATING IS TO BE FIELD APPLIED TO THE INSIDE OF FRAMES THAT ARE TO BE INSTALLED IN MASONRY, OR TO BE GROUTED, PRIOR TO INSTALLATION.**
- B. Install frames plumb, rigid, and in true alignment; properly brace until built in. Set spreader and attached jambs to floor through floor anchors.
- C. In masonry openings, where required, install a second spreader at the mid-height of the door opening, and do not remove until the masonry jambs are in place. Spreader shall be notched wood of approximate jamb width and 1" minimum thickness. Install a minimum of three anchors per jamb to be imbedded in masonry joint as the wall is laid up.
- D. Frames shall be grouted solid.
- E. Doors shall be rigidly secured in frames, hardware applied, and adjusted to achieve smooth operation without forcing or binding. Doors shall be capable of maintaining any degree of opening.

#### 3.2 Protection

After installation, doors and frames shall be protected from damage during subsequent construction activities. Damaged doors and frames shall be replaced.

END OF SECTION

PART 1 – GENERAL

1.1 Related Documents

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

1.2 Section Includes

- A. Flush Wood doors
- B. Acoustical Rated Doors
- C. Positive Pressure Fire Rated Wood Doors
- D. Factory Glazing for Fire Rated Doors

1.3 Related Sections

- A. Section 08110 – Hollow Metal Doors and Frames
- B. Section 08710 – Finish Hardware
- C. Section 08810 – Glass and Glazing

1.4 Requirements Of Regulatory Agencies

- A. Wood Doors and installation shall comply with provisions and standards listed. The latest published edition of each standard applies.
- B. ASTM - American Society for Testing and Materials
  - 1. ASTM E 90-09 - Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements. (All doors tested shall be fully operable.)
  - 2. ASTM E 413-10 - Classification for Rating Sound Insulation.
  - 3. ASTM F 476 Section 18 - Security Test of Swinging Door Assemblies - Door Impact Test
- C. ANSI - American National Standards Institute
  - 1. ANSI/DHI A156.115W - Specifications for Hardware Preparation in Wood Doors and Frames.
  - 2. ANSI/DHI A115.IG - Installation Guide for Doors and Hardware.
  - 3. ANSI A156.7 - Hinge Template Dimensions.
  - 4. ANSI/HPVA HP-1 Standards for Hardwood and Decorative Plywood
  - 5. ANSI A208.1-Particleboard
  - 6. ANSI A208.2-Medium Density Fiberboard (MDF)
  - 7. ANSI-ASA S12.60 - Standard Acoustical Performance Criteria, Design Requirements, and Guidelines for Schools
  - 8. ANSI/A117.1 – Accessible and Useable Buildings and Facilities

D. ANSI/WDMA – Window and Door Manufacturers Association

1. WDMA I.S. 1A-13, Industrial Standards for Architectural Flush Doors
  - a. J-1 – Job Site Information “How to Store, Handle, Finish, Install, and Maintain Wood Doors”
  - b. P-1 – Performance Standards for Architectural Wood Flush Doors
  - c. T-1 – Test for Telegraphing
  - d. T-2 – Test for Warp
  - e. T-3 – Test for Squareness
2. WDMA Test Methods - Provide documentation showing compliance to WDMA performance duty level.
  - a. Adhesive Bonding Durability: WDMA TM-6
  - b. Cycle Slam: WDMA TM-7
  - c. Hinge Loading: WDMA TM-8
  - d. Screw Holding: WDMA TM-10

E. Building Code references

1. IBC – 2021 International Building Code
2. NFPA 80 - Standard for Fire Doors and Other Opening Protective's.
3. NFPA 101 – Life Safety Code
4. NFPA 105 - Standard for the Installation of Smoke Door Assemblies and Other Opening Protective's
5. NFPA 252 – Standard Method of Fire Tests of Door Assemblies
6. ANSI/UL 10C - Standard for Safety for Positive Pressure Fire Tests of Door Assemblies
7. UL 1784 - Air Leakage Tests of Door Assemblies
8. Underwriters Laboratories (UL) - ULI0C Positive Pressure Fire Test of Door Assemblies
9. ITS/WH Certification - Certification Listings for Fire Doors
10. Consumer Products Safety Commission (CPSC) 16 CFR 1201 – Standard for Architectural Glazing
11. US Green Building Council (USGBC)

1.5 Supplier Qualifications

- A. The Wood Door Supplier shall maintain at the location which will be managing the project, a credentialed Architectural Hardware Consultant (AHC) or Certified Door Consultant (CDC) as a full-time employee and member in good standing of DHI - Door Security + Safety Professionals.
- B. The Architectural Hardware Consultant (AHC) or Certified Door Consultant (CDC) shall supervise other individuals employed by the Wood Door Supplier who work on the project and be available throughout the project to meet with the Contractor, Architect or Owner as needed.
- C. Supplier shall be experienced and have completed projects with material, design and scope similar to that specified for this project. If requested by the Owner or Architect, submit a list of projects completed in the last five (5) years with the project name, location, Owner, Architect and Contractor.

- D. As a requirement, the Wood Door Supplier shall maintain an office and warehouse complete with a wood door inventory within a one hundred (100) mile radius of the jobsite. The Supplier shall further have a qualified field service staff available to service the project.
- E. After delivery of wood doors and prior to installation, the Hardware or Door Consultant shall meet with the Contractor to review templates, installation instructions, final hardware schedule, coordination with other trades and preview samples.
- F. Failure to meet the above requirements will disqualify the bidder.
- G. The Owner may visit the location of the Distributor's office and warehouse to observe if the intent of the requirements set forth in the specifications have been met.

1.6 Submittals

- A. Submit complete copies of the wood door shop drawings covering complete details of items required for the project. Complete copies of technical data sheets and other pertinent data are required to indicate compliance with the specification.
  - 1. Shop Drawings: Submit door and frame schedule using reference designations indicated on Drawings. Include opening size(s), handing of doors, details of each frame type, elevations of door design types, location, hardware group numbers, fire label requirements, including fire rating time duration, maximum temperature rise requirements, hardware mounting locations, glass beads/moldings, glass kits, internal blocking, vertical edge details, top and bottom rail details, undercuts, beveling and other pertinent data.
- B. As part of the Shop Drawing submittal, provide copy of WDMA J1, Job Site Information, "How to store, handle, finish, install and maintain wood doors."
- C. Data submitted shall be job specific and shall include product data and printed information in sufficient detail and scope to verify compliance with requirements of the contract documents.
- D. Provide door construction details/drawings of vertical edges, top rail and SWE details for all doors.
- E. Indicate location of cutouts for hardware and blocking to ensure doors are properly prepared and coordinated to receive hardware.
- F. Shop drawings, product data, and samples: Contractor to stamp Shop Drawings verifying they have been coordinated and reviewed for completeness and compliance with the contract documents.
- G. Shop drawings submitted without the above documentation will be considered incomplete, will not be reviewed, and returned directly to the Contractor.
- H. Follow the same procedures for re-submittal as the initial submittal with the appropriate revised dates noted in the shop drawings.

## 1.7 Quality Assurance

- A. Comply with the requirements of the referenced standards. Submit test reports upon request by the Owner or Architect.
- B. Underwriters' Laboratories or Intertek Testing Services / Warnock Hersey, Positive Pressure - Category A labeled fire wood doors:
  - 1. Label fire doors listed in accordance with Underwriters Laboratories standard UL10C, Positive Pressure Fire Tests of Door Assemblies and Air Leakage Tests of Door Assemblies - UL 1784.
  - 2. Construct and install doors in accordance with the standards of NFPA 80.
  - 3. Manufacture fire rated doors under the UL or ITS/WH factory inspection program providing the degree of fire protection capability indicated by the door schedule drawings.
  - 4. Provide metal labels permanently fastened on each fire door at an authorized and licensed facility as evidence of compliance with procedures of the labeling agency.
  - 5. No field modifications shall be made to the fire door assembly that would void the label. Field modifications to a fire door shall be in accordance with NFPA80. Work shall be done by a licensed labeling service approved by the manufacturer.
  - 6. Labels are not to be removed, defaced or made illegible while the door is in service per NFPA 80. Fire labels are not to be painted or pre-finished.
  - 7. Fire doors with continuous hinges shall have the physical label located on the top rail of the door.
  - 8. Conform to applicable codes for fire ratings. It is the intent of this specification that wood doors comply or exceed the standards for labeled openings. In case of conflict between door types required for fire protection, furnish the type required by NFPA and UL.
  - 9. Validate the Smoke and Draft Control ("S") Label for hardware sets that include Category H smoke and draft control seals.
  - 10. All Category G seals required will be concealed in the door or applied to the top rail. No Category G seals will be allowed on the door frame.
- C. Door Supplier shall provide one (1) extra door with 6" top rail and exit device blocking. The Contractor, Door Supplier and the Owner to observe and inspect destructive sampling for proper internal construction.

## 1.8 Warranty

- A. Provide Manufacturer's standard warranty form, signed by manufacturer, in which manufacturer agrees to repair or replace doors that are defective in materials or workmanship for the life of the original installation of the door.

## 1.9 Samples

- A. Sample Submittal
  - 1. Color samples for factory pre-finishing shall consist of four (4) sets of three (3) finish samples per set. Samples to be minimum 5" x 8" size on specified veneer species. The sample should reasonably represent the color range of the veneer species expected in the finished work.
- B. Fire Rated Wood Doors

1. Provide three (3) 10" x 10" cut away corner samples demonstrating door construction with provisions for vertical stiles and top rails as specified.

C. Non-Fire Rated Wood Doors

1. Provide three (3) construction samples demonstrating door construction with provisions for vertical stiles and top rails as specified herein.

1.10 Delivery, Storage, And Handling

- A. Provide protective measures throughout the construction period to safeguard doors from damage or deterioration from the time of acceptance.
- B. Store and protect doors in accordance with manufacturer's recommendations and Section J-1 of WDMA I.S. 1A-13 - "How to Store, Handle, Finish, Install and Maintain Wood Doors"
  1. Store doors flat and off the floor on a level surface in a dry, well-ventilated building. Do not store on edge. Protect doors from dirt, water and abuse and allow for air circulation.
  2. Protect all doors from exposure to direct sunlight and artificial light after delivery.
  3. Do not subject interior doors to extremes of either heat or humidity. HVAC systems must be operational and balanced, providing a temperature range of 50 to 80 degrees Fahrenheit and 30% to 60% relative humidity.
  4. When handling doors, lift and carry when moving. Do not drag across other doors or surfaces. Handle with clean, dry hands or while wearing clean dry gloves.
  5. Manufacturer shall mark each door on the top rail and top hinge pocket with the door opening number. In addition, mark the top rail with manufacture's name, factory order number, and other additional markings to properly identify the door.

1.11 Coordination

- A. Coordinate work with other sections involving manufacture or fabrication of internal cutouts and internal blocking for door hardware, electrified and mortised items. Provide necessary blocking in mineral core doors to prevent door failure from surface applied hardware.
- B. The Contractor shall field verify existing door opening conditions, where existing doors or frames are to remain or be replaced in part, for coordination with the specified hardware and notify the Architect of conflicts prior to proceeding. Failure to notify the Architect of conflicts that result in additional work or material is the responsibility of the Contractor, with no cost to the Owner.
- C. The supplier shall be responsible for proper coordination, templating, dimensions and all details required for doors, frames and hardware application.

PART 2 - PRODUCTS

2.1 Manufacturers

- A. Acceptable manufacturers for wood doors specified are listed below. Only the products of the listed manufacturers will be accepted. No alternates will be



accepted. The manufacturers listed are acceptable providing they adhere to the quality standards as noted herein.

1. Eggers Industries
2. Marshfield-Algoma
3. V.T. Industries

- B. **The manufacturers listed herein are capable of providing products that meet or exceed the specified requirements. Products that do not comply with the specified requirements and construction will be rejected.**
- C. If doors are rejected, replacement doors shall be furnished expeditiously, at no cost to the Owner.

## 2.2 Doors

- A. Quality Assurance Requirements: Flush Wood Doors: Comply with the ANSI/WDMA I.S. 1A-13 Industry Standard for Architectural Wood Flush Doors.
- B. Non-Fire Rated Wood Doors - All solid core flush wood doors shall meet WDMA Door Grade and WDMA Performance Duty Level specified.
1. Grade-Custom Grade Construction and Face Grade.
  2. WDMA Performance Duty Level-Extra Heavy Duty. All doors shall meet specified WDMA Performance Duty Level, including face screw holding requirement. Surface applied hardware shall be installed in accordance with Section 08710.
  3. Door Type - PC-5 - Bonded Wood Based Particle Core, Stiles and rails securely bonded to the core and entire unit abrasively planed prior to application of faces to assure uniform thickness of all components.
- C. Fire Rated Wood Doors: Where fire-resistance classifications are shown or scheduled, provide doors that comply 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.
1. Label Certification: Doors requiring fire-rating shall carry either UL or ITS (Warnock Hersey) label.
  2. Temperature-Rise Limit: Where indicated and at vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 250 degrees F (121 degrees C)] above ambient after 30 minutes of standard fire-test exposure.
  3. Construction: Category A - intumescent included in door construction where required.
  4. Cores: Provide wood fiber or mineral fire-resistant composite core required to provide fire-protection rating indicated.
  5. Blocking: Provide composite blocking approved in doors of fire-protection ratings as indicated.
- D. Electrical Requirements:
1. General: Make provisions for installation of electrical items specified in Section 08710.

- a. Provide all cutouts and blocking required for wood doors to accept electrical door hardware and security system components.

E. Acoustical Doors:

1. Acoustical Doors shall conform to the American National Standard Acoustical Performance Criteria, Design Requirements and Guidelines for Schools, ANSI/ASA S12.60.
  - a. These spaces include, but are not limited to, classrooms, instructional pods or activity areas, group instruction rooms, conference rooms, libraries, offices, speech clinics, offices used for educational purposes and music rooms for instruction, practice and performance.
2. Doors into classrooms and other core learning spaces shall conform to the requirements of ANSI/ASA S12.60 with a minimum of a STC 30 operable rating. Doors to music rooms and doors between two classrooms shall be a minimum STC 40 operable rating. Comply with additional requirements as noted in the door schedule.
3. Provide vision lite system consisting of acoustic glass, lite kit and glazing tape of the proper size and thickness to meet or exceed the STC acoustical rating of the door and frame assembly. Provide Anemostat LoPro-STC vision lite system. The vision lite system is to be factory installed on doors with a STC rating of 40 or greater.
4. Door manufacturer shall provide a Letter of Certification from an independent testing laboratory accredited as an acoustical laboratory verifying that conformance to the acoustical performance has been met. Testing shall be performed at laboratories that are fully accredited.
5. Coordinate door preparation for adjustable mortise door bottom as specified under Section 08710 Mortise prep to end 1/4" before edge of door at lock edge, Solid Wood Edge (SWE) prep configuration from DHSI. Bottom rail shall be hardwood or structural composite lumber. Doors are to be factory prepped to receive the door bottom.
6. Doors shall have a 3/8" undercut.
7. Sound seals and gasketing are not to be painted.

F. Veneer and Veneer Matching

1. Veneer Species and Cut: Architect to specify veneer and cut.
  - a. Veneer Face Grade WDMA: Grade "A" as described in WDMA I.S. 1A and HPVA Door Veneer tables ANSI/HPVA-1.
2. Matching Between Leaves: Book Match
3. Veneer match: Assembly of Spliced Veneer: Running Match
4. Pair match all pairs and set of pairs separated only by mullions.
5. Set match all groups of pairs and/or individual doors indicated on the door schedule or plans.
6. Veneer Cut: Plain Sliced.
7. Veneer Species: Select White Birch.

G. Non- Fire Rated Door

1. Provide wood based particleboard core. Core to be securely bonded to the stiles and rails with Type I Adhesive.

2. Crossbands

- a. Shall be a minimum thickness of 1/16".
- b. Extend the full width of the door and have no seams.
- c. Composite crossbands of either MDF or particleboard are only permitted provided they meet or exceed the following minimum requirements:
  - 1) Minimum properties for composite crossband must meet physical and mechanical properties of thin MDF - Grade 230 as described in ANSI 208.2
  - 2) Internal bond minimum strength of 150 psi.
  - 3) Linear expansion minimum of < 0.3 % measured between 50% and 80% relative humidity.

3. Vertical Edges

- a. Vertical Edges to be same species as face veneer, constructed of two ply laminate hardwood outer layer (outer stile) and hardwood lumber or SCL inner layer (inner stile). Outer ply to be minimum thickness of 1/2" after trim, same species lumber as face. Veneer or lumber less than 1/2" is not acceptable. The net stile width to be minimum 1" after trimming. Veneer edge banding is not acceptable.
- b. Provide detail/cross section drawing of door edge construction.

4. Horizontal Edges

- a. Rails must be present on all doors.
- b. Rails are solid hardwood lumber, with grain running perpendicular to stiles. SCL is allowed for rails. Minimum rail after trim to be 7/8". MDF is unacceptable.

5. Side Panels

- a. Fabricate matching panels with same construction as the door. Side panels will be pair matched to the associated door and receive the same finish.

H. Fire-Rated Doors: Provide Positive Pressure Label Doors.

1. Positive Pressure labeled doors to be Category A

- a. Validate the Smoke and Draft Control ("S") Label for hardware sets that include Category H smoke and draft control seals.

2. Core material shall be dictated by manufacturer's fire door approvals.

- a. Provide 20 and 45-minute fire doors with wood based particleboard core construction where allowed by manufacturers procedure. Mineral core construction is acceptable when requirements exceed particleboard core label procedures.

3. Stiles (Vertical Edges) - Provide manufacturer's standard solid or laminated edge construction approved for each fire protection level with improved screw holding capability of 550 lbs. in accordance with WDMA TM-10, Extra Heavy Duty.

- a. Outer stile to be minimum thickness of ¼" after trim, same species lumber as the face. Veneer or lumber less than ¼" is not acceptable. Veneer edge banding is not acceptable. Provide detail/cross section drawing of door edge construction.
- 4. Rails (Horizontal Edges) - Rails are solid lumber or other material contained in manufacturer's fire door approvals.
- 5. Blocking for fire doors must meet WDMA-EMD face screw pull values for surface hardware.
  - a. All fire doors shall have a 6-inch minimum top rail after trim. 45-minute wood fire doors are not required to have a 6" combined blocking top rail provided assembly meets heavy duty level.
- 6. Pairs: Provide fire rated pairs with manufacturers approved stiles which match face veneer constructed as Category A. Veneered edges allowed where required to match face veneer. Exposed intumescent at door meeting edges or applied to frames is not acceptable.

### 2.3 Door Fabrication

- A. Factory pre-fit and pre-machine doors to receive hardware as specified under Section 08710.
  - 1. All doors shall be machined in accordance with manufacturer's procedures in order to maintain manufacturer's warranty and to avoid any machining conflicts.
  - 2. Doors are to be beveled at both hinge and lock edges.
  - 3. Factory pre-drill all hinge screw pilot holes for full mortise hinges.
  - 4. Doors shall have a 3/8" undercut.
  - 5. Coordinate door undercuts per architect's details and hardware specified under Section 08710.
  - 6. All fire doors shall be in accordance with NFPA 80 for clearances and undercutting requirements.
- B. Factory preparation for light openings:
  - 1. Factory preparation for new wood doors glazing materials in vision panels shall be installed in labeled glass light kits or in accordance with the fire door listing and shall be installed in accordance with inspection service procedure and under label service per NFPA 80, 4.4.3.1.
  - 2. Glass in new wood doors must be installed by the door manufacturer or in a licensed door shop.
  - 3. Fire protection glazing and fire resistance glazing shall meet all applicable impact safety standards.
  - 4. Provide metal vision kits at all fire labeled doors. Vision kits shall be Anemostat LoPro, 20 gage, with tamperproof screws and beige baked enamel finish. Install tamperproof screw heads on secure side of door. Vision kits shall have UL or W/H classification markings visible for inspection.
  - 5. Wood beads for light opening in non-fire rated wood doors:
    - a. Provide manufacturer's standard solid wood straight beads flush design, matching veneer species of door faces. Include finish nails for removable stops in accordance with manufacturers recommendations.

## 2.4 Factory Finishing

- A. All doors, including light beads and moldings, to be factory finished where indicated in schedules or on drawings as factory finished.
- B. Finish Requirements.
- C. Manufacturer's standard UV Cured Acrylated Polyester/Urethanes, equal to WDMA TR-8.
  - 1. Grade-Premium
  - 2. Coating-Clear
  - 3. Satin Gloss (Gloss range 30-40)
- D. Package factory finished doors with manufacturers standard packaging to protect doors from damage during shipment.

## PART 3 - EXECUTION

### 3.1 Installation

- A. Install all wood doors in accordance with door manufacturer's instructions and all tolerances outlined in ANSI/WDMA I.S. 1A-13.
- B. Install label doors in accordance with NFPA-80. Labels are not to be removed, defaced or made illegible while the door is in service.
- C. Inspect doors prior to installation for any damage, manufacturing defects or pre-finish inconsistency.
- D. Remove and replace doors that are damaged, warped, twisted or unacceptable to the Architect or Owner.
- E. Should there be any door issues do not proceed with installation. Contact door supplier to correct unsatisfactory conditions and proceed with installation only after corrections have been made.

### 3.2 Adjusting

- A. Final Adjustments: Adjust doors and hardware prior to final inspection and acceptance by the Architect and Owner. Replace defective items, including doors that are damaged or unacceptable to the Architect or Owner.
- B. Fire Door Assembly Inspection and Testing: Upon completion of the installation, provide functional testing and inspection of each fire door assembly on the project to confirm proper operation and that it meets all criteria of a fire door assembly as per NFPA 80, 5.2 - Inspection and Testing 2013 edition. Inspections shall be performed by individuals with knowledge and understanding of the operating components of the door being subjected to testing and who are certified by Intertek as a Fire Door Assembly Inspector (FDAI) or a credentialed Architectural Hardware Consultant (AHC). A written report using reporting forms provided by the Door and

Hardware Institute shall be maintained and transmitted to the Owner, Contractor, Architect and made available to the Authority Having Jurisdiction (AHJ). The report shall list each fire door throughout the project, and include each door number, location, hardware set used and summary of deficiencies.

1. Schedule fire door assembly inspection within 90 days of Substantial Completion of the Project. Coordinate inspection with the Contractor and Owner.
2. Contractor shall correct all deficiencies and schedule a re-inspection of fire door assemblies which were noted as deficient on the inspection report. All deficiencies must be repaired without delay.
3. Inspector shall re-inspect fire door assemblies after repairs are made.
4. Additional re-inspections which are required due to incomplete repairs will be performed by the inspector at the expense of the Contractor.

### 3.3 Protection

- A. Provide protective measures required throughout the construction period to ensure that doors will be without damage or deterioration at time of acceptance.

End of Section

1.0 - GENERAL

1.1 Summary

- A. Section includes:
  - 1. Non-fire rated wall access panels.
  - 2. Related hardware and attachments.
- B. Related Sections:
  - 1. Section 04210 - Unit Masonry
  - 2. Section 09910 – Painting.

1.2 System Description

- A. Design Requirements:
  - 1. Verification: Obtain specific locations and sizes for required access doors and frames from trades, including mechanical and electrical, requiring access to concealed equipment and indicate on submittal schedule.

1.3 Submittals

- A. Comply with Section 01350.
- B. Shop Drawings:
  - 1. Door and panel units: Show types, elevations, thickness of metals, full size profiles of door members.
  - 2. Hardware: Show materials, finishes, locations of fasteners, types of fasteners, locations and types of operating hardware, and details of installation.
  - 3. General: Show connections of units and hardware to other Work. Include schedules showing location of each type and size of door and panel units.
- C. Product Data: Manufacturer's technical data for each type of access door and panel assembly, including setting drawings, templates, fire-resistive characteristics, finish requirements, and details of anchorage devices.
  - 1. Include complete schedule, types, locations, construction details, finishes, latching or locking provisions, and other pertinent data.
- D. Manufacturer's Installation Instructions: Indicate installation requirements and rough-in dimensions.

1.4 Quality Assurance

- A. Comply with Division 1 requirements.
- B. Single Source Responsibility: Obtain access door and panel units, and frames for entire Project from one source and one single manufacturer.
- C. Fire-Resistance Ratings: Wherever a fire-resistance classification is indicated, provide access door and panel assemblies with panel door, frame, hinge, and latch from manufacturer listed in Underwriter's Laboratories (UL), "Building Materials Directory" for rating shown.
  - 1. Provide 90 minute UL label at 2-hour rated partitions.

2. Provide 3 hour Warnock Hersey label at horizontal applications, up to 24 inch wide x 36 inch high.
  3. Provide 2 hour Warnock Hersey label at horizontal applications greater than 24 inch wide x 36 inch high.
- D. Size Variations: Obtain Architect's acceptance and approval of manufacturer's standard size units that may vary slightly from sizes indicated on Drawings.
- E. Coordination: Provide inserts and anchoring devices that will be built into other Work for installation of access door assemblies. Coordinate delivery with other Work to avoid delay.

#### 1.5 Delivery, Storage and Handling

- A. Package and ship per manufacturer's recommendations.
- B. Store per manufacturer's instructions.
  1. Store in dry area out of direct sunlight.

#### 1.6 Warranty

- A. Provide manufacturer's written warranty per Section 01900.
- B. Warrants all access panels to be free from manufacturing defects in materials and workmanship for a period of one (1) year from the date of final acceptance, but not more than one and one half (1 ½) years from the date of shipment.

Should a product fail to function in normal use within this period, manufacturer shall furnish a new part at no charge. Failure to use product in methods consistent with manufacturer's product manuals shall relieve manufacturer of any liability.

### 2.0 - PRODUCTS

#### 2.1 Manufacturers

- A. Subject to compliance with requirements, provide products from the following manufacturer:
  1. Nystrom Building Products
- B. Substitutions: Comply with Section 01360.
- C. Specifications and Drawings are based on manufacturer's literature from Nystrom Building Products. Other manufacturers shall comply with minimum levels of material, color selection, and detailing indicated in Specifications or on Drawings. Submit requests at least 10 days prior to bid. Other Pre-approved manufacturers shall be identified by Addendum.

#### 2.2 Materials

- A. Type: No. 304 stainless steel with No. 4 satin polish finish.

#### 2.3 Access Panels

- A. Non rated flush access doors, Nystrom N series
  1. Door: Fabricate from 14-gauge cold rolled sheet steel.



2. Frame: Fabricate from 16-gauge cold rolled sheet steel. Provide 1/4 inch mounting holes.
  - a. NT - All surfaces - 1 inch flange at perimeter.
  - b. NW - Wallboard surfaces – 22-gauge galvanized drywall bead at perimeter.
  - c. NP - Plaster surfaces – 22-gauge galvanized plaster bead at perimeter.
3. Hinge:
  - a. NT – Concealed pin type, spring loaded to allow for door removal, set to open 175 degrees.
  - b. NW and NP – Concealed continuous piano hinge.
4. Latching/Locking Devices: Screwdriver cam latch - standard.
5. Finish: Type No. 304 stainless steel with No. 4 satin polish.

#### 2.4 Fabrication

- A. Manufacture each access panel assembly as an integral unit ready for installation.
- B. Welded construction: Furnish with a sufficient quantity of 1/4 inch mounting holes to secure access panels to types of supports indicated.
- C. Recessed panel: Form face of panel to provide specified recess for application of finish material. Reinforce panel as required to prevent buckling.
- D. Furnish number of latches required to hold door in flush, smooth plane when closed.

### 3.0 - EXECUTION

#### 3.1 Examination

- A. Verify that rough openings for door and frame are correctly sized and located.
- B. Verify mechanical and electrical requirements for ceiling or wall access panels.

#### 3.2 Preparation

- A. Advise installers of work relating to access panel installation including rough opening dimensions, locations of supports, and anchoring methods. Coordinate delivery with other work to avoid delay.

#### 3.3 Installation

- A. Install access door and frame units per manufacturer's written instructions.
- B. Install frames plumb and level in opening. Secure rigidly in place.
- C. Position units to provide convenient access to concealed Work requiring access.
- D. Fire-rated units: Include UL or Warnock-Hersey labels.

#### 3.4 Adjust and Clean

- A. Adjust panel after installation for proper operation.
- B. Remove and replace panels or frames that are warped, bowed, or damaged.

1.0 - GENERAL

- 1.1 Scope  
The work under this section consists of steel insulated, fully weatherstripped coiling service doors and fixed wall panels above doors.
- 1.2 Submittals  
A. Submit shop drawings.  
B. Shop drawings to include manufacturer's descriptive literature listing all components to be used.
- 1.3 Manufacturers  
CECO, Cookson Company, Kinnear Door, Cornell, Overhead Door or pre-approved equal.
- 1.4 Warranty  
All doors shall be guaranteed for a period of one (1) year from the date of completion of erection and any part defective in material or workmanship will be replaced without charge to the Owner.

2.0 - PRODUCTS

- 2.1 Doors  
Materials
- A. Curtain- Shall be made from interlocking flat slats, roll-formed from steel, hot-dipped galvanized, with high-grade pure zinc coating per ASTM Standard. Interlocking outer curtain slats shall form a weathertight outer skin. Hot-dipped galvanized inner steel skin shall be roll-formed with outer slat to form a 3/4" void for insulation. Insulating core shall be foamed-in-place, solid Class II urethane with a 2.0 lb. per cubic foot density, providing calculated insulation values of "R" 6.05 and "U" .165. Both ends of alternate slats shall be fitted with endlocks. Windlocks shall be provided on both ends of every 6th slat for doors over 17'-6" wide. The bottom edge of the door shall have a tubular shaped weatherseal.
- B. Guides - Guides and wall angles shall be steel of sufficient dimension to properly retain curtain and support the entire door assembly. Guides shall have full height continuous weatherstrip, to seal flat against exterior curtain surface. All fasteners shall be 3/8" bolts minimum 30" on center.
- C. Brackets - Brackets shall be of heavy steel plate properly reinforced to carry full door weight and support barrel and curtain at each end. Sealed ball bearings shall be furnished at all rotating support points. Brackets to be attached to guide wall angle of door with a minimum of (3) 1/2" bolts.
- D. Counterbalance Assembly - Curtain to wrap on pipe of sufficient size so deflection of barrel with weight of curtain does not exceed .03" per ft. of door width. Springs shall be oil-tempered, helical-wound torsion springs, stress-relieved after coiling. Springs shall be attached to cold-rolled steel shaft of sufficient size to carry load of curtain and torque of springs. Springs to transmit torque to barrel through steel or cast plugs sized to fit pipe. Sealed ball bearings shall be located at rotating support points of barrel. Spring adjusting wheel readily accessible.

- E. Hood - Shall be made from 24-gauge galvanized steel. Top and bottom edges reinforced with galvanized steel angles or rolled curl. A corded neoprene baffle the full width of the hood shall be located inside hood to seal against slats when door is in closed position.
- F. Operation - Hand Crank removable.
- G. Locking - Doors shall be equipped for locking by integral lock from coil side on manual, chain or crank operated doors.
- H. Finish - Steel slats galvanized and chemically treated for paint adhesion then finished with baked-on enamel primer and finish color as selected from manufacturer's full range of colors.

### 3.0 - EXECUTION

#### 3.1 Installation

- A. The work shall be installed by mechanics skilled in the trade and under the supervision of an accredited or franchised representative of the manufacturer.
- B. Work shall be in accordance with the Architect's Drawings, and approved shop drawings, and shall provide for smooth and easy opening and closing of doors, tight fit against jambs, heads and sills and secure attachment to the work of other trades.

END OF SECTION