

**SECTION 07 61 16**

**SHEET METAL ROOFING**

**PART 1 - GENERAL**

1.1 DESCRIPTION

- A. This section specifies the installation of coated copper roofing.
- B. Work in this sections includes but is not limited to:
  - 1. Standing Seam Sheet Metal Roofing
  - 2. Flat Seam Metal Roofing
  - 3. Underlayment
  - 4. Accessories
- C. System Descriptions:
  - 1. Roof Assembly 1 and 2 - Standing Seam Roofing
    - a. Custom fabricated standing seam 17" o.c., coated copper sheet metal
    - b. Red rosin paper slip sheet
    - c. Underlayment, Type I or Type II, refer to Drawings
    - d. Nail Base Roof Assembly 1 = existing wood sheathing
    - e. Nail Base Roof Assembly 2 = ¾" Plywood
  - 2. Roof Assembly 3 and 4 - Flat Lock Seam Roofing
    - a. Flat, interlock-seam, coated copper sheet metal
    - b. Red rosin paper slip sheet
    - c. Underlayment, Type I or Type II, refer to Drawings
    - d. Nail Base Roof Assembly 3 = ¾" Plywood
    - e. Nail Base Roof Assembly 4 = existing wood sheathing

1.2 RELATED WORK

- A. Sealant: Section 07 92 00, JOINT SEALANTS.

B. Gutters, Flashing and Trim: Section 07 62 00, SHEET METAL FLASHING and TRIM.

C. Roof preparation: Section 07 10 50, PREPARATION FOR REROOFING.

### 1.3 INSTALLATION REQUIREMENTS

A. Install in accordance with SMACNA Architectural Sheet Metal Manual except as otherwise shown or specified.

### 1.4 PERFORMANCE REQUIREMENTS:

A. General: Metal roof panels shall comply with performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Provisions for Thermal Movement:

1. Fabricate and install sheet metal roofing systems to provide for expansion and contraction of the component materials without buckling, hole elongation, fastener failure or excess stress loading situations developing at any time during the temperature cycle.
2. Make allowances for temperature at time of sheet metal roofing installation. Provide for a surface temperature range of 82 degrees C minimum, or as calculated. Base calculations on surface temperatures of materials due to direct solar heat gain, reflective solar heat gain, and nighttime-sky heat loss.
3. Design and install clips and cleats to resist rotation and to avoid shear stress when roofing materials expand and contract.

C. Wind Uplift Requirements: Design, fabricate and install sheet metal roofing system and components to resist negative pressures as defined by local codes and standards.

D. Water Penetration: No water penetration when tested according to ASTM E 1646 at the following test-pressure difference:

1. Test-Pressure Difference: 20 percent of positive design wind pressure, but not less than 300 Pa and not more than 575 Pa.
2. Positive Preload Test-Pressure Difference: Greater than or equal to 720 Pa and the greater of 75 percent of building live load or 50 percent of building design positive wind-pressure difference.
3. Negative Preload Test-Pressure Difference: 50 percent of design wind-uplift-pressure difference.

- E. Hydrostatic-Head Resistance: No water penetration when tested according to ASTM E 2140.
- F. Metal Gage Requirements: Thickness or gages indicated are minimum. Where thicknesses or gage are not indicated provide material complying with recommendations of the SMACNA "Architectural Sheet Metal Manual", intended to be provided for indicated applications, uses and configurations, and to provide straight, rigid and flat surfaces for completed fabrications.

#### 1.5 WARRANTY REQUIREMENTS:

- A. Underlayment Membrane Manufacturer's Warranty: Furnish manufacturer's standard material certification that installation is in accordance with manufacturer's recommendations and specifications and warranted to be free of leaks and defects.
- B. Sheet Metal Roofing Warranty: Provide special warranty in which Installer agrees to repair or replace components of sheet metal roof assemblies (with the exception of the roof deck) that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Water intrusion.
    - b. Structural failures, including but not limited to rupturing, cracking, or puncturing.
    - c. Wrinkling or buckling.
    - d. Loose parts.
    - e. Failure to remain weathertight, including uncontrolled water leakage.
    - f. Deterioration of metals, metal finishes, and other materials beyond normal weathering, including non-uniformity of color or finish.
    - g. Galvanic action between sheet metal roofing and dissimilar materials.
    - h. Cracked solder joints.
  - 2. Warranty Period: Five (5) years from date of Substantial Completion.

#### 1.6 SUBMITTALS

- A. Comply with requirements of Section 013323, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES regarding electronic submittals.
- B. Work Plan: Submit roofing installation work plan outlining methods of installation, including the following:

1. Description of tools to be used.
  2. Description of installation methods.
  3. Description of temporary protection measures during inclement weather.
  4. Description of sequencing of Work including the interface with roofing demolition Work.
- C. Product Data: Manufacturer's specifications and installation instructions for each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.
- D. Shop Drawings: Show project specific drawings showing fabrication and installation layouts of sheet metal roofing, including plans, elevations, expansion joint locations, and keyed details. Distinguish between shop- and field-assembled work. Shop drawings for details shall be full size. Include the following:
1. Elevation and Plan views.
  2. Typical copper roof assemblies.
  3. Details for forming sheet metal roofing, including seams and dimensions.
  4. Details for joining and securing sheet metal roofing, including layout of fasteners, cleats, clips, and other attachments. Include pattern of seams.
  5. Details of termination points and assemblies, including fixed points.
  6. Details of expansion joints, including showing direction of expansion and contraction.
  7. Details of roof penetrations.
  8. Details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings.
  9. Details of special conditions.
  10. Details of connections to adjoining work.
  11. Detail the following accessory items, at a scale of not less than 1:2:
    - a. Flashing and trim.
    - b. Gutters and downspouts as they relate to adjacent sheet metal roofing.
    - c. Terminations.
    - d. Penetrations.
    - e. Hips.
- E. Coordination Drawings: Roof plans, drawn to scale, on which the following are shown and coordinated with each other, based on input

from installers of the items involved:

1. Roof panels and attachments.
- F.** Roof mounted items including lightning protection, equipment supports, pipe supports and penetrations.
- G.** Samples: Submit two representative samples of each material specified indicating visual characteristics and finish. Include range samples if variation of finish is anticipated.
1. Sheet Metal Roofing: 12" long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, and other attachments.
  2. Trim and Metal Closures: 12" long and in required profile. Include fasteners and other exposed accessories.
  3. Other Accessories: 12" samples for each type of accessory.
- H.** Qualification Data: For qualified Fabricator, Installer, Professional Engineer, and Testing Agency, include list of completed projects having similar scope of work identified by name, location, date, reference names and phone numbers.
1. Include work history of each individual soldering mechanic who will be performing soldering on this Project. Submit at least one month before soldering work is scheduled to commence or, if new mechanic is added to the workforce, at least one week before being added to the workforce.
- I.** Work Progress Reports: Submit daily a log of roofing Work completed, and weekly compiled reports of progress and status of roofing Work.
- J.** Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.
- K.** Performance Test Reports: Submit the following Test Reports, certified by and Independent Testing Laboratory or an independent professional engineer, to verify that the proposed roofing will meet the performance requirements of this specification.
1. ASTM E 1592 "Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference" test methods.
  2. UL 90 Classification Test Data and report number.
  3. Air Infiltration (ASTM E 283) and Water Penetration (ASTM E 331) Test Results
- L.** Field Quality-Control Reports.

M. Warranties: Sample of special warranties, attached at the end of this section.

N. Maintenance Data: For metal roof panels to include in maintenance manuals.

#### 1.7 QUALITY ASSURANCE

A. CARB for containers 16 oz. or less. Installer shall specialize in specified membrane underlayment and sheet metal roofing installation and which has successfully completed five (5) projects similar in size, scope, and complexity within the last ten (10) years that qualifies as a "Specialist" under the provisions of Division 01, GENERAL REQUIREMENTS.

1. Underlayment Installers: Trained and certified by roofing contractor so as to provide single-source responsibility for work of this Section.

2. Soldering Mechanics: Demonstrate minimum five (5) years of experience performing work similar in nature and scope to Work of this Project. Mechanics without accepted proficiency sample will not be permitted to perform roofing Work.

B. Workforce Requirements: Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work.

C. Installation Supervisor: Installer must maintain full-time supervisor on job site during times that roofing Work is in progress. Supervisor must have minimum of five (5) years experience as supervisor of roofing work similar in nature and scope to Work of this Project.

D. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

E. Sheet Metal Roofing Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or shown on Drawings.

F. Preliminary Roofing Conference: Before starting roof construction, conduct conference at Project site. Comply with requirements for preinstallation conferences in Division 01 Section "Project

Management and Coordination."

1. Review methods and procedures related to roof sheathing construction and sheet metal roofing including, but not limited to, items listed for the Preinstallation Conference.
- G. Preinstallation Conference: Conduct conference at Project site.
1. Meet with VA, VA, VA's insurer if applicable, sheet metal roofing Installer, manufacturer's representative for sheet metal roofing, underlayment manufacturer's representative, and sheathing Installer, and installers whose work interfaces with or affects sheet metal roofing including installers of roof accessories and roof-mounted equipment.
  2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
  3. Review methods and procedures related to sheet metal roofing installation, including portable roll-forming equipment manufacturer's written instructions.
  4. Examine sheathing conditions for compliance with requirements, including flatness and attachment to structural members.
  5. Review structural loading limitations of sheathing during and after roofing installation.
  6. Review flashings, special roofing details, roof drainage, roof penetrations, and condition of other construction that will affect sheet metal roofing. Review governing regulations and requirements for insurance, certificates, and testing and inspecting if applicable.
  7. Review temporary protection requirements for sheet metal roofing during and after roofing installation.
  8. Review roof observation and repair procedures after sheet metal roofing installation.
  9. Document proceedings, including corrective measures and actions required, and furnish a digital copy of record to each participant.
- H. Source Limitations: Obtain each type of metal roof panel from a single source from a single manufacturer.

1.8 PROFICIENCY SAMPLES

- A. Prior to field mock-up production, provide proficiency samples of standing seam and flat seam roof types for review of individual soldering workmanship.
- B. Size and Configuration: Two full size roof pans with typical lock seam; and overall length of 1 m. Provide 3 samples from each soldering and welding mechanic to be engaged in roof installation

of this Project.

C. Materials and Extent:

1. Incorporate production materials and methods as required for finished Work.
2. Include full length of seaming between adjoining pans.

D. Prepare samples on site in outdoor conditions in the presence of VA. Notify VA of time and location at least 2 weeks prior to proficiency sample production.

E. Contracting Officer's Review:

1. CO will review proficiency samples and advise acceptance or rejection of acceptability of soldering craftsmanship of individual panels and craftsman.
2. Review of samples may include testing by test cuts.
3. Samples that do not evidence complete flow of solder into all folds of the flat lock seam will not be accepted.
4. Label each sample including date of approval, craftsman's name, contractor's name, and name of reviewing CO's representative.

F. Maintain accepted samples on Project site as standard for subsequent Work.

G. Remove proficiency samples from Project site at completion of Project.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Do not store sheet metal roofing materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal roofing materials away from uncured concrete and masonry.
- B. Protect strippable protective covering on sheet metal roofing from exposure to sunlight and high humidity, except to the extent necessary for the period of sheet metal roofing installation.

1.10 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 for Testing and Materials (ASTM):

1. B32-04 Solder Metal
2. B152-06 Copper Sheet, Strip, Plate, and Rolled Bar
3. D226-06 Asphalt-Saturated Organic Felt Used In Roofing and Waterproofing
4. D227-03 Coal-Tar Saturated Organic Felt Used in Roofing and Waterproofing
5. D2822-05 Asphalt Roofing Cement
6. F1667-05 Driven Fasteners: Nails, Spikes and Staples

## C. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):

1. Architectural Sheet Metal Manual (Sixth Edition - 1993)

PART 2 - **PRODUCTS**

## 2.1 MANUFACTURERS

- A. Basis-of-Design Manufacturer: Revere Copper Products, Inc. - Freedom Gray.
  1. Description: Z-T Alloy Coated Copper. Thickness: 20 oz.

## 2.2 SOLDER

- A. Solder: For zinc-tin Alloy coated copper, solder shall conform to ASTM Specification B32 and be lead-free.
- B. Soldering: Before soldering Z-T Alloy coated copper, the pre-weathered coating must be removed and surfaces to receive soldering chemically and/or mechanically cleaned to produce clean, bright alloy.

### 2.3 FLAT SEAM ROOFING

- A. Description: Flat, shop welded pans, interlock, continuously soldered in field.
  - 1. Including Roof Assembly 3 and 4 as described above.

### 2.4 STANDING SEAM ROOFING

- A. Seam: Pre-hemmed standing seam, seams 17" o.c, smooth pans.
  - 1. Including Roof Assembly 1 and 2 as described above.

### 2.5 UNDERLAYMENTS

- A. Slip Sheet: Building paper, 3-lb/100sq. ft. (0.16 kg/sq.m) minimum, rosin-sized.
- B. Underlayment Type I - Breathable Polypropylene Sheet: Mechanically attached, slip-resistant, textured surface.
  - 1. Basis-of-Design Product: Vaproshield / Slope-Shield.
    - a. Tensile Strength (ASTM D 1682): Pass.
    - b. Water Vapor Transmission and Permeance (ASTM E 96, Water Method): 59 perms.
    - c. Water Ponding (AC 48, Section 44): Pass.
    - d. Flame Spread Index (ASTM E 84-10, Class A): Pass.
    - e. Smoke Development Index (ASTM E 84 - 35, Class A): Pass.
- C. Underlayment Type II - Self-Adhering High-Temperature Sheet: Minimum 0.76 to 1.0mm thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold-applied. Provide primer when recommended by underlayment manufacturer.
  - 1. Thermal Stability: ASTM D 1970; stable after testing at 116 deg C.
  - 2. Low-Temperature Flexibility: ASTM D 1970; passes after testing a minus 29 deg C.

### 2.6 AUXILIARY MATERIALS

- A. Fasteners: Wood screws, annular-threaded nails, self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads and acceptable to manufacturer, SMACNA and CDA standards. Provide EPDM, PVC, or neoprene sealing washers.
  - 1. General:
    - a. Exposed Fasteners: As recommended by manufacturer compatible with roof system and substrate.
    - b. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
    - c. Blind Fasteners: High-strength stainless-steel rivets suitable for metal being fastened.

2. Fasteners for copper sheet: Copper, hardware bronze or Series 300 stainless steel.
- B. Sealant Tape: Pressure-Sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, non-sag, non-toxic, non-staining tape 13mm wide and 3mm thick.
- C. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; low modulus; of type, grade, class, and use classifications required to seal joints in sheet metal roofing and remain watertight.
- D. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.
- E. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

## 2.7 ACCESSORIES

- A. Sheet Metal Accessories: Provide components required for a complete sheet metal roofing assembly including trim, copings, fasciae, corner units, clips, flashings, sealants, gaskets, fillers, metal closures, closure strips, and similar items. Match material and finish of sheet metal roofing unless otherwise indicated.
  1. Cleats: For mechanically seaming into joints and formed from the following materials:
    - a) Copper Roofing: 20 oz.
  2. Clips: 1.6-mm-thick, copper panel clips designed to withstand negative-load requirements.
  3. Backing Plates: Plates at roofing splices, fabricated from material recommended by SMACNA.
  4. Flashing and Trim: Formed from same material and with same finish as sheet metal roofing, minimum 20 oz.

## 2.8 FABRICATION

- A. General: Custom fabricate sheet metal roofing to comply with details shown and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions (panel width and seam height), geometry, metal thickness, and other characteristics of installation indicated, unless otherwise indicated in the Construction Documents. Fabricate sheet metal roofing and accessories at the shop to greatest extent possible.
  1. Flat-Seam Roofing: Form flat-seam panels from metal sheets as indicated on Drawings.
  2. Standing-Seam Roofing: Form standing-seam panels with finished seam height of 1-1/2".

- B. Fabrication Tolerances: Fabricate sheet metal roofing that is capable of installation to a tolerance of 1/4" in 12' on slope and location lines as indicated and within 1/8" offset of adjoining faces and of alignment of matching profiles.
- C. Form exposed sheet metal work to fit substrates without excessive oil canning, buckling, and tool marks; true to line and levels indicated; and with exposed edges folded back to form hems.
1. Lay out sheet metal roofing so transverse seams, if required, are made in direction of flow with higher panels overlapping lower panels.
  2. Offset transverse seams from each other **12"** (300 mm) minimum.
  3. Fold and cleat eaves and transverse seams in the shop.
  4. Form and fabricate sheets, seams, strips, cleats, valleys, ridges, edge treatments, integral flashings, and other components of metal roofing to profiles, patterns, and drainage arrangements shown on Drawings and as required for leak proof construction.
- D. Expansion Provisions: Fabricate sheet metal roofing to allow for expansion in running work sufficient to prevent leakage, damage, and deterioration of the Work. Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1" (25 mm) deep, filled with butyl sealant concealed within joints.
- E. Sealant Joints: Where movable, nonexpansion-type joints are indicated or required to produce weathertight seams, form metal to provide for proper installation of elastomeric sealant in compliance with SMACNA standards. Metal Protection: Where dissimilar metals will contact each other, protect against galvanic action by painting contact surfaces with bituminous coating.
- F. Sheet Metal Accessories: Custom fabricate flashings 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. Obtain field measurements for accurate fit before shop fabrication.
1. Form exposed sheet metal accessories without excessive oil canning, buckling, and tool marks and true to line and levels

indicated, with exposed edges folded back to form hems.

2. Seams: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
3. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant.
4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
5. Fabricate cleats and attachment devices of sizes as recommended by SMACNA's "Architectural Sheet Metal Manual" for application, but not less than thickness of metal being secured, unless otherwise indicated.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.
  1. Examine roof sheathing to verify that sheathing joints are supported by framing or blocking, that tops of fasteners are flush with surface, and that installation is within flatness tolerances required for finished roofing installation.
  2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and completely anchored, and that provision has been made for drainage, flashings, and penetrations through sheet metal roofing.
- B. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Examine roughing-in for components and systems penetrating sheet metal roofing to verify actual locations of penetrations relative to seam locations of sheet metal roofing before installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 UNDERLAYMENT INSTALLATION

- A. General: Comply with underlayment manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.
- B. Breathable Polypropylene Sheet Underlayment - Type I: Apply in compliance with manufacturer's recommendations to achieve smooth and continuous coverage with minimum 6" (150mm) sheet laps over adjacent underlayments. Mechanically attach using manufacturer-supplied or -recommended components
- C. Self-Adhering Sheet Underlayment - Type II: Install self-adhering sheet underlayment; wrinkle free, on roof deck under sheet metal roofing. Apply primer if required by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer rather than nails for installing underlayment at low temperatures. Apply at locations indicated in shingle fashion to shed water, with end laps of not less than 6" (150mm) staggered 24" (610 mm) between courses. Overlap side edges not less than 3.6" (90mm) Roll laps with roller. Cover underlayment within 14 days.
- D. Slip Sheet: Install with tape or adhesive for temporary anchorage to minimize use of mechanical fasteners under copings. Apply in shingle fashion to shed water, with lapped joints of not less than 2" (50 mm).
- E. Confirm that terminations of underlayment have been fully sealed at penetrations, overlaps, changes in substrate and changes in underlayment material.

### 3.3 INSTALLATION, GENERAL

- A. General: Anchor sheet metal roofing and other components of the Work securely in place, with provisions for thermal and structural movement. Install fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for a complete roofing system and as recommended by fabricator for sheet metal roofing.
  - 1. Field cutting of sheet metal roofing by torch is not permitted.
  - 2. Provide metal closures at rake walls, eaves, and each side of ridge and hip caps.
  - 3. Flash and seal sheet metal roofing with closure strips at eaves, rakes, and perimeter of all openings. Fasten with self-tapping screws.

4. Locate and space fastenings in uniform vertical and horizontal alignment. Pre-drill panels for fasteners.
  5. Install ridge and hip caps as sheet metal roofing work proceeds.
  6. Locate roofing splices over, but not attached to, substrate. Stagger roofing splices and end laps to avoid a four-panel lap splice condition. Install backing plates at roofing splices.
  7. Install sealant tape where indicated.
  8. Lap metal flashing over sheet metal roofing to allow moisture to run over and off the material.
  9. Do not use graphite pencils to mark metal surfaces.
- B. Thermal Movement: Rigidly fasten metal roof panels to substrate at only one location for each panel. Allow remainder of panel to move freely for thermal expansion and contraction.
- C. Avoid attaching accessories through roof panels in a manner that will inhibit thermal movement. Fasteners: Use fasteners of sizes that will penetrate wood sheathing not less than 1 ½" for nails and not less than ¾" for wood screws.
- D. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying self-adhering sheet underlayment to each contact surface, or by other permanent separation as recommended by SMACNA.
1. Coat back side of coated copper sheet metal roofing with bituminous coating where roofing will contact wood, ferrous metal, or cementitious construction.
- E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

### 3.4 CUSTOM-FABRICATED SHEET METAL ROOFING INSTALLATION

- A. Fabricate and install work with lines and corners of exposed units true and accurate. 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. Fold back sheet metal to form a hem on concealed side of exposed edges unless otherwise indicated.

- B. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Prepare edges of sheets to be soldered in accordance with manufacturer's recommendations. Minimize extent of edge preparation to only what is necessary where seam will be exposed in the finished work.
  - C. Flat-Seam Roofing: Attach flat-seam metal panels to substrate with cleats, starting at eave and working upward toward ridge. After panels are in place, mallet seams and solder.
    - 1. Attach roofing panels with cleats spaced not more than 12" o.c. Lock and solder panels to base flashing.
    - 2. Attach edge flashing to face of roof edge with continuous cleat fastened to roof substrate at 12" o.c. Lock panels to edge flashing and apply sealant.
  - D. Standing-Seam Roofing: Attach standing-seam metal panels to substrate with cleats, double fastened at 12" o.c. Install panels reaching from eave to ridge before moving to adjacent panels. Before panels are interlocked, apply continuous bead of sealant to top of flange of lower panel. Lock standing seams by folding over twice so cleat and panel edges are completely engaged.
    - 1. Lock each panel to panel below with soldered transverse seam. Loose-lock panels at eave edges to continuous cleats and flanges at roof edge at gutters.
    - 2. Loose-lock panels at eave edges to continuous edge flashing exposed 24" (610 mm) from roof edge. Attach edge flashing to face of roof edge with continuous cleat fastened to roof substrate at 12" (305 mm) o.c. Lock panels to edge flashing.
    - 3. Fold over seams after locking at ridges and hips.
- 3.5 ACCESSORY INSTALLATION

- A. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.
  - 1. Install components required for a complete sheet metal roofing assembly including trim, copings, seam covers, flashings, sealants, gaskets, fillers, metal closures, closure strips, and similar items.
  - 2. Install accessories integral to sheet metal roofing that are specified in Section 076200, SHEET METAL FLASHING AND TRIM to comply with that Section's requirements.



- B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
1. Install flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers.
  2. Install continuous strip of self-adhering underlayment at edge of continuous flashing overlapping self-adhering underlayment, where "continuous seal strip" is indicated in SMACNA's "Architectural Sheet Metal Manual," and where indicated on Drawings.
  3. Install exposed flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
  4. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10' with no joints allowed within 24" of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1" deep and filled with butyl sealant concealed within joints.

### 3.6 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align sheet metal roofing within installed tolerance of 5/8" in 12' on slope and location lines as indicated and within 1/8" offset of adjoining faces and of alignment of matching profiles.

### 3.7 INSTALLATION TOLERANCES

- A. Shim and align sheet metal roofing within installed tolerances specified in MCA's "Guide Specification for Residential Metal Roofing." CLEANING AND PROTECTION
1. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
  2. Clean and neutralize flux materials. Clean off excess solder.
  3. Clean off excess sealants.

4. Remove temporary protective coverings and strippable films as sheet metal roofing is installed unless otherwise indicated in manufacturer's written installation instructions. On completion of sheet metal roofing installation, clean finished surfaces as recommended by sheet metal roofing manufacturer. Maintain sheet metal roofing in a clean condition during construction.
5. Replace sheet metal roofing components that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

### 3.8 FIELD QUALITY CONTROL

#### A. Workmanship:

1. Soldering:
  - a. Mechanically or chemically clean and remove pre-weathered coating from all surfaces of coated metals in contact with solder. Produce a clean and bright surface.
  - b. Apply flux as required.
  - c. Sweat solder thoroughly into seams, completely filling the full width of the seam.
  - d. Upon completion of soldering, remove all traces of flux residue. If required, apply a neutralizing wash followed by a clean water wash.
2. Cross Folded Seams: Where sheet metal is cross folded at a right angle to the first fold, slit the folded portion of the metal at the cross fold and solder a metal patch over the slit to avoid binding.

#### B. Independent Testing Agency:

1. Inspect and test proficiency samples, and inspect field mock-ups and sample installations for compliance with requirements.
2. Provide visual examination of each phase of execution of roofing installation. If deficiencies are found, re-examine areas after Contractor has corrected deficiencies.
3. Review field records of soldering work. Verify that records identify individual craftsmen and soldering work by location.
4. Inspect soldered lock seam joints as Work is performed to assure joints are properly performed and joints are filled with solder.
5. Testing:
  - a. Perform test cuts by removing a minimum 2" long section of lock seam joint at locations selected by VA and SI.
  - b. Test cut and soldering inspection frequency: 1 test cut per 61 linear feet of soldered joint.
6. Provide daily written reports.
7. Final Inspection: Inspect completed installation with Contractor to evaluate sheet metal roofing application.

#### C. Provide written report: Contractor Responsibilities:

1. Make arrangements for independent agency to perform inspections.
2. Testing and soldering inspection: Patch and repair all test cuts in manner acceptable to CO.
3. Unacceptable test cuts will establish the basis for further inspection as determined by the CO.
4. Correct all deficient soldered joints by means acceptable to the CO.
5. Remove individual craftsmen whose soldering work is consistently found to be deficient through testing and inspection and as determined by CO.
6. Final inspection: Inspect completed installation with independent testing agency to evaluate roofing application.
  - a. Correct deficiencies as identified in written report.

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