

3. Do not use brick smaller than half-brick at any angle, corner, break, and jamb.
4. Where length of cut brick is greater than one half length, maintain vertical joint location.
5. Lay exposed brickwork joints symmetrical about center lines of openings.
6. Do not structurally bond multi-wythe brick walls, unless indicated on drawings.
7. Before starting work, lay facing brick on foundation wall and adjust bond to openings, angles, and corners.

C. Joints:

1. Exterior And Interior Joint Widths: Provide joint widths to match existing.
2. Rake joints for pointing to match existing.

D. Weep Holes:

1. Install weep holes at 600 mm (24 inches) on center in bottom of vertical joints of exterior masonry veneer or cavity wall facing over foundations, bond beams, and other water stops in wall.
2. Form weep holes using wicks made of mineral fiber insulation strips turned up 200 mm (8 inches) in cavity. Anchor top of strip to backup to securely hold in place.
3. Install sand or pea gravel in cavity approximately 75 mm (3 inches) high between weep holes.

E. Cavity Walls:

1. Keep air space clean of mortar accumulations and debris.
2. Lay the interior wythe of the masonry wall full height before laying outer wythe.
3. Insulated Cavity Type Exterior Walls:
 - a. Install insulation against cavity face of inner masonry wythe.
 - b. Place insulation between rows of ties or joint reinforcing.
Adhere insulation to masonry surface with a bonding agent as recommended by insulation manufacturer.
 - c. Lay outer masonry wythe up with air space between insulation and

3.5 INSTALLATION - CONCRETE MASONRY UNITS

A. Types and Uses:

1. Provide special concrete masonry shapes as required, including lintel and bond beam units and corner units. Provide solid concrete

masonry units, where full units cannot be installed, or where needed for anchorage of accessories.

2. Provide solid load-bearing concrete masonry units or grout cell of hollow units at jambs of openings in walls, where structural members impose loads directly on concrete masonry, and where shown.
3. Install concrete building brick only as filler in backup material where not exposed.

B. Laying:

1. Lay concrete masonry units with 9 mm (3/8 inch) joints, with a bond overlap of minimum 1/4 of unit length, except where stack bond is indicated on drawings.
2. Do not wet concrete masonry units before laying.
3. Bond external corners of partitions by overlapping alternate courses.
4. Lay first course in a full mortar bed.
5. Set anchorage items as work progress.
6. Where ends of anchors, bolts, and other embedded items, project into voids of units, completely fill voids with mortar or grout.
7. Lay concrete masonry units with full face shell mortar beds and fill head joint beds for depth equivalent to face shell thickness.
8. Lay concrete masonry units so cores of units, that are to be filled with grout, are vertically continuous with joints of cross webs of such cores completely filled with mortar. Unobstructed core openings minimum 50 mm (2 inches) by 75 mm (3 inches).
9. Do not wedge masonry against steel reinforcing. Minimum 13 mm (1/2 inch) clear distance between reinforcing and masonry units.
10. Install deformed reinforcing bars of sizes indicated on drawings.
11. At time of placement, ensure steel reinforcement is free of loose rust, mud, oil, and other contamination capable of affecting bond.
12. Place steel reinforcement at spacing indicated on drawings before grouting.
13. Minimum clear distance between parallel bars: One bar diameter.
14. Hold vertical steel reinforcement in place vertically by centering clips, caging devices, tie wire, or other approved methods.
15. Support vertical bars near each end and at maximum 192 bar diameter on center.
16. Splice reinforcement or attach reinforcement to dowels by placing in contact and securing with wire ties.

17. Stagger splices in adjacent horizontal reinforcing bars. Lap reinforcing bars at splices a minimum of 40 bar diameters.
18. Grout cells of concrete masonry units, containing reinforcing bars, solid as specified.
19. Install cavity and joint reinforcement as masonry work progresses.
20. Rake joints 6 to 10 mm (1/4 to 3/8 inch) deep for pointing with colored mortar when colored mortar is not full depth.

3.6 POINTING

- A. Fill joints with pointing mortar using rubber float trowel to apply mortar solidly into raked joints.
- B. Wipe off excess mortar from joints of glazed masonry units with dry cloth.
- C. Tool exposed joints to match existing surfaces or as noted.
- D. At joints with existing work, match existing joint.

3.7 GROUTING

- A. Preparation:
 1. Clean grout space of mortar droppings before placing grout.
 2. Close cleanouts.
 3. Install vertical solid masonry dams across grout space for full height of wall at intervals of maximum 9000 mm (30 feet). Do not bond dam units into wythes as masonry headers.
 4. Verify reinforcing bars are installed as indicated on drawings.
- B. Placing:
 1. Place grout in grout space in lifts as specified.
 2. Consolidate each grout lift after free water has disappeared but before plasticity is lost.
 3. Do not slush with mortar or use mortar with grout.
 4. Interruptions:
 - a. When grouting must be stopped for more than an hour, top off grout 40 mm (1-1/2 inches) below top of last masonry course.
 - b. Grout from dam to dam on high lift method.
 - c. Longitudinal run of masonry may be stopped off only by raking back one-half masonry unit length in each course and stopping grout 100 mm (4 inches) back of rake on low lift method.
- C. Puddling Method:
 1. Consolidate by puddling with grout stick during and immediately after placing.

2. Grout cores of concrete masonry units containing reinforcing bars solid as masonry work progresses.

D. Low Lift Method:

1. Construct masonry to 1.5 m (5 feet) maximum height before grouting.
2. Grout in one continuous operation and consolidate grout by mechanical vibration and reconsolidate after initial water loss and settlement has occurred.

3.8 PLACING REINFORCEMENT

- A. General: Clean reinforcement of loose rust, mill scale, earth, ice or other materials which will reduce bond to mortar or grout. Do not use reinforcement bars with kinks or bends not shown on drawings or approved submittal drawings, or bars with reduced cross-section due to excessive rusting or other causes.
- B. Position reinforcement accurately at spacing indicated on drawings. Support and secure vertical bars against displacement. Install horizontal reinforcement as masonry work progresses. Where vertical bars are shown in close proximity, provide clear distance between bars of minimum one bar diameter or 25 mm (1 inch), whichever is greater.
- C. Splice reinforcement bars only where indicated on drawings, unless approved by Contracting Officer's Representative. Provide lapped splices. In splicing vertical bars or attaching to dowels, lap ends, place in contact and wire tie.
- D. Provide minimum lap as indicated on approved submittal drawings, or if not indicated, minimum 48 bar diameters.
- E. Embed metal ties in mortar joints as work progresses, with minimum mortar cover of 15 mm (5/8 inch) on exterior face of walls and 13 mm (1/2 inch) at other locations.
- F. Embed prefabricated horizontal joint reinforcement as work progresses, with minimum cover of 15 mm (5/8 inch) on exterior face of walls and 13 mm (1/2 inch) at other locations. Lap joint reinforcement minimum 150 mm (6 inches) at ends. Use prefabricated "L" and "T" sections to provide continuity at corners and intersections. Cut and bend joint reinforcement for continuity at returns, offsets, column fireproofing, pipe enclosures and other special conditions.
- G. Anchoring: Anchor reinforced masonry work to supporting structure as indicated on drawings.
- H. Anchor reinforced masonry walls at intersections with non-reinforced masonry.

3.9 CONSTRUCTION TOLERANCES

- A. Lay masonry units plumb, level and true to line within tolerances according to ACI 530.1/ASCE 6/TMS 602 and as follows:
- B. Maximum variation from plumb:
 - 1. In 3000 mm (10 feet) - 6 mm (1/4 inch).
 - 2. In 6000 mm (20 feet) - 9 mm (3/8 inch).
 - 3. In 12,000 mm (40 feet) or more - 13 mm (1/2 inch).
- C. Maximum variation from level:
 - 1. In any bay or up to 6000 mm (20 feet) - 6 mm (1/4 inch).
 - 2. In 12,000 mm (40 feet) or more - 13 mm (1/2 inch).
- D. Maximum variation from linear building lines:
 - 1. In any bay or up to 6000 mm (20 feet) - 13 mm (1/2 inch).
 - 2. In 12,000 mm (40 feet) or more - 19 mm (3/4 inch).
- E. Maximum variation in cross-sectional dimensions of columns and thickness of walls from dimensions shown:
 - 1. Minus 6 mm (1/4 inch).
 - 2. Plus 13 mm (1/2 inch).
- F. Maximum variation in prepared opening dimensions:
 - 1. Accurate to minus 0 mm (0 inch).
 - 2. Plus 6 mm (1/4 inch).

3.10 CLEANING AND REPAIR

- A. General:
 - 1. Clean exposed masonry surfaces on completion.
 - 2. Protect adjoining construction materials and landscaping during cleaning operations.
 - 3. Cut out defective exposed new joints to depth of approximately 19 mm (3/4 inch) and repoint.
 - 4. Remove mortar droppings and other foreign substances from wall surfaces.
- B. Brickwork:
 - 1. First wet surfaces with clean water, then wash down with detergent solution. Do not use muriatic acid.
 - 2. Brush with stiff fiber brushes while washing, and immediately wash with clean water.
 - 3. Remove traces of detergent, foreign streaks, or stains of any nature.
- C. Concrete Masonry Units:

1. Immediately following setting, brush exposed surfaces free of mortar or other foreign matter.
2. Allow mud to dry before brushing.

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**SECTION 04 72 00
CAST STONE MASONRY**

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies manufactured concrete units to simulate a natural stone.
- B. Installation of cast stone units.

1.2 RELATED WORK

- A. Section 04 05 13, MASONRY MORTARING, Setting and pointing mortar.
- B. Section 04 05 16, MASONRY GROUTING, Setting and pointing mortar.
- C. Section 07 92 00, JOINT SEALANTS, Joint sealant and application.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. All items indicated below are required submittals requiring Contracting Officer's Representative (COR) review and approval.
- B. Samples:
 - 1. Cast stone, sample panel, size 100 by 300 by 300 mm (4 by 12 by 12 inches) each color and finish.
 - 2. Show finish on two 100 mm (4-inch) edges and 300 by 300 mm (12 by 12 inch) surface.
- C. Shop Drawings:
 - 1. Cast stone showing exposed faces, profiles, cross sections, anchorage, reinforcing, jointing and sizes.
 - 2. Setting drawings with setting mark.
- D. Certificates: Test results indicating that the cast stone meets specification requirements and proof of plant certification.
- E. Submit manufacturers test results of cast stone previously made by manufacturer.
- F. Laboratory Data: Description of testing laboratories facilities and qualifications of its principals and key personnel.
- G. List of jobs furnished by the manufacturer, which were similar in scope and at least three (3) years of age.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Store cast stone under waterproof covers on planking clear of ground.
- B. Protect from handling, dirt, stain, and water damage.
- C. Mark production units with the identification marks as shown on the shop drawings.

- D. Package units and protect them from staining or damage during shipping and storage.
- E. Provide an itemized list of product to support the bill of lading.

1.5 WARRANTY

- A. Warranty exterior masonry walls against moisture leaks, any defects and subject to terms of "Warranty of Construction", FAR clause 52.246-21, except that warranty period shall be two years.

1.6 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by the basic designation only. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
- B. Cast Stone Institute Technical Manual and Cast Stone Institute standard specifications.
- C. ASTM International (ASTM):
 - A167-99 (R2009).....Stainless and Heat Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
 - A615/A615M-20.....Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement
 - A1064/A1064M-18a.....Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
 - C33/C33M-18.....Standard Specification for Concrete Aggregates
 - C150/C150M-20.....Standard Specification for Portland Cement
 - C568/C568M-15.....Standard Specification for Limestone Dimension Stone
 - C979/C979M-16.....Standard Specification for Pigments for Integrally Colored Concrete
 - C1194-19.....Standard Test Method for Compressive Strength of Architectural Cast Stone
 - C1195-19a.....Standard Test Method for Absorption of Architectural Cast Stone
 - C1364-19.....Standard Specification for Architectural Cast Stone.
 - D2244-16.....Standard Practice for Calculation of Color Differences from Instrumentally Measured Color Coordinates.

1.7 QUALITY ASSURANCE**A. The Manufacturer:**

1. Must have 5 years minimum continuous operating experience and have facilities for manufacturing cast stone as described herein.

Manufacturer shall have sufficient plant facilities to produce the shapes, quantities and size of cast stone required in accordance with the project schedule.

B. Stone setter: Must have 5 years' experience setting cast or natural building stone.**C. Testing: One (1) sample from production units may be selected at random from the field for each 500 cubic feet (14 meters squared) delivered to the job:**

1. Three (3) field cut cube specimens from each of these sample shall have an average minimum compressive strength of not less than 85 percent with no single specimen testing less than 75 percent of design strength as specified.
2. Three (3) field cut cube specimens from each of these samples shall have an average maximum cold-water absorption of 6 percent.
3. Field specimens shall be tested in accordance with ASTM C 1194 and C 1195.
4. Manufacturer shall submit a written list of projects similar and at least three (3) years of age, along with owner, architect and contractor references.

1.8 MANUFACTURING TOLERANCES**A. Cross section dimensions shall not deviate by more than + 1/8 inch (3 mm) from approved dimension.****B. Length of units shall not deviate by more than length /360 or + 1/8 inch (3mm), whichever is greater, not to exceed + 1/4 inch (6 mm).**

Maximum length of any unit shall not exceed 15 times the average thickness of such unit unless otherwise agreed by the manufacturer.

C. Warp bow or twist of units shall not exceed length/360 or + 1/8 inch (3 mm), whichever is greater.**D. Location of dowel holes, anchor slots, flashing grooves, false joints and similar features - On formed sides of unit, 1/8 inch (3 mm), on unformed sides of unit, 3/8 inch (9 mm) maximum deviation.****PART 2 - PRODUCTS****2.1 ARCHITECTURAL CAST STONE****A. Comply with ASTM C 1364**

B. Physical properties: Provide the following:

1. Compressive Strength - ASTM C 1194: 6,500 psi (45 Mpa) minimum for products at 28 days.
2. Absorption - ASTM C 1195: 6 percent maximum by the cold water method, or 10 percent maximum by the boiling method for products as 28 days.
3. Air Content - ASTM C173 or C231, for wet cast product shall be 4-8 percent for units exposed to freeze-thaw environments. Air entrainment is not required for vibrant dry tamp (VDT) products.
4. Freeze thaw - ASTM C 1364L The cumulative percent weight loss (CPWL) shall be less than 5 percent after 300 cycles of freezing and thawing.
5. Linear Shrinkage - ASTM C 426L Shrinkage shall not exceed 0.065 percent.

2.2 RAW MATERIALS

- A. Portland cement - Type I or Type III, white and/or grey, ASTM C 150.
- B. Coarse aggregates - Granite, quartz or limestone, ASTM C 33, except for gradation, and are optional for the vibrant dry tamp (VDT) casting method.
- C. Fine aggregates - Manufactured or natural sands, ASTM C 33, except for gradation.
- D. Colors - Inorganic iron oxide pigments, ASTM C 979 except that carbon black pigments shall not be used.
- E. Admixtures- Comply with the following:
 1. ASTM C 260 for air-entraining admixtures.
 2. ASTM C 494/C 495 M Types A-G for water reducing, retarding, accelerating and high range admixtures.
 3. Other admixtures: integral water repellents and other chemicals, for which no ASTM Standard exists, shall be previously established as suitable for use in concrete by proven field performance or through laboratory testing.
 4. ASTM C 618 mineral admixtures of dark and variable colors shall not be used in surfaces intended to be exposed to view.
 5. ASTM C 989 granulated blast furnace slag may be used to improve physical properties. Tests are required to verify these features.
- F. Water - Potable
- G. Reinforcing bars:

1. ASTM A 615/A 615M. Grade 40 or 60 steel galvanized or epoxy coated when cover is less than 1.5 inch (37 mm).
 2. Welded Wire Fabric: ASTM A 1064 where applicable for wet cast units.
- H. All anchors, dowels and other anchoring devices and shims shall be standard building stone anchors commercially available in a non-corrosive material such as zinc plated, galvanized steel, brass, or stainless steel Type 302 or 304.

2.3 COLOR AND FINISH

- A. Match color and finish of existing cast stone units.
- B. All surfaces intended to be exposed to view shall have a fine-grained texture similar to natural stone, with no air voids in excess of 1/32 inch (0.8 mm) and the density of such voids shall be less than 3 occurrences per any 1 inch (25 mm) and not obvious under direct daylight illumination at a 5 feet (1.5 meters) distance.
- C. Units shall exhibit a texture approximately equal to the approved sample when viewed under direct daylight illumination at a 10 feet (3 meters) distance.
- D. ASTM D 2244 permissible variation in color between units of comparable age subjected to similar weathering exposure.
1. Total color difference - not greater than 6 units.
 2. Total hue difference-not greater than 2 units.

2.4 REINFORCING

- A. Reinforce the units as required for safe handling and structural stress.
1. Minimum reinforcing shall be 0.25 percent of the cross section area.
- B. Reinforcement shall be non-corrosive where faces exposed to weather are covered with less than 1.5 inch (38 mm) of concrete material. All reinforcement shall have minimum coverage of twice the diameter of the bars.
- C. Minor chipping resulting from shipment and delivery shall not be grounds for rejection. Minor chips shall not be obvious under direct daylight illumination from a 20 foot (6 meter) distance.
- D. The occurrence of crazing or efflorescence shall not constitute a cause for rejection.
- E. Remove cement film, if required, from exposed surface prior to packaging for shipment.

2.5 CURING

- A. Cure units in a warm curing chamber 100 degrees F (37.8 degrees C) at 95 percent relative humidity for approximately 12 hours, or cure in a 95 percent moist environment at a minimum 70 degrees F (21.1 degrees C) for 16 hours after casting. Additional yard curing at 95 percent relative humidity shall be 350-degree-days (i.e. 7 days @ 50 degrees F (10.0 degrees C) or 5 days @ 70 degrees F (21.0 degrees C) prior to shipping. Form cured units shall be protected from moisture evaporation with curing blankets or curing compounds after casting.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Installing contractor shall check cast stone materials for fit and finish prior to installation. Do not set unacceptable units.

3.2 SETTING TOLERANCES

- A. Comply with Cast Stone Institute Technical Manual.
- B. Set stones 1/8 inch (3 mm) or less, within the plane of adjacent units.
- C. Joints, plus - 1/6 inch (1.5 mm), minus - 1/8 inch (3 mm).

3.3 JOINTING

- A. Joint size: To match existing joints.
- B. Joint Materials:
 - 1. Mortar, Type N, ASTM C 270.
 - 2. Use a full bed of mortar at all bed joints.
 - 3. Flush vertical joints in units other than coping units full with mortar.
 - 4. Leave all joints with exposed tops or under relieving angles open for sealant.
 - 5. Leave head joints in coping and projecting components open for sealant.
- C. Location of joints:
 - 1. As shown on shop drawings.
 - 2. At control and expansion joints unless otherwise shown.

3.4 SETTING

- A. Drench units with clean water prior to setting.
- B. Fill dowel holes and anchor slots completely with non-shrink grout.
- C. Set units in full bed of mortar, unless otherwise detailed.
- D. Rake mortar joints 3/4 inch (18 mm) for pointing or sealant as noted in drawings.
- E. Remove excess mortar from unit faces immediately after setting.

F. Tuck point unit joints to a slight concave profile.

3.5 JOINT PROTECTION

A. Comply with requirements of Section 07 92 00, JOINT SEALANTS.

B. Prime ends of units, insert properly sized backing rod and install required sealant.

3.6 REPAIR AND CLEANING

A. Repair chips with touchup materials furnished by manufacturer.

B. Saturate units to be cleaned prior to applying an approved masonry cleaner.

C. Consult with manufacturer for appropriate cleaners.

3.7 INSPECTION AND ACCEPTANCE

A. Inspect finished installation according to Bulletin #36 published by the Cast Stone Institute.

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**SECTION 05 12 00
STRUCTURAL STEEL FRAMING**

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Structural steel shapes, plates, and bars.
2. Structural pipe.
3. Bolts, nuts, and washers.

1.2 RELATED REQUIREMENTS

- A. Materials Testing and Inspection During Construction: Section 01 45 29, TESTING and LABORATORY SERVICES.
- B. Steel Decking: Section 05 31 00, STEEL DECKING.

1.3 APPLICABLE PUBLICATIONS

- A. Comply with references to extent specified in this section.
- B. American Institute of Steel Construction (AISC):
1. AISC Manual - Steel Construction Manual, 14th Ed.
 2. 303-10 - Code of Structural Steel Buildings and Bridges.
 3. 360-10: Specification for Structural Steel Buildings.
- C. The American Society of Mechanical Engineers (ASME):
1. B18.22.1-09 - Washers: Helical Spring-Lock, Tooth Lock, and Plain Washers.
- D. American Welding Society (AWS):
1. D1.1/D1.1M-15 - Structural Welding Code - Steel.
- E. ASTM International (ASTM):
1. A6/A6M-14 - General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling.
 2. A36/A36M-14 - Carbon Structural Steel.
 3. A53/A53M-12 - Pipe, Steel, Black and Hot-Dip, Zinc-Coated, Welded and Seamless.
 4. A123/A123M-15 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 5. A242/A242M-13 - High-Strength Low-Alloy Structural Steel.
 6. A283/A283M-13 - Low and Intermediate Tensile Strength Carbon Steel Plates.
 7. A307-14 - Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength.

8. A500/A500M-13 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing and Rounds and Shapes.
 9. A501/A501M-14 - Hot-Formed Welded and Seamless Carbon Steel Structural Tubing and Rounds and Shapes.
 10. A572/A572M-15 - High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
 11. A992/A992M-15 - Structural Shapes.
 12. F2329/F2329M-15 - Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy steel Bolts, Screws, washers, Nuts, and Special Threaded Fasteners.
 13. F3125/F3125M-15 - Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions
- F. Master Painters Institute (MPI):
1. No. 18 - Primer, Zinc Rich, Organic.
- G. Military Specifications (Mil. Spec.):
1. MIL-P-21035 - Paint, High Zinc Dust Content, Galvanizing, Repair.
- H. Occupational Safety and Health Administration (OSHA):
1. 29 CFR 1926.752(e) - Guidelines For Establishing The Components Of A Site-Specific Erection Plan.
 2. 29 CFR 1926-2001 - Safety Standards for Steel Erection.
- I. Research Council on Structural Connections (RCSC) of The Engineering Foundation:
1. Specification for Structural Joints Using ASTM F3125 Bolts.

1.4 SUBMITTALS

- A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Submittal Drawings:
1. Show size, configuration, and fabrication and installation details.
- C. Sustainable Construction Submittals:
1. Recycled Content: Identify post-consumer and pre-consumer recycled content percentage by weight.
- D. Test Reports: Certify products comply with specifications.
1. Welders' qualifying tests.
- E. Certificates: Certify each product complies with specifications.
1. Structural steel.
 2. Steel connections.

3. Welding materials.
4. Shop coat primer paint.
- F. Qualifications: Substantiate qualifications comply with specifications.
 1. Fabricator with project experience list.
 2. Installer with project experience list.
 3. Welders and welding procedures.
- G. Delegated Design Drawings and Calculations: Signed and sealed by responsible Architect/Engineer.
 1. Connection calculations.
- H. Record Surveys: Signed and sealed by responsible surveyor or engineer.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: AISC Quality Certification participant designated as AISC Certified Plant, Category STD.
 1. Regularly fabricates specified products.
 2. Fabricated specified products with satisfactory service on five similar installations for minimum five years.
 - a. Project Experience List: Provide contact names and addresses for completed projects.
- B. Installer Qualifications: AISC Quality Certification Program participant designated as AISC-Certified Erector, Category ACSE.
 1. Regularly installs specified products.
 2. Installed specified products with satisfactory service on five similar installations for minimum five years.
 - a. Project Experience List: Provide contact names and addresses for completed projects.
- C. Before commencement of Work, ensure steel erector provides written notification required by OSHA 29 CFR 1926.752(e). Submit a copy of the notification to Contracting Officer's Representative.
- D. Welders and Welding Procedures Qualifications: AWS D1.1/D1.1M.

1.6 WARRANTY

- A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 SYSTEM PERFORMANCE

- A. Delegated Design: Prepare submittal documents including design calculations and drawings signed and sealed by registered design professional, licensed in state where project is located.
- B. Design structural steel framing connections complying with specified performance:
 - 1. Load Capacity: Resist loads indicated on drawings. Account for connection and member loads and eccentricities.
 - a. Request additional design criteria when necessary to complete connection design.
 - 2. Configuration: Design and detail all connections for each member size, steel grade and connection type to resist the loads and reactions indicated on the drawings or specified herein. Use details consistent with details shown on drawings, supplementing where necessary. The details shown on drawings are conceptual and do not indicate the required weld sizes or number of bolts unless specifically noted. Use rational engineering design and standard practice in detailing, accounting for all loads and eccentricities in both the connection and the members. Promptly notify the Contracting Officer Representative of any location where the connection design criteria is not clearly indicated. The design of all connections is subject to the review and acceptance of the Contracting Officer's Representative. Submit structural calculations prepared and sealed by a qualified engineer registered in the state where the project is located. Submit calculations for review before preparation of detail drawings.

2.2 MATERIALS

- A. W-Shapes:
 - 1. ASTM A992/A992M.
- B. Channel and Angles:
 - 1. ASTM A36/A36M.
- C. Plates and Bars:
 - 1. ASTM A36/A36M.
 - 2. ASTM A572/A572M; Grade // 50.
- D. Hollow Structural Sections:
 - 1. ASTM A500/A500M.

- E. Bolts, Nuts and Washers: Galvanized for galvanized framing and plain finish for other framing.
 - 1. High-strength bolts, including nuts and washers: ASTM F3125.
 - 2. Bolts and nuts, other than high-strength: ASTM A307, Grade A.
 - 3. Plain washers, other than those in contact with high-strength bolt heads and nuts: ASME B18.22.1.
- F. Welding Materials: AWS D1.1, type to suit application.

2.3 PRODUCTS - GENERAL

- A. Sustainable Construction Requirements:
 - 1. Steel Recycled Content: 30 percent total recycled content, minimum.
 - 2. Low Pollutant-Emitting Materials: Comply with VOC limits specified in Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for the following products:
 - a. Paints and coatings.

2.4 FABRICATION

- A. Fabricate structural steel according to Chapter M, AISC 360.
- B. Shop and Field Connections:
 - 1. Weld connections according to AWS D1.1/D1.1M. Welds shall be made only by welders and welding operators who have been previously qualified by tests as prescribed in AWS D1.1 to perform type of work required.
 - 2. High-Strength Bolts: High-strength bolts tightened to a bolt tension minimum 70 percent of their minimum tensile strength. Tightening done with properly calibrated wrenches, by turn-of-nut method or by use of direct tension indicators (bolts or washers). Tighten bolts in connections identified as slip-critical using Direct Tension Indicators. Twist-off torque bolts are not an acceptable alternate fastener for slip critical connections.

2.5 FINISHES

- A. Shop Priming:
 - 1. Prime paint structural steel according to AISC 303, Section 6.
 - a. Interstitial Space Structural Steel: Prime paint, unless indicated to receive sprayed on fireproofing.
- B. Shop Finish Painting: Apply primer and finish paint as specified in Section 09 91 00, PAINTING.
- C. Do not paint:
 - 1. Surfaces within 50 mm (2 inches) of field welded joints.

2. Surfaces indicated to be encased in concrete.
 3. Surfaces receiving sprayed on fireproofing.
 4. Beam top flanges receiving shear connector studs applied.
- D. Structural Steel Galvanizing: ASTM A123/A123M, hot dipped, after fabrication. Touch-up after erection: Clean and wire brush any abraded and other spots worn through zinc coating, including threaded portions of bolts and welds and touch-up with galvanizing repair paint.
1. Galvanize structural steel framing installed at exterior locations.
- E. Bolts, Nuts, and Washers Galvanizing: ASTM F2329, hot-dipped.

2.6 ACCESSORIES

- A. General: Shop paint steel according to AISC 303, Section 6.
- B. Finish Paint System: Primer and finish as specified in Section 09 91 00, PAINTING.
- C. Galvanizing Repair Paint: MPI No. 18.

PART 3 - EXECUTION

3.1 ERECTION

- A. Erect structural steel according to AISC 303 and AISC 360.
- B. Set structural steel accurately at locations and elevations indicated on drawings.
- C. Maintain erection tolerances of structural steel within AISC 303 requirements.
 1. Pour Stop Elevation Tolerance: 6 mm (1/4 inch), maximum, before concrete placement.
- D. Weld and bolt connections as specified for shop connections.

3.2 FIELD PAINTING

- A. After welding, clean and prime weld areas to match adjacent finish.
- B. Touch-up primer damaged by construction operations.
- C. Apply galvanizing repair paint to galvanized coatings damaged by construction operations.
- D. Finish Painting: As specified in Section 09 91 00, PAINTING.

3.3 FIELD QUALITY CONTROL

- A. Record Survey:
 1. Engage registered land surveyor or registered civil engineer as specified in Section 01 00 00, GENERAL REQUIREMENTS to perform survey.

2. Measure and record structural steel framing plumbness, level, and alignment after completing bolting and welding and before installation of work supported by structural steel.
3. Identify deviations from allowable tolerances specified in AISC Manual.

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IMPROVE CAMPUS BUILDING EXTERIORS 438-22-600

SECTION 05 31 00
STEEL DECKING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Single pan fluted metal roof deck as roof substrate.

1.2 RELATED WORK

- A. Section 01 81 13. SUSTAINABLE CONSTRUCTION REQUIREMENTS.
- B. Section 05 12 00, STRUCTURAL STEEL FRAMING: Structural Steel Shapes.
- C. Section 09 91 00, PAINTING: Finish Painting.

1.3 APPLICABLE PUBLICATIONS

- A. Comply with references to extent specified in this section.
- B. AISI - American Iron and Steel Institute.
- S100-16.....Specification for the Design of Cold-formed
Steel Structural Members.
- C. American Welding Society (AWS):
- D1.1/D1.1M-20.....Structural Welding Code - Steel.
- 1.3/D1.3M-18..... Structural Welding Code - Sheet Steel.
- D. ASTM International (ASTM):
- A36/A36M-19.....Standard Specification for Carbon Structural
Steel.
- A653/A653M-20.....Standard Specification for Steel Sheet,
Zinc-Coated (Galvanized) or Zinc-Iron
Alloy-Coated (Galvannealed) by the Hot-Dip
Process.
- A1008/A1008M-20.....Standard Specification for Steel, Sheet,
Cold-Rolled, Carbon, Structural, High-Strength
Low-Alloy, High-Strength Low-Alloy with
Improved Formability, Solution Hardened, and
Baked Hardenable.
- C423-17.....Standard Test Method for Sound Absorption and
Sound Absorption Coefficients by the
Reverberation Room Method.
- E119-20.....Standard Test Methods for Fire Tests of
Building Construction and Materials.
- E. FM Global (FM):
- 1-28-15.....Wind Design.
- Factory Mutual Research Approval Guide.

F. Master Painters Institute (MPI):

No. 18.....Primer, Zinc Rich, Organic.

G. Military Specifications (Mil. Spec.):

MIL-P-21035B..... Paint, High Zinc Dust Content, Galvanizing
Repair.

H. Steel Deck Institute (SDI):

No. 31-07.....Design Manual for Composite Deck, Form Decks,
and Roof Decks.

I. UL LLC (UL):

Listed Online Certifications Directory.

580.....Tests for Uplift Resistance of Roof Assemblies.

1.4 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA,
AND SAMPLES. All items indicated below are required submittals
requiring Contracting Officer's Representative (COR) review and
approval.

B. Submittal Drawings:

1. Show layout, connections to supporting members, anchorage, sump
pans, accessories, deck openings and reinforcements.
2. Show similar information necessary for completing installation as
shown and specified, including supplementary framing, ridge and
valley plates, cant strips, cut openings, special jointing or other
accessories.
3. Show welding, side lap, closure, deck reinforcing and closure
reinforcing details.
4. Show openings required for work of other trades, including openings
not shown on structural drawings. Indicate where temporary shoring
is required to satisfy design criteria.

C. Manufacturer's Literature and Data:

1. Description of each product.
2. Show steel decking section properties and structural
characteristics.

D. Sustainable Construction Submittals:

1. Recycled Content: Identify post-consumer and pre-consumer recycled
content percentage by weight.

E. Certificates: Certify each product complies with specifications.

1. Fire Resistance Product Listing: For each metal deck type and thickness supporting concrete slab or fill.
 2. Show steel decking is UL Listed for specified application.
 3. Show noise reduction coefficient test results.
- F. Qualifications: Substantiate qualifications comply with specifications.
1. Welders and welding procedures.
- G. Insurance Certification: Assist the Government in preparation and submittal of roof installation acceptance certification as may be necessary in connection with fire and extended coverage insurance.

1.5 QUALITY ASSURANCE

- A. FM Listing: Provide metal roof deck units which have been evaluated by Factory Mutual Global and are listed in "Factory Mutual Research Approval Guide" for "Class 1" fire rated construction.
- B. Welders and Welding Procedures Qualifications: AWS D1.3/D1.3M.

1.6 WARRANTY

- A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 SYSTEM PERFORMANCE

- A. Design steel decking and accessories according to AISI S100.
1. Wind Uplift Resistance and Corner Conditions:
 - a. See Structural Documents for uplift loads.
 2. Fire Resistance: ASTM E119; Verify with Architect.
 3. Noise Reduction Coefficient (NRC): Minimum 0.90 when tested according to ASTM C423.
 4. Design side and end closures and attachment to supporting steel to safely support wet weight of concrete and construction loads.
 5. Cantilever Closure Deflection: 3 mm (1/8 inch), maximum.

2.2 MATERIALS

- A. Galvanized Steel Sheet: ASTM A653/A653M; G60 coating.
- B. Primer for Shop Painted Sheets: Manufacturer's standard primer (2 coats). When finish painting of steel decking is specified in Section 09 91 00, PAINTING primer coating shall be compatible with specified finish painting.

- C. Steel Shapes: ASTM A36/A36M.
- D. Acoustic Deck: Cellular deck profile, SDI Publication No. 31.
- E. Acoustic Insulation: Manufacturer's standard mineral fiber type, profile matching deck flute profile.

2.3 PRODUCTS - GENERAL

- A. Sustainable Construction Requirements:
 - 1. Steel Recycled Content: 30 percent total recycled content, minimum.

2.4 METAL ROOF DECK

- A. Metal Roof Deck: UL Listed as metal roof deck panels.
 - 1. Steel decking of the type, depth, thickness, and section properties as shown.
 - 2. Deck Style:
 - a. As indicated on drawings.
 - 3. Depth and Thickness: As indicated on drawings.
 - 4. Material: // Galvanized sheet steel.
- B. Do not use steel deck for hanging supports of building components including suspended ceilings, electrical light fixtures, plumbing, heating, or air conditioning pipes or ducts or electrical conduits.

2.5 FABRICATION

- A. Fabricate steel decking in sufficient lengths to extend over 3 or more supports, except for interstitial levels.
 - 1. Cut metal deck units to proper length in shop.
- B. Fabricate accessories required to complete installation of steel decking.
 - 1. Exposed to View: Fabricate from sheet steel matching metal decking.
 - 2. Concealed from View: Fabricate from galvanized sheet steel.
- C. Sheet Metal Accessories:
 - 1. Metal Cover Plates: For end-abutting decking, to close gaps at changes in deck direction, columns, walls and openings.
 - a. Sheet Steel: Minimum 1.0 mm (0.04 inch) thick.
 - 2. Continuous Sheet Metal Edging: At openings, concrete slab edges and roof deck edges.
 - a. Sheet Steel: Minimum 1.0 mm (0.04 inch) thick.
 - 3. Metal Closure Strips: For openings between decking and other construction. Form to configurations required to provide tight-fitting closures at open ends of flutes and sides of decking.
 - a. Sheet Steel: Minimum 1.0 mm (0.04 inch) thick.

4. Ridge and Valley Plates: Minimum 100 mm (4 inch) wide ridge and valley plates where roof slope exceeds 1/24 (1/2 inch per foot).
 - a. Sheet Steel: Minimum 1.0 mm (0.04 inch) thick.
5. Cant Strips: Provide bent metal 45 degree leg cant strips where indicated on the drawings. Fabricate cant strips with minimum 125 mm (5 inch) face width.
 - a. Sheet Steel: Minimum 0.8 mm (0.03 inch) thick.
6. Seat Angles for Deck: Provide where beam does not frame into column.
7. Sump Pans for Roof Drains: Fabricated from single piece galvanized sheet steel with level bottoms and sloping sides to direct water flow to drain. Provide sump pans of adequate size to receive roof drains and with bearing flanges minimum 75 mm (3 inches) wide. Recess pans minimum 38 mm (1-1/2 inches) below roof deck surface, unless otherwise shown or required by deck configuration. Drain holes will be field cut.
 - a. Sheet Steel: Minimum 1.7 mm (0.06 inch) thick.

2.6 FINISHES

- A. Shop prime painted sheet steel with two coats of primer.

2.7 ACCESSORIES

- A. Primer: Manufacturer's standard primer compatible with finish painting specified in Section 09 91 00, PAINTING.
- B. Welding Materials: AWS D1.1, type to suit application.
- C. Galvanizing Repair Paint: MPI No. 18.
- D. Touch-Up Paint: Match shop finish.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine and verify substrate suitability for product installation.
- B. Protect existing construction and completed work from damage.
- C. Remove contaminates from structural steel surfaces where steel decking will be welded.
- D. Verify structural steel framing installation is completed, plumbed, and aligned with temporary bracing installed where required.
- E. Coordinate with structural steel erector to prevent overloading of structural members when placing steel decking for installation.

3.2 ERECTION

- A. Do not use floor deck units for storage or working platforms until permanently secured. Do not overload deck units once placed. Replace

deck units that become damaged after erection and before casting concrete at no cost additional to the Government.

- B. Place steel decking at right angles to supporting members with ends located over supports.
- C. Lap end joints 50 mm (2 inches), minimum.

End Closure Fastening: Tack weld or self-tapping No. 8 or larger machine screws at 900 mm (3 feet) on center.

- a. Longitudinal End Closure Fastening: Tack weld only.
- 2. Weld side laps of adjacent decking units.
 - a. Fastener Locations: Mid-span and maximum 900 mm (3 feet) on center.

D. Roof Deck Fastening:

- 1. Fasten decking to steel supporting members by welding.
 - a. Welds: 16 mm (5/8 inch) diameter puddle welds or elongated welds of equal strength.
 - b. Weld Spacing: as shown on Drawings.
- 2. Fasten split or partial decking panels to structure in every valley.
- 3. Fasten decking to each supporting member at ribs where side laps occur.
 - a. Power driven fasteners are acceptable in lieu of welding if strength equivalent to welding specified above is provided. Submit test data and design calculations verifying equivalent design strength.
- 4. Mechanically fasten decking side laps with self-tapping No. 8 or larger machine screws.
 - a. Fastener Locations: As shown on Drawings.

E. Cutting and Fitting:

- 1. Field cut steel decking to accommodate columns and other penetrating items.
- 2. Cut openings located and dimensioned on Structural Drawings.
- 3. Coordinate openings for other penetrations shown on approved submittal drawings but not shown on Structural Drawings.
 - a. Cut and reinforce required opening.
- 4. Make cuts neat and trim using metal saw, drill or punch-out device. Cutting with torches is prohibited.
- 5. Do not make cuts in the metal deck that are not shown on the approved metal decking submittal drawings.

- a. When additional openings are required, submit scaled drawing, locating required opening and other openings and supports in immediate area.
 - b. Do not cut the opening until the drawing is approved by Contracting Officer's Representative.
 - c. Provide additional reinforcing and framing required for opening.
 - d. Failure to comply with these requirements is cause for rejection of the work and removal and replacement of the affected steel decking.
6. Opening Reinforcement: Provide additional metal reinforcement and closure pieces as required for strength, continuity of decking, and support of other work.
- F. Touch up damaged factory finishes.
1. Apply galvanizing repair paint to damaged galvanized surfaces.
 2. Apply touch up paint to damaged shop painted surfaces.

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IMPROVE CAMPUS BUILDING EXTERIORS 438-22-600

**SECTION 05 50 00
METAL FABRICATIONS**

SPEC WRITER NOTE:

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies items and assemblies fabricated from structural steel shapes and other materials as shown and specified.
- B. Items specified.
 - 2. Frames
 - 5. Gratings
 - 11. Ladders
 - 12. Railings
 - 13. Screens.

1.2 RELATED WORK

- C. Prime and finish painting: Section 09 91 00, PAINTING.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:

Grating, each type	
	Screens

- C. Shop Drawings:
 - 1. Each item specified, showing complete detail, location in the project, material and size of components, method of joining various components and assemblies, finish, and location, size and type of anchors.
 - 2. Mark items requiring field assembly for erection identification and furnish erection drawings and instructions.
 - 3. Provide templates and rough-in measurements as required.
- D. Manufacturer's Certificates:
 - 2. Live load designs as specified.
- E. Design Calculations for specified live loads including dead loads.

- F. Furnish setting drawings and instructions for installation of anchors to be preset into concrete and masonry work, and for the positioning of items having anchors to be built into concrete or masonry construction.

1.4 QUALITY ASSURANCE

- A. Each manufactured product shall meet, as a minimum, the requirements specified, and shall be a standard commercial product of a manufacturer regularly presently manufacturing items of type specified.
- B. Each product type shall be the same and be made by the same manufacturer.
- C. Assembled product to the greatest extent possible before delivery to the site.
- D. Include additional features, which are not specifically prohibited by this specification, but which are a part of the manufacturer's standard commercial product.

1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society of Mechanical Engineers (ASME):
- B18.6.1-97.....Wood Screws
- B18.2.2-87(R2010).....Square and Hex Nuts
- C. American Society for Testing and Materials (ASTM):
- A36/A36M-14.....Structural Steel
- A47-99(R2014).....Malleable Iron Castings
- A48-03(R2012).....Gray Iron Castings
- A53-12.....Pipe, Steel, Black and Hot-Dipped, Zinc-Coated
Welded and Seamless
- A123-15.....Zinc (Hot-Dip Galvanized) Coatings on Iron and
Steel Products
- A240/A240M-15.....Standard Specification for Chromium and
Chromium-Nickel Stainless Steel Plate, Sheet
and Strip for Pressure Vessels and for General
Applications.
- A307-14.....Carbon Steel Bolts and Studs, 60,000 PSI
Tensile Strength
- C1107-13.....Packaged Dry, Hydraulic-Cement Grout
(Nonshrink)
- F436-16.....Hardened Steel Washers

- F468-06(R2015).....Nonferrous Bolts, Hex Cap Screws, Socket Head
Cap Screws and Studs for General Use
- F593-13.....Stainless Steel Bolts, Hex Cap Screws, and
Studs
- F1667-15.....Driven Fasteners: Nails, Spikes and Staples
- D. American Welding Society (AWS):
 - D1.1-15.....Structural Welding Code Steel
 - D1.2-14.....Structural Welding Code Aluminum
 - D1.3-18.....Structural Welding Code Sheet Steel
- E. National Association of Architectural Metal Manufacturers (NAAMM)
 - AMP 521-01(R2012).....Pipe Railing Manual
 - AMP 500-06.....Metal Finishes Manual
 - MBG 531-09(R2017).....Metal Bar Grating Manual
 - MBG 532-09.....Heavy Duty Metal Bar Grating Manual
- F. Structural Steel Painting Council (SSPC)/Society of Protective
Coatings:
 - SP 1-15.....No. 1, Solvent Cleaning
 - SP 2-04.....No. 2, Hand Tool Cleaning
 - SP 3-04.....No. 3, Power Tool Cleaning
- G. Federal Specifications (Fed. Spec):
 - RR-T-650E.....Treads, Metallic and Nonmetallic, Nonskid

PART 2 - PRODUCTS

2.1 DESIGN CRITERIA

- A. In addition to the dead loads, design fabrications to support the
following live loads unless otherwise specified.
- B. Ladders and Rungs: 120 kg (250 pounds) at any point.
- C. Railings and Handrails: 900 N (200 pounds) in any direction at any
point.
- D. Gratings: 500 kg/m² (100 pounds per square foot).

2.2 MATERIALS

- A. Structural Steel: ASTM A36.
- B. Stainless Steel: ASTM A240, Type 302 or 304.
- F. Cast-Iron: ASTM A48, Class 30, commercial pattern.
- G. Malleable Iron Castings: A47.
- H. Primer Paint: As specified in Section 09 91 00, PAINTING.
- K. Grout: ASTM C1107, pourable type.
- L. Insect Screening: ASTM D3656.

2.3 HARDWARE**A. Rough Hardware:**

1. Furnish rough hardware with a standard plating, applied after punching, forming and assembly of parts; galvanized, cadmium plated, or zinc-coated by electro-galvanizing process. Galvanized G-90 where specified.
2. Use G90 galvanized coating on ferrous metal for exterior work unless non-ferrous metal or stainless is used.

B. Fasteners:**1. Bolts with Nuts:**

- a. ASME B18.2.2.
- b. ASTM A307 for 415 MPa (60,000 psi) tensile strength bolts.
- c. ASTM F468 for nonferrous bolts.
- d. ASTM F593 for stainless steel.

2. Screws: ASME B18.6.1.**3. Washers: ASTM F436, type to suit material and anchorage.****4. Nails: ASTM F1667, Type I, style 6 or 14 for finish work.****2.4 FABRICATION GENERAL****A. Material**

1. Use material as specified. Use material of commercial quality and suitable for intended purpose for material that is not named or its standard of quality not specified.
2. Use material free of defects which could affect the appearance or service ability of the finished product.

B. Size:

1. Size and thickness of members as shown.
2. When size and thickness is not specified or shown for an individual part, use size and thickness not less than that used for the same component on similar standard commercial items or in accordance with established shop methods.

C. Connections

1. Except as otherwise specified, connections may be made by welding, riveting or bolting.
2. Field riveting will not be approved.
3. Design size, number and placement of fasteners, to develop a joint strength of not less than the design value.
4. Holes, for rivets and bolts: Accurately punched or drilled and burrs removed.

5. Size and shape welds to develop the full design strength of the parts connected by welds and to transmit imposed stresses without permanent deformation or failure when subject to service loadings.
6. Use Rivets and bolts of material selected to prevent corrosion (electrolysis) at bimetallic contacts. Plated or coated material will not be approved.
7. Use stainless steel connectors for removable members machine screws or bolts.

D. Fasteners and Anchors

1. Use methods for fastening or anchoring metal fabrications to building construction as shown or specified.
2. Where fasteners and anchors are not shown, design the type, size, location and spacing to resist the loads imposed without deformation of the members or causing failure of the anchor or fastener, and suit the sequence of installation.
3. Use material and finish of the fasteners compatible with the kinds of materials which are fastened together and their location in the finished work.
4. Fasteners for securing metal fabrications to new construction only, may be by use of threaded or wedge type inserts or by anchors for welding to the metal fabrication for installation before the concrete is placed or as masonry is laid.
5. Fasteners for securing metal fabrication to existing construction or new construction may be expansion bolts, toggle bolts, power actuated drive pins, welding, self drilling and tapping screws or bolts.

E. Workmanship

1. General:
 - a. Fabricate items to design shown.
 - b. Furnish members in longest lengths commercially available within the limits shown and specified.
 - c. Fabricate straight, true, free from warp and twist, and where applicable square and in same plane.
 - d. Provide holes, sinkages and reinforcement shown and required for fasteners and anchorage items.
 - e. Provide openings, cut-outs, and tapped holes for attachment and clearances required for work of other trades.
 - f. Prepare members for the installation and fitting of hardware.

- g. Cut openings in gratings and floor plates for the passage of ducts, sumps, pipes, conduits and similar items. Provide reinforcement to support cut edges.
 - h. Fabricate surfaces and edges free from sharp edges, burrs and projections which may cause injury.
2. Welding:
- a. Weld in accordance with AWS.
 - b. Welds shall show good fusion, be free from cracks and porosity and accomplish secure and rigid joints in proper alignment.
 - c. Where exposed in the finished work, continuous weld for the full length of the members joined and have depressed areas filled and protruding welds finished smooth and flush with adjacent surfaces. All exposed welds are to be ground smooth to blend with adjacent surfaces before application of prime coat or galvanizing.
 - d. Finish welded joints to match finish of adjacent surface.
3. Joining:
- a. Miter or butt members at corners.
 - b. Where frames members are butted at corners, cut leg of frame member perpendicular to surface, as required for clearance.
4. Anchors:
- a. Where metal fabrications are shown to be preset in concrete, weld 32 x 3 mm (1-1/4 by 1/8 inch) steel strap anchors, 150 mm (6 inches) long with 25 mm (one inch) hooked end, to back of member at 600 mm (2 feet) on center, unless otherwise shown.
 - b. Where metal fabrications are shown to be built into masonry use 32 x 3 mm (1-1/4 by 1/8 inch) steel strap anchors, 250 mm (10 inches) long with 50 mm (2 inch) hooked end, welded to back of member at 600 mm (2 feet) on center, unless otherwise shown.
5. Cutting and Fitting:
- a. Accurately cut, machine and fit joints, corners, copes, and miters.
 - b. Fit removable members to be easily removed.
 - c. Design and construct field connections in the most practical place for appearance and ease of installation.
 - d. Fit pieces together as required.
 - e. Fabricate connections for ease of assembly and disassembly without use of special tools.

- f. Joints firm when assembled.
- g. Conceal joining, fitting and welding on exposed work as far as practical.
- h. Do not show rivets and screws prominently on the exposed face.
- i. The fit of components and the alignment of holes shall eliminate the need to modify component or to use exceptional force in the assembly of item and eliminate the need to use other than common tools.

F. Finish:

- 1. Finish exposed surfaces in accordance with NAAMM AMP 500 Metal Finishes Manual.
- 3. Steel and Iron: NAAMM AMP 504.
 - a. Zinc coated (Galvanized): ASTM A123, G90 unless noted otherwise.
 - b. Surfaces exposed in the finished work:
 - 1) Finish smooth rough surfaces and remove projections and welding slag.
 - 2) Fill holes, dents and similar voids and depressions with epoxy type patching compound.
 - c. Shop Prime Painting:
 - 1) Surfaces of Ferrous metal:
 - a) Items not specified to have other coatings.
 - b) Galvanized surfaces specified to have prime paint.
 - c) Remove all loose mill scale, rust, and paint, by hand or power tool cleaning as defined in SSPC-SP2 and SP3.
 - d) Clean of oil, grease, soil and other detrimental matter by use of solvents or cleaning compounds as defined in SSPC-SP1.
 - e) After cleaning and finishing apply one coat of primer as specified in Section 09 91 00, PAINTING.
 - 2) Non ferrous metals: Comply with MAAMM-500 series.

G. Protection:

- 2. Spot prime all abraded and damaged areas of zinc coating which expose the bare metal, using zinc rich paint on hot-dip zinc coat items and zinc dust primer on all other zinc coated items.

2.9 GRATINGS

- A. Fabricate gratings to support live loads specified and a concentrated load as specified.
- E. Fabricate sections of grating with end-banding bars.

5. Butt or miter, and weld angle frame at corners.

G. Steel Bar Gratings:

1. Fabricate grating using steel bars, frames, supports and other members shown in accordance with Metal Bar Grating Manual.
2. Galvanize steel members after fabrication in accordance with ASTM A123, G-90 for exterior gratings, gratings in concrete floors, and interior grating where specified.
4. Use serrated bars for exterior gratings used at exterior roof access ladder landings. I. Plank Gratings:
 1. Conform to Fed. Spec. RR-G-1602.
 2. Manufacturers standard widths, lengths and side channels to meet live load requirements.
 3. Galvanize exterior steel gratings ASTM A123, G-90 after fabrication.

2.14 LADDERS

A. Steel Ladders:

1. Fixed-rail type with steel rungs shouldered and headed into and welded to rails.
2. Fabricate angle brackets of 50 mm (2 inch) wide by 13 mm (1/2 inch) thick steel; brackets spaced maximum of 1200 mm (4 feet) apart and of length to hold ladder 175 mm (7 inches) from wall to center of rungs. Provide turned ends or clips for anchoring.
3. Provide holes for anchoring with expansion bolts through turned ends and brackets.
4. Where shown, fabricate side rails curved, twisted and formed into a gooseneck.
5. Galvanize exterior ladders after fabrication, ASTM A123, G-90.

2.15 RAILINGS

- A. In addition to the deadload design railing assembly to support live load specified.

B. Fabrication General:

1. Provide continuous welded joints, dressed smooth and flush.
2. Standard flush fittings, designed to be welded, may be used.
3. Exposed threads will not be approved.
4. Form handrail brackets to size and design shown.

C. Handrails:

1. Close free ends of rail with flush metal caps welded in place except where flanges for securing to walls with bolts are shown.

2. Make provisions for attaching handrail brackets to wall, posts, and handrail as shown.

D. Steel Pipe Railings:

1. Fabricate of steel pipe with welded joints.
2. Number and space of rails as shown.
3. Space posts for railings not over 1200 mm (4 feet) on centers between end posts or as noted on drawings.
4. Form handrail brackets from malleable iron.

2.19 SCREENED FRAMES

A. Galvanized ASTM A123, G-90 after fabrication.

B. Wall frame:

1. Fabricate frame from steel members as shown.
3. Miter and weld frame at corners.

C. Insect screen:

1. Fabricate from carbon steel wire.
2. Mesh type: Square (4 x 4).
3. Wire size: 0.063 inch.
4. Opening size: 0.187 inch.
5. Construction type: Woven.
6. Finish: Galvanized.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Set work accurately, in alignment and where shown, plumb, level, free of rack and twist, and set parallel or perpendicular as required to line and plane of surface.
- B. Items set into concrete or masonry.
 1. Provide temporary bracing for such items until concrete or masonry is set.
 2. Place in accordance with setting drawings and instructions.
 3. Build strap anchors, into masonry as work progresses.
- D. Field weld in accordance with AWS.
 1. Design and finish as specified for shop welding.
 2. Use continuous weld unless specified otherwise.
- E. Install anchoring devices and fasteners as shown and as necessary for securing metal fabrications to building construction as specified. Power actuated drive pins may be used except for removable items and where members would be deformed or substrate damaged by their use.

- F. Spot prime all abraded and damaged areas of zinc coating as specified and all abraded and damaged areas of shop prime coat with same kind of paint used for shop priming.

3.6 OTHER FRAMES

- A. Set frame flush with surface unless shown otherwise.
- B. Anchor frames at ends and not over 450 mm (18 inches) on centers unless shown otherwise.

3.13 LADDERS

- A. Anchor ladders to walls and floors with expansion bolts through turned lugs or angle clips or brackets.

3.14 RAILINGS

- A. Steel Posts:
 - 1. Secure fixed posts into concrete with sleeves or core drilled holes as shown in drawings.
 - 2. Install sleeves in concrete formwork.
 - 3. Set post in sleeve and pour grout to surface. Apply beveled bead of urethane sealant at perimeter of post or under flange fitting as specified in Section 07 92 00, JOINT SEALANTS—on exterior posts.
 - 7. Secure posts to steel with welds.
- G. Handrails:
 - 1. Anchor brackets for metal handrails as detailed.
 - 2. Install brackets within 300 mm (12 inches) of return of walls, and at evenly spaced intermediate points not exceeding 1200 mm (4 feet) on centers unless shown otherwise.
 - 3. Expansion bolt to concrete or solid masonry.
 - 4. Toggle bolt to installed supporting frame wall and to hollow masonry unless shown otherwise.

3.20 CLEAN AND ADJUSTING

- A. Adjust movable parts including hardware to operate as designed without binding or deformation of the members centered in the opening or frame and, where applicable, contact surfaces fit tight and even without forcing or warping the components.
- B. Clean after installation exposed prefinished and plated items and items fabricated from stainless steel, aluminum and copper alloys, as recommended by the metal manufacture and protected from damage until completion of the project.

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**SECTION 06 10 00
ROUGH CARPENTRY**

PART 1 - GENERAL

1.1 DESCRIPTION:

- A. This section specifies wood blocking, framing, sheathing, nailers, rough hardware, and light wood construction.

1.2 RELATED WORK:

- A. Gypsum sheathing: Section 09 29 00, GYPSUM BOARD.
B. Cement board sheathing: Section 06 16 63, CEMENTITIOUS SHEATHING.

1.3 SUBMITTALS:

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
1. Submit data for lumber.
 2. Submit data for wood-preserved treatment from chemical treatment manufacturer and certification from treating plants that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
 3. Submit 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.
 4. For products receiving a waterborne treatment, submit statement that moisture content of treated materials was reduced to levels specified before shipment to project site.
- C. Manufacturer's certificate for unmarked lumber.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING:

- A. Protect lumber and other products from dampness both during and after delivery at site.
- B. Pile lumber in stacks in such manner as to provide air circulation around surfaces of each piece.
- C. Stack plywood and other board products so as to prevent warping.
- D. Locate stacks on well drained areas, supported at least 152 mm (6 inches) above grade and cover with well-ventilated sheds having firmly constructed over hanging roof with sufficient end wall to protect lumber from driving rain.

1.5 QUALITY ASSURANCE:

- A. Installer: A firm with a minimum of three (3) years' experience in the type of work required by this section.

1.6 GRADING AND MARKINGS:

- A. Any unmarked lumber or plywood panel for its grade and species will not be allowed on VA Construction sites for lumber and material not normally grade marked, provide manufacturer's certificates (approved by an American Lumber Standards approved agency) attesting that lumber and material meet the specified the specified requirements.

1.7 APPLICABLE PUBLICATIONS:

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in the text by basic designation only.
- B. American Forest and Paper Association (AFPA):
- NDS-15.....National Design Specification for Wood
Construction
- WCD1-01.....Details for Conventional Wood Frame
Construction
- C. American Society of Mechanical Engineers (ASME):
- B18.2.1-12(R2013).....Square and Hex Bolts and Screws
- B18.2.2-10.....Square and Hex Nuts
- B18.6.1-81(R2008).....Wood Screws
- D. American Plywood Association (APA):
- E30-11.....Engineered Wood Construction Guide
- E. ASTM International (ASTM):
- A653/A653M-13.....Steel Sheet Zinc-Coated (Galvanized) or Zinc-
Iron Alloy Coated (Galvannealed) by the Hot Dip
Process
- C954-11.....Steel Drill Screws for the Application of
Gypsum Board or Metal Plaster Bases to Steel
Studs from 0.033 inch (2.24 mm) to 0.112-inch
(2.84 mm) in thickness
- C1002-14.....Steel Self-Piercing Tapping Screws for the
Application of Gypsum Panel Products or Metal
Plaster Bases to Wood Studs or Metal Studs
- D198-14.....Test Methods of Static Tests of Lumber in
Structural Sizes

- D2344/D2344M-13.....Test Method for Short-Beam Strength of Polymer
Matrix Composite Materials and Their Laminates
- F844-07a(R2013).....Washers, Steel, Plan (Flat) Unhardened for
General Use
- F1667-13.....Nails, Spikes, and Staples
- F. American Wood Protection Association (AWPA):
AWPA Book of Standards
- G. Commercial Item Description (CID):
A-A-55615.....Shield, Expansion (Wood Screw and Lag Bolt Self
Threading Anchors)
- H. Forest Stewardship Council (FSC):
FSC-STD-01-001(Ver. 4-0)FSC Principles and Criteria for Forest
Stewardship
- I. Military Specification (Mil. Spec.):
MIL-L-19140E.....Lumber and Plywood, Fire-Retardant Treated
- J. Environmental Protection Agency (EPA):
40 CFR 59(2014).....National Volatile Organic Compound Emission
Standards for Consumer and Commercial Products
- K. U.S. Department of Commerce Product Standard (PS)
PS 1-95.....Construction and Industrial Plywood
PS 20-10.....American Softwood Lumber Standard

PART 2 - PRODUCTS

2.1 LUMBER:

- A. Unless otherwise specified, each piece of lumber must bear grade mark, stamp, or other identifying marks indicating grades of material, and rules or standards under which produced.
1. Identifying marks are to be in accordance with rule or standard under which material is produced, including requirements for qualifications and authority of the inspection organization, usage of authorized identification, and information included in the identification.
 2. Inspection agency for lumber approved by the Board of Review, American Lumber Standards Committee, to grade species used.
- B. Lumber Other Than Structural:
1. Unless otherwise specified, species graded under the grading rules of an inspection agency approved by Board of Review, American Lumber Standards Committee.

2. Furring, blocking, nailers and similar items 101 mm (4 inches) and narrower Standard Grade; and, members 152 mm (6 inches) and wider, Number 2 Grade.

C. Sizes:

1. Conforming to PS 20.
2. Size references are nominal sizes, unless otherwise specified, actual sizes within manufacturing tolerances allowed by standard under which produced.

D. Moisture Content:

1. Maximum moisture content of wood products is to be as follows at the time of delivery to site.
 - a. Boards and lumber 50 mm (2 inches) and less in thickness: 19 percent or less.

E. Fire Retardant Treatment:

1. Comply with Mil Spec. MIL-L-19140.
2. Treatment and performance inspection, by an independent and qualified testing agency that establishes performance ratings.

F. Preservative Treatment:

1. Do not treat Heart Redwood and Western Red Cedar.
2. Treat wood members and plywood exposed to weather or in contact with plaster, masonry or concrete, including framing of open roofed structures; sills, sole plates, furring, and sleepers that are less than 610 mm (24 inches) from ground; nailers, edge strips, blocking, crickets, curbs, cant, vent strips and other members provided in connection with roofing and flashing materials.
3. Treat other members specified as preservative treated (PT).
4. Preservative treat by the pressure method complying with AWPA Book use category system standards U1 and T1, except any process involving the use of Chromated Copper Arsenate (CCA) or other agents classified as carcinogenic for pressure treating wood is not permitted.

2.2 PLYWOOD:

- A. Comply with PS 1.
- B. Bear the mark of a recognized association or independent inspection agency that maintains continuing control over quality of plywood which identifies compliance by veneer grade, group number, span rating where applicable, and glue type.
- C. Sheathing:

1. APA rated Exposure 1 or Exterior; panel grade CD or better.
2. Wall sheathing:
 - a. Minimum 9 mm (11/32 inch) thick with supports 406 mm (16 inches) on center and 12 mm (15/32 inch) thick with supports 610 mm (24 inches) on center unless specified otherwise.
 - b. Minimum 1200 mm (48 inches) wide at corners without corner bracing of framing.

2.3 ROUGH HARDWARE AND ADHESIVES:

- A. Anchor Bolts:
 1. ASME B18.2.1 and ASME B18.2.2 galvanized, 13 mm (1/2 inch) unless shown otherwise.
 2. Extend at least 203 mm (8 inches) into masonry or concrete with ends bent 50 mm (2 inches).
- B. Miscellaneous Bolts: Expansion Bolts: C1D A-A-55615; lag bolt, long enough to extend at least 65 mm (2-1/2 inches) into masonry or concrete. Provide 13 mm (1/2 inch) bolt unless shown otherwise.
- C. Washers
 1. ASTM F844.
 2. Provide zinc or cadmium coated steel or cast iron for washers exposed to weather.
- D. Screws:
 1. Wood to Wood: ASME B18.6.1 or ASTM C1002.
 2. Wood to Steel: ASTM C954, or ASTM C1002.
- E. Nails:
 1. Size and type best suited for purpose unless noted otherwise. Provide aluminum-alloy nails, plated nails, or zinc-coated nails, for nailing wood work exposed to weather and on roof blocking.
 2. ASTM F1667:
 - a. Common: Type I, Style 10.
 - b. Concrete: Type I, Style 11.
 - c. Barbed: Type I, Style 26.
 - d. Underlayment: Type I, Style 25.
 - e. Masonry: Type I, Style 27.
 - f. Provide special nails designed for use with ties, strap anchors, framing connectors, joists hangers, and similar items. Nails not less than 32 mm (1-1/4 inches) long, 8d and deformed or annular ring shank.

PART 3 - EXECUTION**3.1 INSTALLATION OF FRAMING AND MISCELLANEOUS WOOD MEMBERS:**

- A. Conform to applicable requirements of the following:
 - 1. AFPA NDS for timber connectors.
 - 3. AFPA WCD1 for nailing and framing unless specified otherwise.
 - 4. APA for installation of plywood or structural use panels.
- B. Fasteners:
 - 1. Nails.
 - a. Nail in accordance with the Recommended Nailing Schedule as specified in AFPA WCD1 where detailed nailing requirements are not specified in nailing schedule. Select nail size and nail spacing sufficient to develop adequate strength for the connection without splitting the members.
 - b. For sheathing and subflooring, select length of nails sufficient to extend 25 mm (1 inch) into supports.
 - c. Use 8d or larger nails for nailing through 25 mm (1 inch) thick lumber and for toe nailing 50 mm (2 inch) thick lumber.
 - d. Use 16d or larger nails for nailing through 50 mm (2 inch) thick lumber.
 - 2. Bolts:
 - a. Fit bolt heads and nuts bearing on wood with washers.
 - b. Countersink bolt heads flush with the surface of nailers.
 - c. Embed in concrete and solid masonry or provide expansion bolts. Special bolts or screws designed for anchor to solid masonry or concrete in drilled holes may be used.
 - d. Provide toggle bolts to hollow masonry or sheet metal.
 - e. Provide bolts to steel over 2.84 mm (0.112 inch, 11 gage) in thickness. Secure wood nailers to vertical structural steel members with bolts, placed one at ends of nailer and 610 mm (24 inch) intervals between end bolts. Provide clips to beam flanges.
 - 3. Drill Screws to steel less than 2.84 mm (0.112 inch) thick.
 - a. ASTM C1002 for steel less than 0.84 mm (0.033 inch) thick.
 - b. ASTM C954 for steel over 0.84 mm (0.033 inch) thick.
 - 4. Power actuated drive pins may be provided where practical to anchor to solid masonry, concrete, or steel.
 - 5. Do not anchor to wood plugs or nailing blocks in masonry or concrete. Provide metal plugs, inserts or similar fastening.

6. Screws to Join Wood:

- a. Where shown or option to nails.
- b. ASTM C1002, sized to provide not less than 25 mm (1 inch) penetration into anchorage member.
- c. Spaced same as nails.

C. Blocking Nailers, and Furring:

1. Install furring, blocking, nailers, and grounds where shown.
2. Provide longest lengths practicable.
3. Provide fire retardant treated wood blocking where shown at openings and where shown or specified.
4. Layers of Blocking or Plates:
 - a. Stagger end joints between upper and lower pieces.
 - b. Nail at ends and not over 610 mm (24 inches) between ends.
 - c. Stagger nails from side to side of wood member over 127 mm (5 inches) in width.

D. Sheathing:

1. Provide plywood for sheathing.
2. Lay panels with joints staggered, with edge and ends 3 mm (1/8 inch) apart and nailed over bearings as specified.
3. Set nails not less than 9 mm (3/8 inch) from edges.

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**SECTION 06 16 63
CEMENTITIOUS SHEATHING**

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cement board sheathing at exterior framed wall construction.

1.2 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this Section.

B. American National Standards Institute (ANSI):

1. A118.9-10 - Cementitious Backer Units.

C. ASTM International (ASTM):

1. C954-18 - Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness
2. C1002-18 - Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
3. C1325-14 - Non-Asbestos Fiber-Mat Reinforced Cementitious Backer Units.

1.3 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data:

1. Description of each product.
2. Installation instructions.
3. Warranty.

1.4 DELIVERY AND STORAGE

A. Deliver products in manufacturer's original sealed packaging.

B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, production run number, and manufacture date.

C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.5 STORAGE AND HANDLING

A. Store products indoors in dry, weathertight facility.

B. Protect products from damage during handling and construction operations.

1.6 WARRANTY

- A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."
- B. Manufacturer's Warranty: Warrant sheathing against material and manufacturing defects.
 - 1. Warranty Period: 10 years.

PART 2 - PRODUCTS**2.1 PRODUCTS - GENERAL**

- A. Provide each product from one manufacturer.

2.2 SHEATHING

- A. Cement Boards: Meeting ANSI A118.9 and ASTM C1325.
 - 1. Thickness: As noted in drawings.
 - 2. Width: 1219 mm (48 inches), minimum.

2.3 ACCESSORIES

- A. Steel Drill Screws: Corrosion-resistant, self-drilling.
 - 1. ASTM C1002, Type S for fastening to framing less than 0.8 mm (33 mils) thick.
 - 2. ASTM C954 for fastening to framing 0.8 mm (33 mils) thick and greater.
- B. Joint Reinforcement: Alkali resistant tape as recommended by sheathing manufacturer.
- C. Bonding Material: As recommended by sheathing manufacturer.

PART 3 - EXECUTION**3.1 PREPARATION**

- A. Examine and verify substrate suitability for product installation.
- B. Protect existing construction and completed work from damage.
- C. Verify framing is plumb and level and in plane.
- D. Correct substrate deficiencies.

3.2 SHEATHING INSTALLATION

- A. Install products according to manufacturer's instructions.
 - 1. Secure units to framing members with screws spaced maximum 200 mm (8 inches) o.c. and not closer than 13 mm (1/2 inch) from edge of unit.
 - 2. Install screw heads without penetrating cement board surface.

3. Install sheathing with 6 mm (1/4 inch) gap where sheathing abuts masonry or similar materials to prevent wicking of moisture.
4. Install sheathing with 10 mm (3/8 inch) gap where non-load-bearing construction abuts structural elements or building expansion joints.
5. Horizontal Installation: Abut ends of boards over centers of studs. Stagger end joints minimum one stud spacing for adjacent boards. Fasten boards at perimeter and within field of board to each stud.
6. Vertical Installation: Install board vertical edges centered over studs. Abut ends and edges of each board with those of adjacent boards. Fasten boards at perimeter and with fin field of board to each stud.
7. Apply bonding material to imbed tape and completely fill board joints, and gaps between each panel.

3.3 PROTECTION

- A. Remove loose or spalling joint finish. Patch areas missing joint finish.
- B. Replace broken or damaged boards.
- C. Protect boards from moisture using temporary coverings until finishes are applied.

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**SECTION 06 20 13
EXTERIOR FINISH CARPENTRY**

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior wood trim.
2. Lumber soffits and fascia.
3. Exterior ornamental trim.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for furring, blocking, and other carpentry work not exposed to view.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of factory-fabricated product. Indicate component materials, dimensions, profiles and include construction and application details.

1. Include data for wood-preservative treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained. Include chemical-treatment manufacturer's written instructions for finishing treated material.
2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced before shipment to Project site to levels specified.

B. Samples for Initial Selection: For each type of product involving selection of profiles.

1.3 INFORMATIONAL SUBMITTALS

A. Compliance Certificates:

1. For lumber that is not marked with grade stamp.
2. For preservative-treated wood that is not marked with treatment-quality mark.

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

1. Wood-preservative-treated wood.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber and other panels flat with spacers between each bundle to provide air circulation. Protect materials from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

1.5 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecast weather conditions permit work to be performed and at least one

coat of specified finish can be applied without exposure to rain, snow, or dampness.

- B. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.
 - 1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated.
- B. Factory mark each piece of lumber with grade stamp of inspection agency, indicating grade, species, moisture content at time of surfacing, and mill.
 - 1. For exposed lumber, mark grade stamp on end or back of each piece, or omit grade stamp and provide certificates of grade compliance issued by inspection agency.
- C. Softwood Plywood: DOC PS 1.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Water-Repellent Preservative Treatment by Nonpressure Process: AWP A N1; dip, spray, flood, or vacuum-pressure treatment.
 - 1. Preservative Chemicals: 3-iodo-2-propynyl butyl carbamate (IPBC).
 - 2. Use chemical formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants in solution to distinguish treated material from untreated material.
 - 3. Application: Exterior trim.
- B. Preservative Treatment by Pressure Process: AWP A U1; Use Category UC3a.
 - 1. Kiln dry lumber and plywood after treatment to a maximum moisture content of 19 and 18 percent, respectively.
 - 2. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
 - 3. Do not use material that is warped or does not comply with requirements for untreated material.
 - 4. Mark lumber with treatment-quality mark of an inspection agency approved by the American Lumber Standard Committee's Board of Review.

2.3 EXTERIOR TRIM

- A. Lumber Trim for Painted Finish:
 - 1. Species and Grade: Hem-fir, Prime or D finish; NLGA, WCLIB, or WWPA.
 - 2. Maximum Moisture Content: 15 percent with at least 85 percent of shipment at 12 percent or less.
 - 3. Finger Jointing: Not allowed.

4. Face Surface: Surfaced (smooth).
 5. Factory Priming: Factory coated on faces and edges, with exterior primer compatible with topcoats specified.
- B. Moldings for Painted Finish: MMPA WM 4, P-grade wood moldings. Made from kiln-dried stock to patterns included in MMPA's "WM/Series Wood Moulding Patterns."
1. Species: Eastern white, Idaho white, lodgepole, ponderosa, radiata, or sugar pine.
 2. Finger Jointing: Not allowed.
 3. Factory Priming: Factory coated on faces and edges, with exterior primer compatible with topcoats specified.

2.4 LUMBER SOFFITS AND FASCIA

- A. Provide kiln-dried lumber siding complying with DOC PS 20, factory coated with exterior primer compatible with topcoats specified.
- B. Species and Grade: Prime or D finish hem-fir; NLGA, WCLIB, or WWPA.

2.5 MISCELLANEOUS MATERIALS

- A. Fasteners for Exterior Finish Carpentry: Provide nails or screws, in sufficient length to penetrate not less than 1-1/2 inches (38 mm) into wood substrate.
1. For pressure-preservative-treated wood, provide hot-dip galvanized-steel fasteners.
 2. For applications not otherwise indicated, provide hot-dip galvanized-steel fasteners.
- B. Continuous Soffit Vents: Copper channel shape with 3/32 inch perforations on 5/32 inch staggered centers, 2 inches (51 mm) wide and in lengths not less than 96 inches (2438 mm).
1. Net-Free Area: 40 percent.

2.6 FABRICATION

- A. Back out or kerf backs of standing and running trim wider than 5 inches (125 mm), except members with ends exposed in finished work.
- B. Ease edges of lumber less than 1 inch (25 mm) in nominal thickness to 1/16-inch (1.5-mm) radius and edges of lumber 1 inch (25 mm) or more in nominal thickness to 1/8-inch (3-mm) radius.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of projections and substances detrimental to application.
- B. Prime lumber and moldings to be painted, including both faces and edges, unless factory primed. Cut to required lengths and prime ends. Comply with requirements in Section 099100 "Painting."

3.3 INSTALLATION, GENERAL

- A. Do not use materials that are unsound, warped, improperly treated or finished, inadequately seasoned, or too small to fabricate with proper jointing arrangements.
- B. Install exterior finish carpentry level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.
 - 1. Scribe and cut exterior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
 - 2. Install to tolerance of 1/8 inch in 96 inches (3 mm in 2438 mm) for level and plumb. Install adjoining exterior finish carpentry with 1/32-inch (0.8-mm) maximum offset for flush installation and 1/16-inch (1.5-mm) maximum offset for reveal installation.
 - 3. Coordinate exterior finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate exterior finish carpentry.

3.4 STANDING AND RUNNING TRIM INSTALLATION

- A. Install flat-grain lumber with bark side exposed to weather.
- B. Install trim with minimum number of joints as is practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches (610 mm) long, except where necessary.
 - 1. Use scarf joints for end-to-end joints.
 - 2. Stagger end joints in adjacent and related members.
- C. Fit exterior joints to exclude water. Cope at returns and miter at corners to produce tight-fitting joints, with full-surface contact throughout length of joint. Plane backs of casings to provide uniform thickness across joints, where necessary for alignment.
- D. Where face fastening is unavoidable, countersink fasteners, fill surface flush, and sand unless otherwise indicated.

3.5 ADJUSTING

- A. Replace exterior finish carpentry that is damaged or does not comply with requirements. Exterior finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing. Adjust joinery for uniform appearance.

3.6 CLEANING

- A. Clean exterior finish carpentry on exposed and semiexposed surfaces.

3.7 PROTECTION

- A. Protect installed products from damage from weather and other causes during construction.

- B. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.
 - 1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 062013

**SECTION 07 01 50.19
PREPARATION FOR RE-ROOFING**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Complete roof removal for new roof system installation.
- B. Existing Roofing Systems: EPDM (ballasted and adhered) and TPO (adhered). System components include:
 - 1. Pavers.
 - 2. Aggregate ballast.
 - 3. Roof insulation.
 - 4. Roofing membrane.
 - 5. Cover board.
 - 6. Roof insulation.
 - 7. Vapor retarder.
 - 8. Substrate board.
 - 9. Specific components for each roof area are noted in the roof demolition plans.

1.2 RELATED WORK

- A. Section 05 31 00, STEEL DECKING: Replacement Roof Deck.
- B. Section 06 10 00, ROUGH CARPENTRY: Replacement Parapet Sheathing and Blocking.
- C. Section 07 54 23, THERMOPLASTIC POLYOLEFIN (TPO) ROOFING: New Roofing System.
- D. Section 07 60 00, FLASHING AND SHEET METAL: Sheet Metal Counterflashing.

1.3 APPLICABLE PUBLICATIONS

- A. Comply with references to extent specified in this section.
- B. American National Standards Institute/Single-Ply Roofing Institute (ANSI/SPRI):
 - FX-1 (R2016).....Standard Field Test Procedure for Determining the Withdrawal Resistance of Roofing Fasteners.
- C. ASTM International (ASTM):
 - C578-19.....Rigid, Cellular Polystyrene Thermal Insulation.
 - D4263-83(2018).....Indicating Moisture in Concrete by the Plastic Sheet Method.

D. U.S. Department of Commerce National Institute of Standards and Technology (NIST):

DOC PS 1-19.....Structural Plywood.

DOC PS 2-18.....Performance Standard for Wood-Based
Structural-Use Panels.

1.4 PREINSTALLATION MEETINGS

A. Conduct preinstallation meeting minimum 30 days before beginning Work of this section.

1. Required Participants:

- a. Contracting Officer's Representative.
- b. Architect.
- c. Contractor.
- d. Installer.
- e. Manufacturer's field representative.
- f. Other installers responsible for adjacent and intersecting work, including mechanical and electrical equipment installers.

2. Meeting Agenda: Distribute agenda to participants minimum 3 days before meeting.

- a. Removal and installation schedule.
- b. Removal and installation sequence.
- c. Preparatory work.
- d. Protection before, during, and after installation.
- e. Removal and installation.
- f. Temporary roofing including daily terminations.
- g. Transitions and connections to other work.
- h. Inspecting and testing.
- i. Other items affecting successful completion.

3. Document and distribute meeting minutes to participants to record decisions affecting installation.

1.5 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Photographs: Document existing conditions potentially affected by roofing operations before work begins.

1.6 QUALITY ASSURANCE

A. Installer Qualifications:

1. Same installer as Section 07 54 23, THERMOPLASTIC POLYOLEFIN (TPO) ROOFING.

1.7 FIELD CONDITIONS

- A. Building Occupancy: Perform work to minimize disruption to normal building operations.
 - 1. Verify occupants are evacuated from affected building areas when working on structurally impaired roof decking above occupied areas.
 - 2. Provide notice minimum 72 hours before beginning activities affecting normal building operations.
- B. Weather Limitations: Proceed with reroofing preparation only during dry weather conditions as specified for new roofing installation in Section 07 54 23, THERMOPLASTIC POLYOLEFIN (TPO) ROOFING.
 - 1. Remove only as much roofing in one day as can be made watertight in same day.
- C. Hazardous materials are not expected in existing roofing system.
 - 1. Do not disturb suspected hazardous materials. If materials are discovered that are suspected to be of hazardous content, notify Contracting Officer's Representative immediately.
 - 2. Hazardous materials discovered during execution of the work will be removed by Government as work of a separate contract.

1.8 WARRANTY

- A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS**2.1 MATERIALS**

- A. Patching Materials: Match existing roofing system materials.
- B. Plywood Sheathing: See Section 06 10 00, ROUGH CARPENTRY.
- C. Metal Flashing: See Section 07 60 00, FLASHING AND SHEET METAL.
- D. Temporary Protection Materials:
 - 1. Expanded Polystyrene (EPS) Insulation: ASTM C578-19.
 - 2. Plywood: NIST DOC PS 1-19, Grade CD Exposure 1-18.
 - 3. Oriented Strand Board (OSB): NIST DOC PS 2-18, Exposure 1.
- E. Temporary Roofing System Materials: Contractor's option.
 - 1. Insulation: See Section 07 22 00, ROOF AND DECK INSULATION.
- F. Fasteners: Type and size required by roof membrane manufacturer to resist wind uplift.

PART 3 - EXECUTION**3.1 PREPARATION**

- A. Examine and verify substrate suitability for product installation.
- B. Protect existing construction and completed work from damage.

- C. Protect landscaping from damage.
- D. Maintain access to existing walkways and adjacent occupied facilities.
- E. Coordinate use of rooftop fresh air intakes with Contracting Officer's Representative to minimize effect on indoor air quality.
- F. Ensure temporary protection materials are available for immediate use in case of unexpected rain.
- G. Ensure roof drainage remains functional.
 - 1. Keep drainage systems clear of debris.
 - 2. Prevent water from entering building and existing roofing system.
- H. Coordinate rooftop utilities remaining active during roofing work with Contracting Officer's Representative.

3.2 RE-ROOFING PREPARATION - GENERAL

- A. Notify Contracting Officer's Representative of planned operations, daily.
 - 1. Identify location and extent of roofing removal.
 - 2. Request authorization to proceed.

3.3 OVERBURDEN REMOVAL

- A. Remove aggregate ballast.
- B. Remove pavers..
 - 1. Dispose of pavers.

3.4 COMPLETE ROOFING SYSTEM REMOVAL

- A. Remove existing roofing system completely, exposing structural roof deck.
 - 1. Remove cover boards, roof insulation, vapor retarders, and substrate boards.
 - 2. Remove or cut-off roofing system fasteners. Cut-off fasteners should not be allowed to fall onto finished spaces or onto APC ceilings below.

3.5 DECK PREPARATION

- A. Inspect structural roof deck after roofing system removal.
- B. Concrete Roof Decks:
 - 1. Visually confirm concrete roof deck is dry.
 - 2. Remove any mastics or adhesives that may impact the installation of new roofing products.
 - 3. Perform moisture test according to ASTM D4263-83(2018) each day for each separate roof area.
 - a. Proceed with roofing work only when moisture is not observed.
- C. Steel Roof Decks:

1. Visually inspect structural roof deck installation and fasteners.
 - a. Notify Contracting Officer's Representative of unsuitable conditions and inadequate fastenings potentially affecting roof system performance.
2. Secure roof deck with additional fastenings as determined by Contracting Officer's Representative.
3. Replace roof deck as indicated on drawings.
 - a. Replacement Roof Deck: See Section 05 31 00, STEEL DECKING.

3.6 TEMPORARY ROOFING

- A. Install temporary roofing to maintain building watertight.
- B. Remove temporary roofing before installing new roofing.

3.7 BASE FLASHING REMOVAL

- A. Expose base flashings to permit removal.
 1. Two-Piece Counterflashings: Remove cap flashing and store for reuse.
 2. Single Piece Counterflashings: Carefully bend counterflashing or remove as indicated in drawings.
 3. Metal Copings: Remove and dispose of.
- B. Remove existing base flashings.
 1. Clean substrates to receive new flashings.
- C. Replace counterflashings damaged during removal.
 1. Counterflashings: See Section 07 60 00 FLASHING AND SHEET METAL.

3.8 DISPOSAL

- A. Collect waste materials in containers.
- B. Remove waste materials from project site, regularly, to prevent accumulation.
- C. Legally dispose of waste materials.

- - E N D - -

SECTION 07 13 52
MODIFIED BITUMINOUS SHEET WATERPROOFING

PART 1 - GENERAL**1.1 SUMMARY**

A. Section Includes:

1. Modified bituminous sheet material used for exterior below grade waterproofing.

1.2 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.

B. ASTM International (ASTM):

C578-19.....Rigid, Cellular Polystyrene Thermal Insulation.

D41/D41M-11(2016).....Asphalt Primer Used in Roofing, Dampproofing
and Waterproofing.

D4586/D4586M-07(2018)...Asphalt Roof Cement, Asbestos-Free.

D6380/D6380M-03(2018)...Asphalt Roll Roofing (Organic Felt).

1.3 SUBMITTALSA. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA,
AND SAMPLES.

B. Manufacturer's Literature and Data:

1. Description of each product.
2. Installation instructions.
3. Warranty.

C. Samples:

1. Waterproofing and Flashing Sheet: 200 mm (8 inch) square, each type
and color.
2. Insulation: 200 mm (8 inch) square.

D. Test reports: Certify products comply with specifications.

E. Certificates: Certify products comply with specifications.

1.4 DELIVERY

A. Deliver products in manufacturer's original sealed packaging.

B. Mark packaging, legibly. Indicate manufacturer's name or brand, type,
color, production run number, and manufacture date.C. Before installation, return or dispose of products within distorted,
damaged, or opened packaging.**1.5 STORAGE AND HANDLING**

A. Store products indoors in dry, weathertight conditioned facility.

B. Protect products from damage during handling and construction
operations.

1.6 FIELD CONDITIONS**A. Environment:**

1. Product Temperature: Minimum 4 degrees C (40 degrees F) for minimum 48 hours before installation.
2. Weather Limitations: Install waterproofing only during dry current and forecasted weather conditions.

1.7 WARRANTY

- A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS**2.1 SYSTEM DESCRIPTION**

- A. Waterproofing System: Modified bituminous sheet material for exterior below grade.

2.2 PRODUCTS - GENERAL

- A. Provide each product from one manufacturer.

2.3 BITUMINOUS SHEET

- A. Cold applied waterproofing membrane composed primarily of modified bituminous material prefabricated in sheet form designed for below grade exterior. Sheet reinforced with fibers at manufacturer's option.
- B. Thickness: Not less than 1.5 mm (60 mils), plus or minus 0.13 mm (5 mils), and bonded to 0.1 mm (4 mil) thick plastic sheet.
- C. Provide release sheet to prevent bonding of bituminous sheet to itself.

2.4 PROTECTION MATERIAL

- A. Polystyrene Insulation: ASTM C578, Type I or VIII, 13 mm (1/2 inch) minimum thickness.

2.5 ACCESSORIES

- A. Patching Compound: Factory-prepared, non-shrinking, fast-setting, cementitious adhesive compound containing no ferrous metal or oxide.
- B. Primer: ASTM D41/D41M.
- C. Roof Cement: ASTM D4586/D4586M.

PART 3 - EXECUTION**3.1 PREPARATION**

- A. Examine and verify substrate suitability for product installation.
1. Concrete surfaces cured minimum time recommended by waterproofing manufacturer.
 2. Substrate to be dry as recommended by waterproofing manufacturer.
- B. Protect existing construction and completed work from damage.
- C. Correct substrate deficiencies.

1. Fill voids, joints, and cracks with patching compound.
- D. Clean substrates. Remove contaminants capable of preventing full adhesion.
- E. Priming:
 1. Prime concrete and masonry surfaces.
 2. Application method, amount of primer and condition or primer before installation of bituminous sheet as recommended by primer manufacturer.
 3. Reprime when required according to manufacturer's instructions.

3.2 INSTALLATION - GENERAL

- A. Install products according to manufacturer's instructions and approved submittal drawings.
 1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.

3.3 WATERPROOFING INSTALLATION

- A. Bituminous Sheet Installation:
 1. Remove release sheet before application.
 2. Lay bituminous sheet from low point to high point so laps shed water.
 3. Treat expansion, construction and control joints and evident working cracks as expansion joints. Apply bituminous sheet in double thickness over joint by first applying a strip of bituminous sheet minimum 200 mm (8 inches) wide, centered over joint.
 4. Lap seams minimum 50 mm (2 inches).
 5. Lay succeeding sheet with laps, and roll or press into place.
 6. Repair misaligned or inadequately lapped seams according to manufacturer's instructions.
 7. Seal seams and terminations according to sheet manufacturer's instructions.
- B. Corner Treatment:
 1. At inside and outside corners, apply double cover using an initial strip minimum 280 mm (11 inches) wide, centered along axis of corner.
 2. Cover each strip completely by the regular application of bituminous sheet.
 3. Provide a fillet or cant on inside corners.
 4. Form cants using patching compound.

5. Do not use wood, fiber, and insulating materials for cants.

C. Projection Treatment:

1. Apply a double layer of bituminous sheet around pipes and similar projections at least 150 mm (6 inches) wide.
2. At drains, apply a bead of roof cement over a double layer of bituminous sheet under clamping rings.

D. Patching:

1. Repair tears, punctures, air blisters, and inadequately lapped seams, according to manufacturer's instructions before protection course is applied.

E. Permanent Protection:

1. Vertical Surfaces:

- a. Install polystyrene insulation protection material.
- b. Extend protection full height from footing to top of backfill.

F. Temporary Protection:

1. When waterproofing materials are subjected to damage by sunlight and cannot be immediately protected as specified, protect waterproofing materials by waterproof building paper or suitable coating approved by manufacturer of waterproofing system used.

3.4 CLEANING

- A. Remove excess adhesive before adhesive sets.
- B. Clean exposed waterproofing surfaces. Remove contaminants and stains.

3.5 PROTECTION

- A. Protect waterproofing from construction operations.
- B. Remove protective materials immediately before acceptance.
- C. Repair damage.

- - - E N D - - -

**SECTION 07 21 13
THERMAL INSULATION**

PART 1 - GENERAL**1.1 SUMMARY**

- A. Section Includes:
 - 1. Thermal insulation.
 - a. Board insulation at masonry cavity walls.

1.2 RELATED WORK

- A. Section 04 20 00, UNIT MASONRY: Insulation for Cavity Face of Masonry.
- B. Section 07 22 00, ROOF AND DECK INSULATION; Insulation for roofing.

1.3 APPLICABLE PUBLICATIONS

- A. Comply with references to extent specified in this section.
- B. ASTM International (ASTM):
 - C578-19.....Rigid, Cellular Polystyrene Thermal Insulation.
 - C591-20.....Unfaced Preformed Rigid Cellular
Polyisocyanurate Thermal Insulation.
 - E84-20.....Surface Burning Characteristics of Building
Materials.
 - F1667-18a.....Driven Fasteners: Nails, Spikes, and Staples.

1.4 SUBMITTALS

- A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Submittal Drawings:
 - 1. Show insulation type, thickness, and R-value for each location.
- C. Manufacturer's Literature and Data:
 - 1. Description of each product.
 - 2. Adhesive indicating manufacturer recommendation for each application.

1.5 DELIVERY

- A. Deliver products in manufacturer's original sealed packaging.
- B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, production run number, and manufacture date.
- C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.6 STORAGE AND HANDLING

- A. Store products indoors in dry, weathertight facility.

B. Protect products from damage during handling and construction operations.

C. Protect foam plastic insulation from UV exposure.

1.7 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 INSULATION - GENERAL

A. Insulation Thickness:

1. Provide thickness indicated on drawings.

B. Insulation Types:

1. Provide one insulation type for each application.

2.2 THERMAL INSULATION

A. Perimeter Insulation In Contact With Soil:

1. Polystyrene Board: ASTM C578, Type IV, V, VI, VII, or IX.

B. Masonry Cavity Wall Insulation:

1. Polyurethane or Polyisocyanurate Board: ASTM C591, Type I, with vapor retarder facing; maximum permeance 29 ng/Pa/s/sq. m (0.5 perms).

2.3 ACCESSORIES

A. Insulation Adhesive: Nonflammable type recommended by insulation manufacturer to suit application.

B. Tape: Pressure sensitive adhesive on one face.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine and verify substrate suitability for product installation.

B. Protect existing construction and completed work from damage.

C. Clean substrates. Remove contaminants capable of affecting subsequently installed product's performance.

3.2 INSTALLATION - GENERAL

A. Install products according to manufacturer's instructions and approved submittal drawings.

1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.

B. Install insulation with vapor barrier facing the heated side, unless indicated otherwise.

- C. Install board insulation with joints close and flush, in regular courses, and with end joints staggered.
- D. Fit insulation tight against adjoining construction and penetrations, unless indicated otherwise.

3.3 THERMAL INSULATION

- A. Masonry Cavity Wall Insulation:
 - 1. Install insulation on exterior faces of concrete and masonry inner wythes of cavity walls.
 - 2. Bond polyurethane or polyisocyanurate board to surfaces with adhesive.
 - 3. Fill insulation joints with same material used for bonding.

3.4 CLEANING

- A. Remove excess adhesive before adhesive sets.

3.5 PROTECTION

- A. Protect insulation from construction operations.
- B. Repair damage.

- - E N D - -

**SECTION 07 22 00
ROOF AND DECK INSULATION**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
- B. Roof and deck insulation, vapor retarder, and cover board on existing concrete and metal deck substrates ready to receive roofing membrane.

1.2 RELATED WORK

- A. Section 06 10 00, ROUGH CARPENTRY: Wood Blocking, and Edge Strips.

1.3 APPLICABLE PUBLICATIONS

- A. Comply with references to extent specified in this section.
- B. American Society of Civil Engineers
ASCE 7-16.....Minimum Design Loads and Associated Criteria
for Buildings and Other Structures
- C. American Society of Heating, Refrigeration and Air Conditioning
(ASHRAE):
Standard 90.1-13.....Energy Standard for Buildings Except Low-Rise
Residential Buildings.
- D. ASTM International (ASTM):
C1177/C1177M-17.....Glass Mat Gypsum Substrate for Use as
Sheathing.
C1289-19.....Faced Rigid Cellular Polyisocyanurate Thermal
Insulation Board.
D41/D41M-11 (2016).....Asphalt Primer Used in Roofing, Dampproofing,
and Waterproofing.
D312/D312M-16a.....Asphalt Used in Roofing.
D1970/D1970M-20.....Self-Adhering Polymer Modified Bituminous Sheet
Materials Used as Steep Roofing Underlayment
for Ice Dam Protection.
D2178/D2178M-15a.....Asphalt Glass Felt Used in Roofing and
Waterproofing.
D4586/D4586M-07(2018)...Asphalt Roof Cement, Asbestos-Free.
E84-20.....Surface Burning Characteristics of Building
Materials.
F1667-18a.....Driven Fasteners: Nails, Spikes, and Staples.
- E. National Roofing Contractors Association (NRCA):
Manual-15.....The NRCA Roofing Manual: Membrane Roof Systems-
2019.

F. UL LLC (UL):

Listed Online Certifications Directory.

G. U.S. Department of Agriculture (USDA):

USDA BioPreferred Program Catalog.

H. U.S. Department of Commerce National Institute of Standards and Technology (NIST):

DOC PS 1-19.....Structural Plywood.

DOC PS 2-18.....Performance Standard for Wood-Based
Structural-Use Panels.

1.4 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Submittal Drawings:

1. Show size, configuration, and installation details.

a. Nailers and terminations.

b. Layout of insulation showing slopes, tapers, penetrations, and edge conditions.

C. Manufacturer's Literature and Data:

1. Description of each product.

D. Samples:

1. Roof insulation, each type.

2. Fasteners, each type.

E. Qualifications: Substantiate qualifications meet specifications.

1. Installer.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Same installer as Division 07 roofing section installer.

1.6 DELIVERY

A. Comply with recommendations of NRCA Manual.

B. Deliver products in manufacturer's original sealed packaging.

C. Mark packaging, legibly. Indicate manufacturer's name or brand, type, and manufacture date.

D. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.7 STORAGE AND HANDLING

A. Comply with recommendations of NRCA Manual.

B. Store products indoors in dry, weathertight facility.

- C. Protect products from damage during handling and construction operations.

1.8 FIELD CONDITIONS

- A. Environment: Install products when existing and forecasted weather permit installation according to manufacturer's instructions.

1.9 WARRANTY

- A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."
- B. Manufacturer's Warranty: Warrant substrate board, vapor retarder, insulation, and cover board against material and manufacturing defects as part of Division 07 roofing system warranty.

PART 2 - PRODUCTS

2.1 SYSTEM PERFORMANCE

- A. Insulation Thermal Performance:
 - 1. Overall Average R-Value: R-30, minimum.
 - 2. Any Location R-Value: R-8, minimum.
- B. Fire and Wind Uplift Resistance: Provide roof insulation complying with requirements specified in Division 07 roofing section.
- C. Insulation on Metal Decking: UL labeled indicating compliance with one of the following:
 - 1. UL Listed.
 - 2. Insulation Surface Burning Characteristics: When tested according to ASTM E84.
 - a. Flame Spread Rating: 75 maximum.
 - b. Smoke Developed Rating: 150 maximum.

2.2 PRODUCTS - GENERAL

- A. Provide each product from one manufacturer.

2.3 ADHESIVES

- A. Primer: ASTM D41/D41M.
- B. Asphalt: ASTM D312, Type III or IV for vapor retarders and insulation.
- C. Bead-Applied Urethane Insulation Adhesive: Insulation manufacturer's recommended bead-applied, low-rise, one- or multicomponent urethane adhesive formulated to adhere roof insulation to substrate or to another insulation layer.
- D. Full-Spread Applied Urethane Insulation Adhesive: Insulation manufacturer's recommended spray-applied, low-rise, two-component urethane adhesive formulated to adhere roof insulation to substrate or to another insulation layer.

- E. Roof Cement: Asbestos free, ASTM D2822/D2822M, Type I or Type II; or, ASTM D4586/D4586M, Type I or Type II.

2.4 ROOF AND DECK INSULATION

- A. Roof and Deck Insulation, General: Preformed roof insulation boards approved by roofing manufacturer.
- B. Polyisocyanurate Board Insulation: ASTM C1289, Type II, Class 1, Grade 2, faced with glass fiber reinforced cellulosic felt facers on both major surfaces of the core foam.
- C. Tapered Roof Insulation System:
1. Fabricate of polyisocyanurate. Use only one insulation material for tapered sections. Use only factory-tapered insulation.
 2. Cut to provide high and low points with crickets and slopes as shown.
 3. Minimum thickness of tapered sections; 38 mm (1-1/2 inch).
 4. Minimum slope 1/48 (1/4 inch per 12 inches).
- D. Composite Nail Base Insulated Roof Sheathing:
1. Oriented-Strand-Board-Surfaced, Polyisocyanurate-Foam Sheathing: Polyisocyanurate thermal insulation ASTM C1289, Type V, insulation thickness as shown, with oriented strand board laminated to top surface.
 2. Oriented Strand Board: NIST DOC PS 1, Exposure 1, 16 mm (5/8 inch) thick.
 3. Bottom surface faced with felt facers.

2.5 INSULATION ACCESSORIES

- A. Glass (Felt): ASTM D2178/D2178M, Type VI, heavy duty ply sheet.
- B. Vapor Retarder:
1. Self-Adhering Sheet Vapor Retarder: ASTM D1970/D1970M, minimum 1.0 mm (40 mils) thick membrane of HDPE film fully coated with asphalt adhesive, or 0.76 to 1.0 mm (30 to 40 mils) thick membrane of butyl rubber based adhesive backed by a layer of high density cross-laminated polyethylene; maximum permeance rating of 6 ng/Pa/s/sq. m (0.1 perms).
 2. Polyethylene Film: ASTM D4397, 10 mil (0.25 mm) thick, minimum, with maximum permeance rating of 0.076 perm (0.050 metric perm)].
 - a. Tape: Pressure-sensitive tape of type recommended by vapor retarder manufacturer for sealing joints and penetrations in vapor retarder.
- C. Cover Board:

1. Glass-Mat, Water-Resistant Gypsum Roof Board: ASTM C1177/C1177M, 16 mm (5/8 inch) thick, factory primed.

2.6 ACCESSORIES

- A. Fasteners: Corrosion-resistant carbon steel fasteners and galvalume-coated steel or plastic round plates for fastening substrate board and insulation to roof deck.
- B. Nails: ASTM F1667; type to suit application.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Comply with requirements of Division 07 roofing section.

3.2 PREPARATION

- A. Examine and verify substrate suitability for product installation.
- B. Protect existing construction and completed work from damage.

3.3 INSTALLATION - GENERAL

- A. Install products according to manufacturer's instructions.
 1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.
- B. Comply with requirements of UL for insulated steel roof deck.
- C. Attach substrate board and other products to meet requirements of Division 07 roofing section.

3.4 VAPOR RETARDER INSTALLATION

- A. Vapor Retarder Installation, General:
 1. Install continuous vapor retarder on roof decks where indicated.
 2. At vertical surfaces, turn up vapor retarder to top of insulation or base flashing.
 3. Seal penetrations through vapor retarder with roof cement to prevent moisture entry from below.
- B. Cast in Place Concrete Decks:
 1. Prime substrate if required by manufacturer. Install self-adhering-sheet vapor retarder over area to receive vapor retarder, side and end lapping each sheet a minimum of 3-1/2 and 6 inches (90 and 150 mm), respectively. Seal laps by rolling.
- C. Metal Decks:
 1. Loosely lay polyethylene-film vapor retarder in a single layer over area to receive vapor retarder, side and end lapping each sheet a minimum of 2 and 6 inches (50 and 150 mm), respectively. Continuously seal side and end laps with tape.

3.5 INSULATION INSTALLATION**A. Insulation Thickness:**

1. Thickness of roof insulation shown on drawings is nominal. Provide thickness required to comply with specified thermal performance.
2. Insulation on Metal Decks: Provide insulation in minimum thickness recommended by insulation manufacturer to span deck flutes. Support edges of insulation on metal deck ribs.
3. When actual insulation thickness differs from drawings, coordinate alignment and location of roof drains, flashing, gravel stops, fascias and similar items.
4. Where tapered insulation is used, maintain insulation thickness at high points and roof edges shown on drawings.
 - a. Low Point Thickness: Minimum 38 mm (1-1/2 inches).
5. Use minimum two layers of insulation with joints offset a minimum of 6 inches..

B. Lay insulating units with close joints, in regular courses and with end joints staggered.

1. Stagger joints between layers minimum 150 mm (6 inches).

C. Seal cut edges at penetrations and at edges against blocking with bitumen or roof cement.**D. Cut to fit tightly against blocking or penetrations.****E. Cover all insulation installed on the same day; comply with temporary protection requirements of Division 07 roofing section.****F. Installation Method:****1. Adhered Insulation at Concrete Roof Decks:**

- a. Prime substrate as required.
- b. Set each layer of insulation firmly in ribbons of bead-applied insulation adhesive or in uniform application of full-spread insulation adhesive.

2. Mechanically Fastened Insulation at Metal Roof Decks:

- a. Fasten insulation according to requirements in Division 07 roofing section.
- b. Fasten insulation to resist uplift pressures specified in Division 07 roofing section and ASCE-7.

3.6 COVER BOARD INSTALLATION

- A. Install cover boards over insulation with long joints in continuous straight lines with staggered end joints.

- B. Offset cover board joints from insulation joints 150 mm (6 inches), minimum.
- C. Secure cover boards according to "Adhered Insulation" and "Mechanically Fastened Insulation" requirements.

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SECTION 07 24 00
DIRECT EXTERIOR FINISH SYSTEMS

PART 1 - GENERAL**1.1 SUMMARY**

A. Section Includes:

1. Drainable direct exterior finish systems (DEFS).

1.2 RELATED WORK

A. Section 06 16 63, CEMENTITIOUS SHEATHING; Cement Board Sheathing.

B. Section 09 29 00, GYPSUM BOARD: Gypsum Board Sheathing.

1.3 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.

B. ASTM International (ASTM):

B117-19.....Operating Salt Spray (Fog) Apparatus.

C67/C67M-20.....Sampling and Testing Brick and Structural Clay
Tile.

C177-19.....Steady-State Heat Flux Measurements and Thermal
Transmission Properties by Means of the
Guarded-Hot-Plate Apparatus.

C297/C297M-16.....Flatwise Tensile Strength of Sandwich
Constructions.

C578-19.....Rigid, Cellular Polystyrene Thermal Insulation.

C666/C666M-15.....Resistance of Concrete to Rapid Freezing and
Thawing.

C920-18.....Elastomeric Joint Sealants.

D968-17.....Abrasion Resistance of Organic Coatings by
Falling Abrasive.

D2794-93(2019).....Resistance of Organic Coatings to the Effects
of Rapid Deformation (Impact).

E84-20.....Surface Burning Characteristics of Building
Materials.

E96/E96M-16.....Water Vapor Transmission of Materials.

E119-20.....Fire Tests of Building Construction and
Materials.

E330/E330M-14.....Structural Performance of Exterior Windows,
Doors, Skylights and Curtain Walls by Uniform
Static Air Pressure Difference.

E331-00(2016).....Water Penetration of Exterior Windows,
Skylights, Doors, and Curtain Wall by Uniform
Static Air Pressure Differences.

E2486/E2486M-13(2018)...Impact Resistance of Class PB and PI Exterior
Insulation and Finish Systems (EIFS).

G90-17.....Performing Accelerated Outdoor Weathering of
Nonmetallic Materials Using Concentrated
Natural Sunlight.

1.4 PREINSTALLATION MEETINGS

- A. Conduct preinstallation meeting at project site minimum 30 days before beginning Work of this section.
 - 1. Required Participants:
 - a. Contracting Officer's Representative.
 - b. Architect/Engineer.
 - c. Contractor.
 - d. Installer.
 - e. Other installers responsible for adjacent and intersecting work, including air barriers and sealants.
 - 2. Meeting Agenda: Distribute agenda to participants minimum 3 days before meeting.
 - a. Installation schedule.
 - b. Installation sequence.
 - c. Preparatory work.
 - d. Protection before, during, and after installation.
 - e. Installation.
 - f. Terminations.
 - g. Transitions and connections to other work.
 - h. Other items affecting successful completion.
 - 3. Document and distribute meeting minutes to participants to record decisions affecting installation.

1.5 SUBMITTALS

- A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Submittal Drawings:
 - 1. Show size, configuration, and fabrication and installation details.
 - 2. Show details for corner treatment, soffits, penetrations, flashing, and other special applications.
- C. Manufacturer's Literature and Data:

1. Description of each product.
 2. Installation instructions.
 3. Warranty.
- D. Samples: Two 300 mm (1 foot) square samples of finishes over cement board identical to proposed installation in thickness, color, texture and workmanship.
- E. Test reports: Certify each product and complete system complies with specifications.
- F. Qualifications: Substantiate qualifications comply with specifications.
1. Installer with project experience list.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications:
1. Regularly installs specified products.
 2. Installed specified products with satisfactory service on five similar installations for minimum five years.

1.7 DELIVERY

- A. Deliver products in manufacturer's original sealed packaging.
- B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, production run number, and manufacture date.
- C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.8 STORAGE AND HANDLING

- A. Store products indoors in dry, weathertight conditioned facility.
- B. Protect products from damage during handling and construction operations.

1.9 FIELD CONDITIONS

- A. Environment: Unless greater temperature is required by system manufacturer, install products only when ambient air temperature is minimum 7 degrees C (45 degrees F) and rising and predicted to persist for 24 hours after installation.

1.10 WARRANTY

- A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."
- B. Manufacturer's Warranty: Warrant EIFS system materials against material and manufacturing defects.
1. Warranty Period: 10 years.

PART 2 - PRODUCTS**2.1 PRODUCTS - GENERAL**

- A. Provide system components from one manufacturer.

2.2 DIRECT EXTERIOR FINISH SYSTEMS (DEFS)

- A. Description: Direct exterior finish system consisting of synthetic base coat with reinforcing mesh, and simulated stucco finish coat applied over an exterior cement board that is installed over a drainage spacer and water-resistive barrier.

- B. Water resistive barrier: Flexible roller or trowel applied polymer based, non-cementitious, protective air/water-resistive barrier applied over acceptable exterior substrates.

1. Joint tape: An open weave fiberglass mesh tape with pressure sensitive adhesive in rolls 4 in (102 mm) wide by 100 yds (91 m) long.

- C. Spacer: A polyethylene spacer, installed over the water resistive barrier which separates the exterior cement board from the sheathing substrate 1/8 in (3.2 mm) thick by 3 in (76 mm) wide.

- D. Stucco Finish:

1. Base coat: Ready-to-mix, Portland cement mortar containing dry latex polymers.
2. Finish coat: Pre-colored, ready-mixed, polymeric coating.

- E. Performance Requirements:

1. Surface Burning Characteristics: When tested according to ASTM E84.
- a. Flame Spread Rating: 25 maximum.
- b. Smoke Developed Rating: 450 maximum.
2. Abrasion Resistance: ASTM D968; 500 liters of light smoothing sand with no loss of film integrity.
3. Bond Strength (with gypsum board sheathing): ASTM C297/C297M, 345 kPa (50 psi).
4. Salt Spray Resistance: ASTM B117; 300 hours exposure with no deleterious effects.
5. Freeze/Thaw Resistance (with gypsum board sheathing): ASTM C666/C666M; 100 Cycles with no deterioration, no delamination.
6. Accelerated Weathering: ASTM G90; 2000 hours with no deterioration.
7. Rapid Deformation: ASTM D2794; No cracking or impact failure.

- F. Accessories:

1. Trim, control joints, casing beads, casing beads with weeps, and corner beads as recommended by DEFS manufacturer.

2. Joint Reinforcement:

- a. Reinforcing tape: Minimum 100 mm (4 inch) wide, polymer coated, open mesh glass fiber tape.
 - b. Tape embedding material: Ready-to-mix Portland cement mortar base coat containing dry latex polymers.
3. Sealant: ASTM C920, Class 50 with 100 percent recovery. Type, grade and use as recommended by the sealant manufacturer.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine and verify substrate suitability for product installation.
- B. Protect existing construction and completed work from damage.
- C. Notify Contracting Officer's Representative in writing of conditions detrimental to proper completion of work.
- D. Do not proceed with work until unsatisfactory conditions are corrected.

3.2 INSTALLATION - GENERAL

- A. Install products according to manufacturer's instructions and approved submittal drawings.
 1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.

3.3 CONTROL JOINT INSTALLATION

- A. See drawings for location of building control joints and surface control joints.
- B. Install surface control joints as follows:
 1. Direct Exterior Finish: Install at 6 meters (20 feet) maximum on center, both directions, erecting continuous vertical joints first at building expansion joints, intersection of dissimilar substrates or finishing materials where concentrated stresses or movement is anticipated. Leave 13 mm (1/2inch) minimum continuous gap between board panels to receive control joint.

3.4 SEALANT INSTALLATION

- A. Direct Exterior Finish System: Apply sealant at intersections of cement board with windows, doors, control joints, other openings and locations as shown on drawings.
- B. Do not apply sealant in locations intended for water drainage.

3.5 DIRECT EXTERIOR FINISH SYSTEM INSTALLATION

- A. Water Resistive Barrier: Apply joint tape over all sheathing joints, including inside and outside corners and trowel apply a layer of water

resistive barrier over the tape. Apply water resistive barrier over the entire wall surface, including previously treated joints. Refer to the manufacturer's instructions for proper tools and respective coverage. Allow water resistive barrier to dry per manufacturer's instructions.

- B. Spacer: Secure the spacer to the gypsum sheathing in continuous vertical strips spaced a maximum of 16 in (406 mm) on center installed over each framing member using corrosion resistant staples through the water-resistive barrier and into the substrate or framing. Additionally, install the spacers flush with the vertical edge of all system terminations and changes in wall direction. Do not install spacers horizontally.
- C. Cement Board: Install in accordance with manufacturer's instructions and Section 06 16 63 - Cementitious Sheathing.
1. Align sheathing joints with the spacer and install fasteners through the spacer as needed.
 2. Do not align joints with corners of wall penetrations.
 3. Exterior cement board joints shall be offset from gypsum sheathing board substrate joints.
- D. Trim: Install trim pieces and flash per project details and per manufacturer's instructions.
- E. Joint Reinforcement: Pre-fill sheathing board joints and trim with synthetic base coat mixed according to manufacturer's directions.
1. Immediately embed reinforcing tape into wet base coat and tightly trowel to board surface to avoid crowning joints.
 2. Cure for four hours minimum before applying base coat.
- F. Base Coat: Uniformly apply base coat minimum 1.6 mm (1/16 inch) thick, smooth and flat over entire surface including joints and trim. Dampen board surface as necessary under rapid drying conditions.
1. Embed reinforcing fabric in basecoat while wet and cover with basecoat material so fabric pattern is not visible.
- G. Finish: Trowel apply exterior finish to base coat texturing surface as specified to uniform thickness of 1.5 mm to 5 mm (1/16 inch to 3/16 inch).
1. Dampen base coat as necessary under rapid drying conditions.
 2. Extend finish so breaks between batches occur at surface breaks such as corners, control joints, windows, and other interruptions.

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**SECTION 07 31 26
SLATE SHINGLES**

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Synthetic slate shingles over underlayment nailed to roof sheathing.

1.2 RELATED WORK

A. Section 07 60 00, FLASHING AND SHEET METAL; Counterflashing and Flashing of Roof Projections.

1.3 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.

B. ASTM International (ASTM):

C406/C406M-15.....Roofing Slate.

D1970/D1970M-19.....Self-Adhering Polymer Modified Bituminous Sheet
Materials Used as Steep Roofing Underlayment
for Ice Dam Protection.

D4586/D4586M-07(2018)...Asphalt Roof Cement, Asbestos-Free.

F1667-18a.....Driven Fasteners: Nails, Spikes, and Staples.

1.4 PREINSTALLATION MEETINGS

A. Conduct pre-installation meeting at project site minimum 30 days before beginning Work of this section.

1. Required Participants:

1.5 CONTRACTING OFFICER'S REPRESENTATIVE.

1. Architect/Engineer.

2. Contractor.

a. Installer.

b. Other installers responsible for adjacent and intersecting work,
including flashing and sheet metal.

3. Meeting Agenda: Distribute agenda to participants minimum 3 days
before meeting.

a. Installation schedule.

b. Installation sequence.

c. Preparatory work.

d. Protection before, during, and after installation.

e. Installation.

f. Terminations.

g. Transitions and connections to other work.

h. Other items affecting successful completion.

4. Document and distribute meeting minutes to participants to record decisions affecting installation.

1.6 SUBMITTALS

- A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
 1. Description of each product.
 2. Installation instructions.
- C. Samples:
 1. Shingles: Full sized, each type and color. Submit quantity required to show full color and texture range.
- D. Qualifications: Substantiate qualifications comply with specifications.
 1. Installer with project experience list.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacture of synthetic shingles.
- B. Installer Qualifications:
 1. Regularly installs specified products.
 2. Installed specified products with satisfactory service on five similar installations.
 - a. Project Experience List: Provide contact names and addresses for completed projects.

1.8 DELIVERY

- A. Deliver products in manufacturer's original sealed packaging.
- B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, production run number, and manufacture date.
- C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.9 STORAGE AND HANDLING

- A. Protect products from damage during handling and construction operations.

1.10 WARRANTY

- A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."
- B. Manufacturer's Warranty: 50 year warranty against breakage and deterioration resulting in leaks under normal weather and use conditions.

PART 2 - PRODUCTS**2.1 PRODUCTS - GENERAL**

- A. Basis of Design: Multi-Width Synthetic Slate in Vinyard color by DaVinci Roofscapes or equal.
- B. Provide each product from one manufacturer.

2.2 SLATE SHINGLES

- A. Synthetic Slate Shingles:
 - 1. Description: Lightweight, synthetic slate shingles with appearance, color, texture, and thickness of quarried shakes.
 - 2. Material: Engineered polymer formulated from 100 percent virgin plastic resins; recycled materials not acceptable.
 - 3. Performance characteristics:
 - a. Fire resistance: Class A, tested to ASTM E 108.
 - b. Class A rated by Cal-Fire.
 - c. Water absorption: 0.18 percent by weight, tested to ASTM D471.
 - d. Impact resistance: Class 4, tested to UL 2218.
 - e. Nail pull through resistance: 138 foot-pounds at 72 degree F (187 joules at 22 degrees C) and 166 foot-pounds at 32 degrees F (225 joules at 0 degrees C), tested to ASTM D3462/D3462M.
 - f. Freeze-thaw resistance: No crazing, cracking, delamination of coating, or other deleterious surface changes after one month exposure with temperature cycled from minus 40 to plus 180 degrees F (0 degrees to 82 degrees C) in 22 hours, tested to ICC ES Acceptance Criteria AC07 Section 4.9.
 - g. Accelerated weathering: Little change after 2,500 hours exposure to ultraviolet radiation, elevated temperature, moisture, and thermal shock.
 - h. Fungus resistance: No algae growth when inoculated with blue green algae in warm, damp environment for 4 to 6 weeks, tested to ASTM G21.
 - i. Approved by NRCC CCMC.
 - 4. Installation exposure:
 - a. 8 inch (203 mm) exposure.
 - 5. Profile:
 - a. Rectangular shape with exposed-to-view upper surface and edges textured to resemble natural slate.
 - b. Underside formed with reinforcing ribs.
 - 6. Size:

- a. Thickness: Varies from 1/8 inch (3 mm) at top to 1/2 inch (13 mm) at bottom.
 - b. Length: 18 inches (457 mm).
 - c. Widths: Variable widths from 6, 7, 9, 10, and 12 inches (152, 178, 229, 254, and 305 mm) to create appearance of random sized natural slate.
7. Starter shingle: 12 inches (305 mm) long x 12 inches (305 mm) wide.
8. Markings: Form shingles with markings on upper surface to indicate nailing locations and provide alignment guide lines for different exposure lengths.
9. Color and pattern:
- a. Provide shingles in multiple colors comparable to natural slate.
 - b. Provide ultraviolet protection consisting of internal stabilizer.
 - c. Provide shingles factory blended in multiple colors and widths.
 - d. Shingles to be Multi-Width Synthetic Slate in Vinyard color by DaVinci Roofscapes or equal.

2.3 ROOFING NAILS

A. Roofing Nails:

- 1. 3/8 inch (9.5 mm) flat head nails, 1-1/2 inches (38 mm) long.
- 2. Material: Stainless steel.

2.4 ROOFING UNDERLAYMENT

A. Self-Adhering Modified Bituminous Underlayment: ASTM D1970/D1970M.

2.5 METAL FLASHING

A. Provide metal roof flashings, including apron flashings, step flashings, valley flashings, drip edges, and vent pipe flashings specified in Section 07 60 00, FLASHING AND SHEET METAL.

- 1. Metal: Copper.
 - a. Valleys: 1 mm (20 oz., 0.039 inches).
 - b. Other Locations: 0.55 mm (16 oz., 0.022 inches).

2.6 SNOW GUARDS

A. Snow Guards: Individual copper snow guards, designed not to penetrate slate shingles.

2.7 ACCESSORIES

A. Asphalt Roof Cement: ASTM D4586/D4586M.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine and verify substrate suitability for roofing installation.

1. Verify roof substrates are sound, within manufacturer's tolerances, and free from defects which would interfere with roofing installation.
2. Verify roof accessories, vent pipes and other projections through roof are in place and roof flashing is installed, or ready for installation, before installing shingles.

B. Protect existing construction and completed work from damage.

3.2 INSTALLATION - GENERAL

A. Install products according to manufacturer's instructions.

1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.

3.3 METAL DRIP EDGE INSTALLATION

A. At eaves and rakes, install copper drip edges specified in Section 07 60 00, FLASHING AND SHEET METAL.

1. Eaves: Install metal drip edge before underlayment.
2. Rakes: Install metal drip edge after underlayment.

B. Secure metal drip edges with compatible nails spaced minimum 250 mm (10 inches) on center along inner edges.

3.4 FLASHING INSTALLATION

A. Install copper flashings at intersections of roofs, adjoining walls, roof slope changes, under ridges, hips, and valleys, and at projections through deck such as chimneys and vent stacks. Install metal flashings to comply with requirements in Section 07 60 00, FLASHING AND SHEET METAL.

B. Install step flashing at intersections with vertical surfaces.

1. Length: Length of shingle plus 50 mm (2 inches).
2. Vertical Leg Height: 200 mm (8 inches) minimum.
3. Horizontal Leg Width: 150 mm (6 inches) minimum.

C. Valley Flashing: Shingle type, as shown and as specified in Section 07 60 00, FLASHING AND SHEET METAL.

1. Secure valley flashing according to shingle manufacturer's instructions.
2. Width: 300 mm (12 inches) minimum, both sides of valley.

D. Hip and Ridge Flashing: Step flashing.

1. Length: Length of shingle plus 50 mm (2 inches).
2. Width: 13 mm (1/2 inch) less than shingle on both sides of hip or ridge.

3. Install step flashing as each course of slate shingles is installed. Extend upper edge of flashing 50 mm (2 inches) minimum above each course of shingles. Extend lower edge 13 mm (1/2 inch) above butt of shingle forming next course.

3.5 UNDERLAYMENT INSTALLATION

- A. Install self-adhering sheet underlayment, working from low point to high point. Lap sides 90 mm (3-1/2 inches) minimum, and lap ends 150 mm (6 inches) minimum. Install at the following locations:
 1. Eaves and Rakes: From edge of eave and rake to 600 mm (24 inches) minimum beyond inside face of exterior wall.
 - a. Lap underlayment over eave metal drip edge.
 2. Valleys, Hips and Roof Slope Transitions: Centered over change in slope, and extended 450 mm (18 inches) minimum on both sides.
 3. Ridges: Centered on ridge, and extended 900 mm (36 inches) minimum on both sides.
 4. Sidewalls and Projections through Roof: Extended 450 mm (18 inches) from projection, and extended up projection 100 mm (4 inches) minimum.
 5. Roll underlayment to ensure adhesion to roof deck and metal flashings.
- B. Underlayment/Slip Sheet: Install one ply asphalt felt over full roof area, with ends weather lapped minimum 4 inches (102 mm). Nail in place with roofing nails spaced in accordance with manufacturer's recommendations.

3.6 SLATE SHINGLE INSTALLATION

- A. Install starter course of roof shingles with 50 mm (2 inch) overhang at eaves. Install first course over starter course.
- B. At rake, overhang roof edge 25 mm (1 inch).
- C. Install shingles with specified head lap.
- D. Fasten shingles using two nails per shingle, concealed by head lap.
- E. Valleys: Open, to match existing.

3.7 HIP AND RIDGE SHINGLE INSTALLATION

- A. Fasten nailing strips to both sides of hip and ridge.
- B. Install step flashing at hips and ridges.
 1. Begin ridge shingle installation at leeward end of ridge.
 2. Begin hip shingle installation at eave.

C. Install hip and ridge shingles in pairs, over step flashing. Butt shingles together, nail in place, then install the next course of flashing.

D. Seal ridge joint with asphalt roof cement.

3.8 SNOW GUARD INSTALLATION

A. Install snow guards as recommended by manufacturer.

B. Snow guard layout:

1. Lower portion of roof:

a. Install three rows of snow guards 16" from eave and 16" between rows.

b. Snow guards spaced 24" o.c. in each row.

c. Offset snow guards 12" from previous row.

2. Middle portion of roof:

a. Snow guards 48" o.c. in each row.

b. Each row 24" o.c. between rows

c. Offset snow guards 24" from previous row.

d. Install to within 10' of ridge.

3. Fasten snow guards with fasteners concealed by shingles. Do not penetrate shingles.

3.9 PROTECTION

A. Protect slate shingles from construction operations.

B. Repair damage.

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**SECTION 07 41 13.16
STANDING SEAM METAL ROOF PANELS**

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies pre-finished, pre-fabricated standing seam metal roof system and related flashing, trim, and underlayment as shown on contract documents.

1.2 RELATED WORK

- A. Section 05 31 00, STEEL DECKING
- B. Section 06 16 00, SHEATHING
- C. Section 07 22 00, ROOF AND DECK INSULATION
- D. Section 07 92 00, JOINT SEALANTS: Sealant.

1.3 DEFINITIONS

- A. Metal Roof Panel Assembly: Metal roof panels, attachment system components, miscellaneous metal framing, thermal, and accessories necessary for a complete weathertight roofing system.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples: Finish samples of manufacturer's colors for color selection.
- C. Shop Drawings:
 - 1. Detailed drawings showing profile and gauge of exterior sheets, location and type of fasteners, location, gauges, shape and method of attachment of all trim locations and types of sealants, and any other details as may be required for a weather-tight installation.
 - 2. Show fabrication and installation layouts of metal roof panels, metal wall corners, anchorages, trim, flashings, closures and accessories and special details. Distinguish between factory and field-assembled work.
 - 3. Roof Plans, drawn to scale, on which roof panels and attachments; metal trusses, bracings and supports; and any roof mounted items are coordinated with each other based on input from installer of items involved.
- D. Manufacturer's Literature and Data: Standing Seam Roof Panels
- E. Manufacturer's Certificates: Indicating manufacturer's qualifications specified.
- F. Installer qualifications.
- G. Manufacturer warranty.

1.5 QUALITY ASSURANCE

- A. Approval by Contracting Officer Representative (COR) is required of products of proposed manufacturer.
- B. Certify manufacturer has five (5) years continuous documented experience in fabrication of metal roofing and siding panels.
- C. Source: For each material type required for work of this section, provide primary materials, which are products of one manufacturer. Provide secondary or accessory materials, which are acceptable to manufacturers of primary materials.
- D. Installer: A firm with a minimum of five (5) years' experience in type of work required by this section and which is acceptable to manufacturers of primary materials.
- E. Panels shall be factory-produced only. No portable, installer-owned or installer-rented machines will be permitted.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Ordering: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.
- B. Deliver components, sheets, metal roof panels and other manufactured items in manufacturer's original sealed packaging in a manner so as not to be damaged or deformed. Package metal roof panels for protection during transportation and handling.
- C. Unload, store and erect metal roof panels in a manner to prevent bending, warping, twisting and surface damage.
- D. Stack metal roof panels on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal roof panels to ensure dryness. Do not store metal roof panels in contact with other materials that might cause staining, denting or other surface damage.
- E. Protect strippable protective coating on any metal coated product from exposure to sunlight and high humidity, except to the extent necessary for material installation.

1.7 FIELD CONDITIONS

- A. Environment: Install products when existing and forecasted weather permit installation according to manufacturer's instructions.
- B. Field Measurements: Verify actual dimensions of construction contiguous with metal roof panels by field measurements before fabrication.

1.8 WARRANTY

- A. Construction Warranty: Comply with FAR clause 52.246-21 "Warranty of Construction".
- B. Manufacturer Weathertight Warranty: Manufacturer shall agree to repair or replace standing seam metal roof panel assemblies that fail to remain weathertight, including leaks, for a minimum of twenty (20) years from date of installation and final acceptance by the Government. Submit manufacturer warranty.
- C. Warranty on Panel Finishes: Manufacturer shall agree to repair finish or replace standing seam metal roof panels that show evidence of deterioration of factory-applied finish within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when testing according to ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 20 years from date of installation and final acceptance by the COR.

1.9 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extend referenced. The publications are referenced in the text by the basic designation only.
- B. Aluminum Association. Aluminum Design Manual.
- C. American Architecture Manufacturers Association (AAMA):
 - 611-14..... Anodized Architectural Aluminum
 - 621-02..... Voluntary Specifications for High Performance Organic Coatings on Coil Coated Architectural Hot Dipped Galvanized (HDG) and Zinc-Aluminum Coated Steel Substrates
 - 2605-13..... Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels

D. American Iron and Steel Institute (AISI):

SG03-02 Cold-Formed Steel Design Manual

E. ASTM International (ASTM):

A463/A463M-15 Steel Sheet, Cold-Rolled, Aluminum-Coated, by
the Hot-Dip Process

A653/A653M-20 Steel Sheet, Zinc-Coated (Galvanized), or Zinc-
Iron Alloy-Coated (Galvannealed) by the Hot-Dip
Process.

ASTM A792 Steel Sheet, Aluminum-Zinc Alloy Coated by the
Hot Dip Process

A924/A924M-19 Steel Sheet, Metallic Coated by the Hot-Dip
Process

A1008/A1008M-18 Steel, Sheet, Cold-Rolled, Carbon, Structural,
High Strength Low Alloy

B209-14 Aluminum and Aluminum Alloy Sheet and Plate

B209M-14 Aluminum and Aluminum Alloy Sheet and Plate
(Metric)

B370 Standard Specification for Copper Sheet and
Strip for Building Construction

C553-19 Mineral Fiber Blanket Thermal Insulation for
Commercial and Industrial Applications

C591-20 Unfaced Preformed Rigid Cellular
Polyisocyanurate Thermal Insulation

C612-14 (2019) Mineral Fiber Block and Board Thermal
Insulation

C1396/C1396M-17 Gypsum Board

D2244-16 Calculation of Color Tolerances and Color
Differences from Instrumentally Measured Color
Coordinates

D4214-07 (2015) Test Methods for Evaluating the Degree of
Chalking of Exterior Paint Films

E119-20 Fire Test of Building Construction and
Materials

E283-19 Test Method for Determining Rate of Air Leakage
Through Exterior Windows, Curtain Walls, and
Doors Under Specified Pressure Differences
Across the Specimen

- E331-00(2016) Test Method for Water Penetration of Exterior Windows, Skylight, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
- E1592-05(2017) Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Method
- E1646-95(2018) Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference
- E1680-16 Test Method for Rate of Air Leakage Through Exterior Metal Roof Panel Systems
- E1980-11(2019) Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces
- E2140-01(2017) Test Method for Water Penetration of Metal Roof Panel Systems by Static Water Pressure Head
- F. Cool Roof Rating Council (CRRC):
 - Standard-14
- G. FM Global:
 - 4471-10..... Class 1 Panel Roofs
- H. Metal Construction Association. Preformed Metal Wall Guidelines.
- I. Sheet Metal and Air Conditioning Contractors National Association (SMACNA). SMACNA Architectural Sheet Metal Manual, current edition.
- J. Underwriters Laboratories (UL):
 - 580-05(R2018) Tests for Uplift Resistance of Roof Assemblies
 - Fire Resistance Directory
- K. Code References:
 - a. ASCE, Minimum Loads for Buildings and Other Structures
 - b. BOCA National Building Codes
 - c. UBC Uniform Building Code
 - d. SBC Standard Building Code

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS ROOF PANELS

- A. General Performance: Metal roof panels shall comply with performance requirements without failure due to defective manufacture, fabrication, installation or other defects in construction.
- B. Energy Performance: Provide roof panels according to one of the following when tested according to CRRC-1:

1. Three-year, aged solar reflectance of not less than 0.55 and emissivity of not less than 0.75.
 2. Three-year, aged Solar Reflectance Index (SRI) of not less than 64 when calculated according to ASTM E1980.
- C. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E1592.
1. Wind Loads: Roof System shall be designed to meet Standard Building Code Wind Load requirements.
 2. Other Design Loads: As indicated.
 3. Deflection Limits: For wind loads, as indicated.
 4. Minimum Panel rib depth: 1-3/4"H Seam.
 5. Panel width: 12 inches.
- D. Air Infiltration: Air leakage of not more than 0.3 liter/second per square meter (0.06 cfm/square foot) when tested according to ASTM E1680 or ASTM E283 at the following test-pressure difference:
1. Test-Pressure Difference: 75 Pa (1.57 pound force/square foot);300 Pa (6.24 pound force/square foot).
- E. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E1646 or ASTM E331 at the following test-pressure difference:
1. Test-Pressure Difference: 137 Pa (2.86 pound force/square foot);300 Pa (6.24 pound force/square foot).
- F. Hydrostatic-Head Resistance: No water penetration when tested according to ASTM E2140.
- G. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.
1. Uplift Rating: UL 90.
- H. FM Global Listing: Provide metal roof panels and composite component materials that comply with requirements FM Global 4771 as part of a panel roofing system and that are listed in FM Global's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Global markings.
1. Fire/Windstorm Classification: UL Class 90.
 2. Hail Resistance: SH; UL2218 Impact Resistant rated..
- I. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joints sealants, failure of