

SECTION 073150 – SLATE SHINGLE ROOFING

PART 1 - GENERAL

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1.01 SUMMARY

A. This procedure includes new slate shingle roofing, salvage slate roofing and underlayment. Note that it also includes two (2) Alternates.

B. Quality Assurance

Slate Roofing Specialist: Contractor that performs slate roofing work shall be regularly engaged in slate roofing repair and new construction. Contractor shall demonstrate to Architect's satisfaction that, within previous five (5) years, he has successfully performed and completed in a timely manner at least three (3) projects similar in scope and type to required work involving buildings designated as Landmarks by local governmental authorities; or buildings listed on the National Register of Historic Places or on a State Register of Historic Places.

C. Safety Precautions:

1. Wear rubber-soled shoes that have non-slip tread (preferably sneakers with a high top for good ankle support). Avoid wearing loose clothing.
2. Wear a safety belt or harness and secure it to a substantial chimney or other substantial object secured to the building. Leave only enough slack to work comfortably in one area. Move and adjust as required to work on other sections of the roof.
3. As the work proceeds, keep roof clear of debris and water. Avoid stepping on damaged or crumbling roofing materials.
4. On slopes where the roof is steeper than 4 inches rise per foot, special consideration must be given to footing and handling of materials. Chicken ladders or cleats should be used on the roof as required for adequate footing.
5. Do not work on shingled roofs when wet or snow-covered.
6. Carrying and transporting of materials should be limited to a safe amount so that balance and footing are not impaired.

D. Acceptance at Site: Keep roof materials dry during delivery, storage, and handling.

E. Storage and Protection:

1. Store materials in stacks with provisions for air circulation within stacks. Protect bottom of stacks against contact with damp surfaces. Protect materials against weather.
2. When the slates are stored in an open yard, cover the piles with overlapping boards or use tar paper weighted down. Adequate protection prevents the slates from being frozen together. While slates are of ample strength when used in their proper place, reasonable care should be used in the handling of the material.
3. Slates up to and including 20" X 11" may be safely piled up to 6 tiers high. Slates of a larger size should never be piled more than 4 tiers high. Closely piled, 100 commercial slates average 20" to 24".

1.02 PROJECT SITE CONDITIONS

A. Environmental Requirements:

1. Do not apply new or repaired shingle roofs in wet weather.
2. Do not remove roofing from structures when rain is forecasted or in progress.
3. If roofing is to be removed on a clear day, remove no more than can be replaced or repaired in one day.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Slating tools:

John Stortz & Sons
210 Vine Street
Philadelphia, PA 19106
215/627-3855

B. Waterproof Underlayment:

W.R. Grace & Co.
62 Whitetmore Avenue
Cambridge, MA 02140

C. Breather Membrane:

Proctor Group Ltd.
The Hague, Blairgowrie
Perthshire, PH10 7ER
Scotland, United Kingdom
Phone: 01144-1250-872261

Posi-Slope
5720 Timberlea Boulevard,
Suite 206,
Mississauga, Ontario L4W 4W2
Phone:1-877-767-4123

2.02 MATERIALS

- A. Slate: Roofing slate shall be Unfading Green as provided by Vermont Structural Slate Company, or Architect approved equal.
1. **Base Bid Slates** shall be 10" wide by 16" long by ¼" thick and shall meet the requirements of Grade S1 per ASTM C-406 and Federal Specification SS-S-451.
 2. **Alternate #1 - Slates** shall be 10" wide by 14" long by ¼" thick and shall meet the requirements of Grade S1 per ASTM C-406 and Federal Specification SS-S-451.
 3. **Base Bid Slates** shall be Unfading Green by Vermont Structural Slate. Modulus of Rupture 11,687 lbs per square in. Water Absorption 0.167 of 1% in 48 hours. Acid Resistance 0.0012 of an inch.
 4. **Alternate #2 - Slates** shall be Semi-weathering Gray-Green by Vermont Structural Slate. Modulus of Rupture 611 lbs, Ave. thickness 0.253 in. Water Absorption 0.163% (max. .25%). Acid Resistance 0.0019 of an inch (max. .002 in.)
 5. Slates with broken corners greater than 3/4" shall not be accepted.
 6. Slates shall not curve more than 1/8" over 12 inches.
 7. Slates must be free of ribbons.
 8. Cracked slates will not be accepted. Questionable slates can be sounded. Only slates capable of ringing will be accepted.
 9. Face dimensions of slates shall no vary by more than 1/8"
- B. Large flat-head hard solid copper wire nails not less than 1-1/2" long for field and 2" long at hips and ridges. Length should be twice the thickness of an individual slate plus 1 inch.
- D. Waterproof Underlayment: Minimum 40-mil- (1-mm-) thick, self-adhering, polymer-modified, bituminous sheet membrane, complying with ASTM D 1970. Provide primer when recommended by underlayment manufacturer.
1. Ice & Water Shield by W.R. Grace & Co.
- E. Underlayment: #30 Asphalt Felt, ASTM D226. Install double, half-lapped felts in direction of flow of water.
- E. Elastic cement or exterior grade caulk such as "Gutter-Seal" (Dow), "Roof Sealant" (Alcoa), or approved equal. Color shall match roof slates.

2.03 EQUIPMENT

- A. 25' steel tape

- B. Hacksaw(s)
- C. Slate ripper
- D. Machine punch and hand (or mawl) punch
- E. Slate cutter
- F. Hammer
- G. Slater's Stake
- H. Nail pouch

PART 3---EXECUTION

3.01 EXAMINATION

- A. Inspect the deck to determine whether it is sound. Make whatever repairs are necessary to the existing roof framing to strengthen it and to level and true the deck. Replace rotted, damaged, or warped sheathing or plywood.

3.02 PREPARATION

- B. Surface Preparation:
 1. Carefully examine, measure, and record existing slate shingle patterns at edges, hips, ridges, and other special conditions.
 2. Remove existing roofing down to the roof deck. Contractor may salvage slates for his own resale purposes.
 3. Use a slate ripper to remove the nails of slates in good condition which can be reused. Use care in the removal and stacking of slates to avoid damage.
 4. Be careful not to damage old metal wall and vent flashings that may be used as a pattern for cutting templates. If metal cap flashings at the chimney and other vertical masonry wall intersections have not deteriorated, bend them up out of the way so that they may be used again. Carefully remove slate shingles in these areas to avoid damaging reusable base flashing.
 5. Remove loose or protruding nails or hammer them down.

3.03 ERECTION, INSTALLATION, APPLICATION

- A. The roof decks shall be treated with a self-adhereing membrane of rubberized asphalt integrally bonded to polyethylene sheeting. Follow manufacturer's written instructions

for membrane application. Areas to be sheeted with membrane are valleys, eaves, all slope changes or tie-ins and protrusions through the roof.

- B. Lay breather membrane over entire deck not required to be covered with ice and watershield membrane waterproofing.
 - 1. Lay felt in horizontal layers printed side up with 4 inch horizontal laps and 6 inch vertical laps. Overlaps to be run with the flow of water in a shingling manner.
 - 2. Overlap breather membrane with self-adhereing membrane
 - 3. Secure to roof deck using minimum No. 12 gauge corrosion resistant steel or stainless steel nail with minimum 3/8-inch-dia. heads. The underlayment shall be fastened only as necessary to hold in place.
- C. Determine exposure of slate: subtract 3" (standard head lap between alternating courses) from overall length of slates being used. Divide this number in half to determine final exposure. 16" tall slates will result in a 6-1/2" exposure.
- D. If required by slope of roof, nail cant strip at bottom eaves, even with edge of sheathing, to slightly raise first courses of slate. Thickness of cant strip allows second course of slate to be laid correctly. A 1/4" taper is usually sufficient.
- E. Lay under-eave starter slate. Butt of slate shall project 2" beyond cant strip or bottom edge of sheathing, and 1" beyond the edge of the sheathing at gable ends. Under-eave slate is shorter than other slates. Determine length of under-eave slates by adding 3" to the exposure as determined in B. above. Secure each slate with two nails.
 - 1. Drive the nails into the punched holes until heads just clear surface of slate. The slates should "hang" on the nails, not be driven in so far as to produce a strain on the slate.
 - 2. Use 3d nails for standard-thickness slates up to 18 in. long. Use 4d nails for extra-long slates, and 6d nails on hips and ridges.
- F. Lay full first course with bottom of slate even with bottom of under-eave slate. Position joints between slates so that there is a minimum 3" off-set between the vertical joints of the under-eave slates below.
- G. Lay second full course of slate using the exposure as determined in C. above. Off-set vertical joints a minimum of 3" from the vertical joints in the course below. Continue to lay main field of slates in this manner.
- H. Lay hip slates and ridge slates (or install ridge and hip cap flashing) as originally designed. Consult with slate manufacturer for construction details.
 - 1. Ridge types (slate): saddle ridge.
 - 2. Hip types (slate): mitered.

- I. Build in and place all flashing pieces furnished by the sheet metal contractor. Valley design shall match original construction. Valleys shall be open.
- J. Slates overlapping sheet metal work should have the nails so placed as to avoid puncturing the sheet metal. Exposed nails should be permissible only in top courses where unavoidable.
- K. Scribe slate neatly around any roof penetrations.
- L. The roofer shall build in and place, all flashing pieces. Each course of slate shall have copper step-flashing neatly woven into the slate.
- M. Entire surfaces of all roofs, except at open valleys, shall be covered with slate in the specified and weatherproof manner. Upon completion, all slates must be sound, whole and clean. The roof must be left watertight and neat in every respect, and subject to the architect's approval.
- N. The Owner shall be furnished with a stock of 2% extra slates for future roof repairs.

END OF SECTION

SECTION 075419 – MEMBRANE ROOFING

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes the following:
 - 1. Site inspection by General Contractor and Roofing Subcontractor of existing conditions and materials prior to initiating submittal process. General Contractor shall assure new roofing system and flashings are compatible with existing to remain.
 - 2. Provide mechanically fastened polyvinyl chloride (PVC) thermoplastic membrane roofing and base flashing system or other compatible system. New system shall integrate with existing to remain, be watertight, withstand wind loads, thermally induced movement and exposure to weather without failure.
 - 3. Preparation of roof surfaces for application of roofing system.

1.02 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division-1 Specification Sections.
- B. Product data including roofing manufacturer's and specifications, installation instructions, and general recommendations for roofing applications. Include certification or other data substantiating that materials comply with requirements.
- C. Shop drawings showing base flashings and membrane terminations.

1.02 SYSTEM DESCRIPTION

- A. General: Provide a PVC (or other compatible) membrane roofing system that complies with roofing system manufacturer's written design instruction and with the following:
 - 1. ASTM E 108 Class A for application
 - 2. FM: Fire/Wind Uplift – Class 1A-60.
 - 3. CBC: Section 1504 – Roofing Classification : UBC Standard 15-2 Class A.
 - 4. EF Legacy Report (NER 227).

1.03 QUALITY ASSURANCE

- A. Installer specializing in installing roofing systems similar to specified system, and who is approved, authorized, or licensed by the roofing system manufacturer to install manufacturer's product.
- B. Installer Certificate and References: Certificate signed by roofing system manufacturer certifying that installer is approved, authorized, or licensed to install specified roofing system. Supply list of five (5) completed projects similar in scope using the specified roofing system, with names and addresses of projects, architects and owners.
- C. Pre-Installation Meeting:
 - 1. Before beginning roofing and associated work, the General Contractor shall hold a Pre-Installation Meeting. The meeting shall be attended by the Project Manager, Construction Superintendent, the roofing subcontractor, the installer and personnel directly responsible for the installation of roofing and flashing work.
 - 2. Agenda:
 - a. Review methods and procedure related to roofing work.
 - b. Tour representative areas of roof decks, and inspect and discuss conditions of substrates and other preparatory work.
 - c. Review approved submittals.
 - d. Review weather and forecasted weather conditions, and procedures for coping with unfavorable conditions, including possible need for temporary roofing.
 - e. Safety requirements including installation, material handling and OSHA safety requirements. Provide filled and operating fire extinguishers meeting current code standards on the roof deck at all times during roofing operations.

1.04 WARRANTY

- A. Standard Roofing Manufacturer's Warranty: Submit a written warranty, without monetary limitation, signed by roofing system manufacturer, agreeing to promptly repair leaks resulting from defects in materials or workmanship for a period of not less than 15 years. Warranty shall include the following:
 - 1. Manufacturer shall pay all costs associated with replacement of rusted or otherwise defective "approved" fasteners.
 - 2. The warranty shall cover 100 percent replacement cost.
 - 3. There shall be no penal sum associated with this warranty.
 - 4. The Owner shall be able to make temporary repairs without voiding the warranty.
 - 5. There shall be no exclusions in the warranty for consequential damages.

PART 2---PRODUCTS

2.01 MANUFACTURERS

- A. Primary materials shall be the products of one manufacturer. Secondary materials shall be as required or recommended by primary materials manufacturer and in accordance with these specifications.
- B. Approved PVC Thermoplastic Membrane Roofing Manufacturers: Duro-Last, Bondcote, Fibertite or architect approved equal.

2.02 MATERIALS

- A. Roof Membrane Sheet: Uniform flexible sheet formed from polyvinyl chloride with plasticizers and modifiers, complying with ASTM D4434, Type IV of the following type, grade, thickness and exposed face color:
 - 1. Thickness: 40 mils, nomina, 16 mils above reinforcement.
 - 2. Exposed Face Color: Match existing roof membrane to remain.
 - 3. Minimum physical properties:
 - a. Breaking Strength: 275 lbs/in., ASTM D751, Procedure A.
 - b. Elongation at Break: 25 percent, ASTM D751.
 - c. Tearing Strength: 90 lbs/ft.
 - d. Resistance to Heat Aging: 90 percent retention of breaking strength and elongation at break, ASTM D3045.
 - e. Low-Temperature Bend: Pass at minus 40 degrees F, ASTM D2136.
 - f. Accelerated Weathering Test: No cracking or crazing after 6000 hours, ASTM D4434.
 - g. Linear Dimensional Change: 0.5 percent maximum after 6 hours at 176 degrees F, ASTM D1204.
- B. Auxiliary Materials
 - 1. General: Furnish auxiliary materials recommended by roofing system manufacturer for intended use and compatible with existing and new membrane roofing systems.
 - 2. Furnish liquid-type auxiliary materials that meet VOC limits of authorities having jurisdiction.
 - 3. Sheet Flashing: Manufacturer's standard.
 - 4. Slip Sheet: Manufacturer's recommended slip sheet of type required for application.
 - 5. Termination Bars: Manufacturer's standard bars, approximately 1 to 1.5 inches wide, formed, and pre-punched.
 - 6. Fasteners: Factory coated steel fasteners and metal or plastic plates meeting corrosion-resistance provision of FM4470, designed for fastening sheet to substrate, and acceptable to roofing system manufacturer.
 - 7. Miscellaneous Accessories: Provide pourable sealer, preformed pipe sheet flashings, and other accessories recommended by roofing manufacturer for intended use. These accessories are to be covered by the roofing systems manufacturer's system warranty for the warranty period.

PART 3---EXECUTION

3.01 EXAMINATION

- A. Inspect the roof deck, existing roofing to remain and substrates and verify that there are no conditions which may prevent or interfere with the installation of the roof and flashing system.
- B. Report any adverse condition which may affect the performance of the roof system in writing to the architect. Absence of such notification shall constitute Contractor and Subcontractor's verification that existing conditions will allow the installation of the system in accordance with the Drawings, Specifications and manufacturer's warranty.
- C. Ensure that the following conditions exist prior to application of roofing materials:
 - 1. Existing roofing system is compatible with the new roofing and other requirements of this specification.
 - 2. The substrate plane does not vary more than 1/8" within an area 10 by 10 feet when checked with a 10-foot straight edge placed anywhere on the substrate.
 - 3. Walls and vertical surfaces are constructed to receive base flashings and counter flashings.
 - 4. Treated wood nailers are fastened in place and ready to receive membrane.

3.02 PREPARATION

- A. Clean substrate of dust, debris, and other substances detrimental to roofing installation, in accordance with roofing system manufacturer's written instructions. Remove sharp projections.
- B. Prevent materials from migrating onto surface of adjacent areas.
- C. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of each workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining work.
- D. Surface Preparation:
 - 1. Prior to commencing roof installation, all roof substrates shall be clean and free of all debris.
 - 2. Correct defects and inaccuracies in roof deck surface to eliminate hollow and low spots.
- E. Do not apply roofing materials unless proper temperature can be maintained.
- F. Coordinate the work with other trades to assure that components which are to be secured to or built into the roofing system are available and that flashing and counter flashing are installed as the work progresses.

3.03 MECHANICALLY FASTENED SHEET INSTALLATION

- A. Install roof membrane over area to receive roofing according to roofing system manufacturer's written instructions and standard installation details. Unroll sheet and allow to relax for a minimum of 30 minutes. Install according to ASTM D5082.
- B. Accurately align sheets and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- C. Mechanically fasten sheet securely at terminations and perimeter.
- D. Apply roofing sheet with side laps shingled with slope of roof deck.
- E. Install sheet and auxiliary materials in accordance with manufacturer's written instructions.

3.03 SEAM INSTALLATION

- A. Clean seam areas, overlap sheets, and weld side and end laps of sheets and flashings according to manufacturer's written instruction to ensure a watertight seam installation. Weld seams using hot air method.
 - 1. If required, apply bonding adhesive to substrate and underside of flashing sheet at required rate and allow to partially dry. Do not apply bonding adhesive to seam area of flashing.
 - 2. At walls and vertical surfaces, if there is presence of materials that are not compatible with flashing, install separation sheet as recommended by roof membrane manufacturer's written instructions.
- B. Flash penetrations with pre-fabricated flashing assemblies provided by roof membrane manufacturer and field form sheet flashing inside and outside corners as recommended by manufacturer.
- C. Clean seam areas and overlap sheets. Weld side and end laps to ensure watertight seam installation.
- D. Test lap edges with probe to verify seam weld continuity. Apply lap sealant and seal exposed edges of sheet flashing terminations.
- E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.04 FIELD QUALITY CONTROL

- A. Provide full-time supervisor on job site during roofing work who is experienced in installation of specified roofing system.
- B. Provide roof membrane inspections as required for the Warranty.

- C. Verify field strength of seams a minimum of twice daily, according to manufacturer's written instructions and repair seam sample areas.
- D. Final Roof Inspection: Arrange for roofing system manufacturer's technical representative to inspect roofing installation on completion and submit report to architect.

3.04 PROTECTION AND CLEANING

- A. Protect membrane roofing system from damage and wear during remainder of construction period. When construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing in nature and extent in written report with copies to the architect.
- B. Correct deficiencies or remove roofing that does not comply with requirements, repair substrates, reinstall roofing, and repair sheet flashings to a condition free of damage and deterioration at the time of Substantial Completion and according to warranty requirements.
- C. Clean debris from adjacent construction using procedures required by manufacturer of affected construction.

3.05 PROTECTION

- A. Provide final protection in a manner acceptable to installer that ensures that copper roofing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 075419

SECTION 076120 – COPPER FLASHINGS AND GUTTERS

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes the following:
 - 1. Flat-seam COPPER apron at main roof.
 - 2. COPPER flashings.
 - 3. Corrugated, Textured COPPER gutters and ridge cap.
 - 4. COPPER thimbles and new copper downspouts and brackets.
 - 5. Underlayment including asphalt saturated felts, fully adhered Vycor strips and rosin paper slip layer.

1.02 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division-1 Specification Sections.
- B. Product data including metal manufacturer's and fabricator's specifications, installation instructions, and general recommendations for roofing applications. Include certification or other data substantiating that materials comply with requirements.
- C. Shop drawings showing manner of forming, joining, anchorage details, pattern of seams, flashing and gutter and downspouts. Show expansion joint details and waterproof connections to adjoining work and at obstructions and penetrations. Provide details at 3-inch scale.

1.03 QUALITY ASSURANCE

- A. Installer: A firm with 5 years of successful experience with installation of copper roofing of type and scope equivalent to Work of this Section.
- B. Industry Standard: Except as otherwise shown or specified, comply with applicable recommendations and details of "Copper in Architecture Handbook" by Copper Development Association (CDA). Conform to dimensions and profiles shown.
- C. Wind Uplift: Provide roof assemblies meeting requirements of UL 580 for Class 90 wind uplift resistance.

- D. Mock-Up: Before proceeding with final purchase of materials and fabrication of copper roofing components, prepare a scale mock-up of work. Incorporate materials and methods of fabrication and installation identical with project requirements. Install mock-up at roof area location directed by Architect or off-site as accepted by Architect. Retain accepted mock-up as quality standard for acceptance of completed copper roofing. If accepted, mock-up may be incorporated as part of copper roofing work.
1. Provide mock-up of sufficient size and scope to show typical pattern of seams, fastening details, edge construction, and finish texture and color. Mock-up shall include length of gutter and apron.

PART 2---PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide materials by one of the following:
1. Revere Copper Products, Inc.
 2. Hussey Copper, Ltd.
 3. Outokumpu American Brass Company.

2.02 MATERIALS

- A. Copper Roofing Sheets: Cold-rolled copper sheet complying with ASTM B 370 temper designation, H00, unless otherwise indicated, and as follows:
1. Weight: 20 oz. per sq. ft. unless otherwise indicated.
- B. Copper Gutters: Cold-rolled corrugated, textured copper sheet complying with ASTM B 370 temper designation, H00, unless otherwise indicated, and as follows:
1. Weight: 20 oz. per sq. ft. unless otherwise indicated.
 2. Corrugated texture to match existing gutters and ridge cap.
- C. Miscellaneous Materials: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants and accessory items as recommended by copper sheet manufacturer and fabricator for copper roofing work, except as otherwise indicated.
- D. #30 Asphalt Saturated Roofing Felts: ASTM 226, Type II
- E. Fully Adhered Flashing Strips: Smooth surface underlayment with rubberized asphalt adhesive backed by a layer of high density, cross laminated polyethylene such as Grace Vycor strips or architect approved equal.

- F. Paper Slip Sheet: Minimum 4-lb. rosin-sized building paper.
- G. Accessories: Except as indicated as work of another specification Section, provide components required for a complete roof system, including trim, copings, fascias, ridge closures, cleats, seam covers, battens, flashings, sealants, gaskets, and closure strips. Match materials and finishes of roof.
 - 1. Sealing Tape: Pressure-sensitive 100 percent solids polyisobutylene compound sealing tape with release paper backing. Provide permanently elastic, non-sag, nontoxic, non-staining tape.
 - 2. Joint Sealant: One-part silicone rubber sealant as recommended by the copper manufacturer.
- H. Bituminous Coating: Cold-applied asphalt mastic, SSPC Paint 12, compounded for 15-mil dry film thickness per coat, except as otherwise indicated. Provide inert-type noncorrosive compound, nominally free of sulfur components and other deleterious impurities.
- I. Nails: Copper or hardware bronze, 0.109 inch minimum not less than 7/8" long barbed with large head.
- J. Screws & Bolts: Copper, bronze or brass.
- K. Cleats: 20 ounce cold rolled copper. 2" wide x 3" long.
- L. Solder: ASTM Specification B-32, Composition 50% tin and 50% lead.
- M. Flux: Muriatic acid neutralized with zinc or approved brand of soldering flux.
- N. Rivets: 1/8" - 3/16" diameter, with solid copper mandrels and washers.

2.03 SHOP-FABRICATED UNITS

- A. General Metal Fabrication: Shop-fabricate work to greatest extent possible. Comply with details shown and with applicable requirements of CDA "Copper in Architecture Handbook" and other recognized industry practices. Fabricate for waterproof and weather-resistant performance with expansion provisions for running work, sufficient to permanently prevent leakage, damage, or deterioration of the work. Form work to fit substrate. Comply with material manufacturer's instructions and recommendations for forming material. Form exposed copper work without excessive oil-canning, buckling, and tool marks, true to line and levels indicated, with exposed edges folded back to form hems.
- B. Seams: Fabricate non-moving seams in copper sheet with flat-lock seams and conforming with SMACNA recommendations. Tin edges to be seamed, form seams, and solder. Rivet joints for additional strength where indicated.

- C. Expansion Provisions: Where lapped or bayonet-type expansion provisions in work cannot be used, or would not be sufficiently water/weatherproof, form expansion joints of intermeshing hooked flanges, not less than 1" deep, filled with mastic sealant (concealed within joints).
- D. Sealant Joints: Where movable, non-expansion-type joints are indicated or required for proper performance of work, form copper to provide for proper installation of elastomeric sealant, in compliance with CDA standards.
- E. Separations: Provide for separation of copper from noncompatible metal or corrosive substrate by coating concealed surfaces at locations of contact, with bituminous coating or other permanent separation as recommended by manufacturer/fabricator.

PART 3---EXECUTION

3.01 COORDINATION

- A. Coordinate copper roofing with other adjoining work to provide a leak-proof, secure, and non-corrosive installation.

3.02 EXAMINATION

- A. Examine substrates, areas, and conditions with installer present to verify actual locations, dimensions and conditions affecting performance of the work. Verify that substrate is sound, dry, smooth, clean, sloped for drainage and securely anchored.

3.03 PREPARATION

- A. Clean surfaces to receive copper roofing. Substrate to be smooth and free of defects. Drive all projecting nails or other fasteners flush with substrate. Proceed with installation only after unsatisfactory conditions have been corrected.

3.04 FABRICATION

- A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated. Shop fabricate items where practicable. Obtain field measurements for accurate fit before shop fabrication.
 1. Apron Flashings: Fabricate with lower flange extending a minimum of **4 inches (100 mm)** over and **4 inches (100 mm)** beyond each side of downslope slate shingles and **6 inches (150 mm)** up the vertical surface.
 2. Step Flashings: Fabricate with a **3-inch (75-mm)** headlap extending a minimum of **4 inches (100 mm)** over the underlying slate shingles and up the vertical surface.

3. Hip Flashings: Fabricate to length of slate shingle and to extend **3 inches (75 mm)** beyond joint of hip shingle with adjoining roof shingle.
 4. Closed-Valley Flashings: Fabricate in lengths not exceeding **10 feet (3 m)** and equal flange widths of **12 inches (300 mm)**.
 5. Drip Edges: Fabricate in lengths not exceeding **10 feet (3 m)** with **2-inch (50-mm)** roof-deck flange and **1-1/2-inch (38-mm)** fascia flange with **3/8-inch (10-mm)** drip at lower edge.
 6. Vent-Pipe Flashings: ASTM B 749, Type L51121, at least **1/16 inch (1.6 mm)** thick. Provide lead sleeve sized to slip over and turn down into pipe, soldered to skirt at slope of roof and extending at least **4 inches (100 mm)** from pipe onto roof.
- B. Sealed Joints: Form non-expansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA recommendations.
- C. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.
- D. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
1. Thickness: As recommended by SMACNA's "Architectural Sheet Metal Manual" and FMG Loss Prevention Data Sheet 1-49 for application but not less than thickness of metal being secured.
- E. Roof Drainage Sheet Metal Fabrications
1. Gutters: Fabricate to cross section indicated, complete with mitered corners, outlet tubes, and other accessories as required. Fabricate in minimum **96-inch (2400-mm)** long sections. Furnish flat-stock gutter spacers and gutter brackets fabricated from same metal as gutters, of size recommended by SMACNA but not less than twice the gutter thickness. Fabricate expansion joints, expansion-joint covers, gutter bead reinforcing bars, and gutter accessories from same metal as gutters.
 2. Gutter Style: Ogee
 3. Expansion Joints: Lap type.
 4. Accessories: Bronze wire ball downspout strainer.
 5. Gutters with Girth up to **15 inches (380 mm)**: Fabricate from the following material:
 - a) Corrugated Copper: **20 oz./sq. ft. (0.55 mm thick)**.
 6. Fasteners: Use fasteners of sizes that will penetrate substrate not less than **1-1/4 inches (32 mm)** for nails and not less than **3/4 inch (19 mm)** for wood screws.
 - a) Copper: Use copper, hardware bronze, or stainless-steel fasteners.

3.05 INSTALLATION

- A. Manufacturer's Recommendations: Except as otherwise shown or specified, comply with recommendations and instructions of manufacturer of copper being fabricated and installed.
- B. Separate dissimilar metals by painting each metal surface in area of contact with a bituminous coating by applying rubberized asphalt underlayment to each metal surface, or by other permanent separation as recommended by manufacturers of dissimilar metals.
- C. Install asphalt saturated felt underlayment on substrate under copper roofing to greatest extent possible unless otherwise recommended by manufacturer of sheet metal. Attach felts using copper nails driven through sheet copper washers and placed no more than 6" on center at seams. Fasteners and washers shall finish flush with the underlayment. Overlap seams minimum 2".
- D. Paper slip sheets must be installed over the underlayment. Use adhesive for temporary anchorage, where possible, to minimize use of mechanical fasteners under copper roofing. Lap joints 2" minimum.
- E. Form and fabricate sheets, seams, strips, cleats, valleys, ridges, edge treatments, integral flashings and other components of copper roofing to profiles, patterns and drainage arrangements shown and as required for permanently leak-proof construction. Provide for thermal expansion and contraction of the work, as indicated. Seal joints as shown and as required for leak-proof construction. Shop-fabricate materials to greatest extent possible.
- F. Sealant-Type Joints: Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1" into sealant. Form joints to conceal sealant completely. When ambient temperature is moderate at time of installation, 40 deg to 70 deg F (4 deg to 21 deg C), set joint members for 50 percent movement either way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F (4 deg C). Comply with requirements of Division-7 "Sealant" Sections for handling and installing sealants.
- G. Fabricate and install work with lines and corners of exposed units true and accurate. New roofing installation to match original design as precisely as possible. Form exposed faces flat and free of buckles, excessive waves, and avoidable tool marks considering temper and reflectivity of metal. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant. Except as otherwise shown, fold back sheet metal to form a hem on concealed side of exposed edges.
- H. Conceal fasteners and expansion provisions where possible in exposed work, and locate so as to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

- I. Tin uncoated copper surfaces at edges of sheets to be soldered, for a width of 1-1/2", using solder recommended for copper work. Where surfaces to be soldered are lead-coated, do not tin the edges, but wire brush lead coating before soldering.

3.06 CLEANING

- A. Remove protective film (if any) from exposed surfaces of copper roofing promptly upon installation. Strip with care to avoid damage to finishes.
- B. Clean exposed metal surfaces of substances that would interfere with uniform oxidation and weathering.

3.07 PROTECTION

- A. Provide final protection in a manner acceptable to installer that ensures that copper roofing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 076120

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Silicone joint sealant
 - 2. Polyurethane joint sealant
- B. Related Sections:
 - 1. Division 06 "Finish Carpentry"
 - 2. Division 07 "Copper Roofing"

1.3 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- wide joints formed between two 6-inch- long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- D. Joint-Sealant Schedule: Include the following information:
 - 1. Joint-sealant application, joint location, and designation.
 - 2. Joint-sealant manufacturer and product name.
 - 3. Joint-sealant formulation.
 - 4. Joint-sealant color.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each kind of joint sealant and accessory, from manufacturer.

- B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that sealants comply with requirements.
- C. Warranties: Sample of special warranties.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance.
- B. Product Testing: Test joint sealants using a qualified testing agency.
 - 1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.

1.6 PROJECT CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
 - 2. When joint substrates are wet.
 - 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 - 4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.7 WARRANTY

- A. Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.
- B. Manufacturer's Warranty: Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.
- C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:

1. Movement of the structure caused by structural settlement or errors attributable to design or construction resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
2. Disintegration of joint substrates from natural causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. **Compatibility:** Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. **VOC Content of Interior Sealants:** Provide sealants and sealant primers for use inside the weatherproofing system that comply with the following limits for VOC content when calculated according to 40 CFR 59, Part 59, Subpart D (EPA Method 24):
 1. Architectural Sealants: 250 g/L.
 2. Sealant Primers for Nonporous Substrates: 250 g/L.
 3. Sealant Primers for Porous Substrates: 775 g/L.
- C. **Stain-Test-Response Characteristics:** Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.
- D. **Colors of Exposed Joint Sealants:** As selected by Architect from manufacturer's full range.

2.2 SILICONE JOINT SEALANTS

- A. **Sealant Type 1:** Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant; ASTM C 920, Type S, Grade NS, Class 100/50, for Use NT, M, G, A and O.
 1. **Products:** Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Dow Corning Corporation; 790 (VOC 43); 756 SMS (VOC 87) for cold applications.
 - b. GE Advanced Materials - Silicones; SilPruf LM SCS2700.
 - c. Pecora Corporation; 890 (VOC na).
 - d. Sika Corporation, Construction Products Division; SikaSil-C990.
 - e. Tremco Incorporated; Spectrem 1 (VOC 1).

2.3 POLYURETHANE JOINT SEALANTS

- A. Sealant Type 2: one-component, moisture-curing, Polyurethane Joint Sealant; ASTM C 920, Type S, Grade NS, Class 25, for Use NT, M, A and O.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include the following:
 - a. Tremco; Dymonic, high-performance, low-modulus, expansion joint sealant.

2.4 JOINT SEALANT BACKING

- A. General: Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
 - 1. Use Type O (open cell material) at metal-to-metal joints.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.5 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 - 2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air.
 - 3. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
 - a. Metal.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of sealant backings.
 - 2. Do not stretch, twist, puncture, or tear sealant backings.
 - 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 - 1. Remove excess sealant from surfaces adjacent to joints.
 - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 - 3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.
 - a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

3.4 CLEANING

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

3.5 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite

such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.6 JOINT-SEALANT SCHEDULE

- A. Exterior Expansion, and Soft Joints at Flat-Seamed Copper Roof Work.
 - 1. Silicone Joint Sealant: Sealant Type 1.
 - 2. Joint-Sealant Color: Bronze.

- B. Exterior Joints for Which No Other Sealant Type is Indicated.
 - 1. Polyurethane Joint Sealant: Sealant Type 2.
 - 2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION 079200