

**SECTION 07 61 17**  
**FLAT SEAM SHEET METAL ROOFING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies the installation of flat locked and soldered seam copper roofing.

**1.2 RELATED WORK**

Sealant: Section 07 92 00, JOINT SEALANTS.

**1.3 INSTALLATION REQUIREMENTS**

- A. Install in accordance with SMACNA Architectural Sheet Metal Manual except as otherwise shown or specified.
- B. Coordinate copper roofing with rain drainage work, flashing, gutters, downspouts, trim and construction of decks, parapets, walls, and other adjoining work to provide permanently watertight, secure, and noncorrosive installation.

**1.4 PERFORMANCE REQUIREMENTS**

- A. Installation Requirements:
  - 1. Drawings are diagrammatic and are intended to establish basic dimension of units, sight lines, and profiles of units.
  - 2. Make modifications only to meet field conditions and to ensure fitting of system components.
  - 3. Provide concealed fastening wherever possible.
  - 4. Attachment considerations: Account for site peculiarities and expansion and contraction movements so there is no possibility of loosening, weakening and fracturing connection between units and building structure or between components themselves.
  - 5. Accommodate building structure deflections in system connections to structure.
- B. Performance Requirements:
  - 1. System shall accommodate movement of components without buckling, failure of joint seals, undue stress on fasteners, or other detrimental effects when subjected to seasonal temperature changes and live loads.
  - 2. Design system capable of withstanding building code requirements for negative wind pressure.
- C. Interface With Adjacent Systems:
  - 1. Integrate design and connections with adjacent construction.

2. Accommodate allowable tolerances and deflections for structural members in installation.

### 1.5 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop drawings showing manner of forming, joining, and securing copper roofing, and pattern of seams. Show expansion joint details and waterproof connections to adjoining work and at obstructions and penetrations.
- C. Product data including metal manufacturer's specifications, installation instructions, and general recommendations for roofing applications. Include certification or other data substantiating that materials comply with requirements.

### 1.6 QUALITY ASSURANCE

- A. Fabricator's Qualifications: Company specializing in copper sheet metal roofing work with three years experience in similar size and type of installations.
- B. Installer: A firm with 3 years of successful experience with installation of copper roofing of type and scope equivalent to Work of this Section.
- C. Industry Standard: Except as otherwise shown or specified, comply with applicable recommendations and details of the "Copper in Architecture" handbook published by the Copper Development Association Inc. (CDA). Conform to dimensions and profiles shown.
- D. Wind Uplift: Provide roof assemblies meeting wind uplift ratings as required by code.

### 1.7 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):
  - B32-08 ..... Solder Metal
  - B152-09 ..... Copper Sheet, Strip, Plate, and Rolled Bar
  - C171-07 ..... Sheet Materials for Curing Concrete
  - D226-09 ..... Asphalt-Saturated Organic Felt Used In Roofing  
and Waterproofing
  - D227-03 ..... Coal-Tar-Saturated Organic Felt Used in Roofing  
and Waterproofing

D2822-05 ..... Asphalt Roofing Cement  
 F1667-11 ..... Driven Fasteners: Nails, Spikes and Staples  
 D. Sheet Metal and Air Conditioning Contractors National  
 Association (SMACNA): Architectural Sheet Metal Manual (Sixth  
 Edition - 2003)

## **PART 2 - PRODUCTS**

### **2.1 SHEET COPPER**

- A. Copper Roofing Sheets: Cold-rolled copper sheet complying with ASTM B 370 temper H00, unless otherwise indicated, and as follows:
1. Weight: 16 oz. per sq. ft. (0.0216-inch thick) (0.55-mm) unless otherwise indicated.

### **2.2 FLASHING CEMENT**

ASTM D2822, Type I.

### **2.3 SOLDER**

ASTM B32: Flux type and alloy composition as required for use with metals to be soldered.

### **2.4 UNDERLLEMENTS**

- A. Roofing Felt:

ASTM D226, Type I or ASTM D227.

- B. Self-Adhering Sheet Membrane Roof Underlayment: Provide products with the following characteristics:

1. Material: Cold applied, self-adhering membrane composed of an innovative and proprietary rubberized asphalt adhesive and interwound with a disposable release sheet. An embossed, slip resistant surface is provided on the high performance film with UV barrier properties.
2. Membrane Thickness: 40 mils (1.02 mm) per ASTM D3767 Method A.
3. Membrane Tensile Strength: MD 33 lbf/in, CD 31 lbf/inch per ASTM D412 Die C Modified.
4. Membrane Elongation: 250% per ASTM D412 Die C Modified.
5. Low Temperature Flexibility: Unaffected at -20 degrees F (-29 degrees C) per ASTM D1970.
6. Adhesion to Plywood: 5.0 lb/in. width ( 876 N/m) per ASTM D903.
7. Maximum Permeance: 0.05 perms (2.9 ng/sgms Pa) per ASTM E96.
8. Maximum Material Weight Installed: 0.22 pounds/sqft (1.1 kg/sqm) per ASTM D461.
9. Service Temperature: 240 degrees F (115.6 degrees C) per ASTM

D1204

10. Compatibility: Suitable for use under all types of sloped roofing with the exception high altitude climates where zinc, copper or Cor-Ten roof coverings are used.
11. Adhesive: Rubberized asphalt adhesive containing post-consumer recycled content, contains no calcium carbonate, sand or fly ash.
12. Exposure: Can be left exposed for a maximum of 120 days from date of installation per ASTM G90 - EMMAqua test.
13. Primer: Water-based Perm-A-Barrier WB Primer by Grace Construction Products.
14. Code and Standards Compliance:
  - a. ASTM D1970.
  - b. ICC-ES AC 48 Acceptance Criteria for Roof Underlayments for use in Severe Climate Areas.
  - c. Underwriters Laboratories Inc. R13399 - Class A fire classification under fiber-glass shingles and Class C under organic felt shingles (per ASTM E108/UL 790).

## 2.5 ACCESSORIES

- A. Nails: ASTM F1667, copper slating nails with large flat heads and needle points.
  1. Nails of sufficient length to penetrate nailer at least 22 mm (7/8-inch).
- B. RIVETS: Copper or copper alloy not less than 3 mm (1/8-inch) diameter.
- C. BUILDING PAPER: ASTM C171.
- D. CLEATS:
  1. Concealed type as indicated in the "Copper in Architecture " handbook published by the Copper Development Association Inc. (CDA) for flat lock seams spaced on 12-inch (300-mm) centers.
  2. Fabricate cleats to allow thermal movement of copper roof panels while preventing copper panel distortion due to wind uplift forces.
- E. Solder: ASTM B32; Provide 50-50 tin/lead or lead free alternative of similar or greater strength solder. Killed acid flux.
- F. Flux: Muriatic acid neutralized with zinc or approved brand of soldering flux.

## 2.6 FABRICATION

- A. General Metal Fabrication: Shop-fabricate work to greatest extent possible. Comply with details shown and with applicable requirements of the "Copper in Architecture" handbook published by the Copper

Development Association (CDA) 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.

1. Fabricate to allow for adjustments in field for proper anchoring and joining.
2. Form sections true to shape, accurate in size, square, free from distortion and defects.
3. Cleats: Fabricate cleats and starter strips of same material as sheet, interlockable with sheet in accordance with CDA recommendations.
4. Tin edges of copper sheets and cleats at soldered joints for flat lock and soldered system.
5. Flat Locked Panel Seams:
  - a. Fabricate flat seams for solid soldered dry joints.
  - b. Fabricate seams for panels to be installed in overlapped, interlocking shingle manner for locked down engaged seams.
  - c. Fold two adjacent edges over 180 degrees for width of 3/4 inch and other two adjacent edges under 3/4 inch (19 mm). Refer to CDA "Copper in Architecture Handbook".
  - d. Fabricate flat seam roofing from pans 18 inches (450 mm) by 24 inches (600 mm) in size.
- B. Seams: Fabricate nonmoving seams in copper sheet with flat-lock seams. Tin edges and cleats to be soldered, form seams, and solder.
- 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-inch (25-mm) 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 the "Copper in Architecture" handbook published by the Copper Development Association Inc. (CDA).

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.

F. Solder:

1. Solder and seal non-moving copper joints on slopes up to 3:12, except those indicated or required to be expansive type joints.
  2. After soldering, remove flux. Wipe and wash solder joints clean.
- Refer to CLEANING Article in PART 3.

## **2.4 FINISHES**

A. Natural weathering mill finished copper. No applied finish.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION**

A. Follow SMACNA manual except as otherwise specified here.

B. Roofing surface:

1. Clean and dry before application.
2. Cover surface with Self-Adhering Sheet Membrane Roof Underlayment with seams lapped as required by manufacturer.
3. Use copper nails driven through sheet copper washers not less than 25 mm (1-inch) square.

C. Self-Adhering Sheet Membrane Roof Underlayment

1. Schedule installation such that underlayment is covered by roofing within the published exposure limit of the underlayment.
2. Do not install underlayment on wet or frozen substrates.
3. Install when surface temperature of substrate is a minimum of 40 degrees F (5 degrees C) and rising.
4. Remove dust, dirt, loose materials and protrusions from deck surface.
5. Install membrane on clean, dry, continuous structural deck. Fill voids and damaged or unsupported areas prior to installation.
6. Install membrane such that all laps shed water. Work from the low point to the high point of the roof at all times. Apply the membrane in valleys before the membrane is applied to the eaves. Following placement along the eaves, continue application of the membrane up the roof. Membrane may be installed either vertically or horizontally after the first horizontal course.
7. Side laps minimum 3-1/2 inches (89 mm) and end laps minimum 6

inches (152 mm) following lap lines marked on underlayment.

8. Patch penetrations and damage using manufacturer's recommended methods.

9. Extend membrane 36" up behind existing faux slate shingles.

### **3.2 INSTALLATION**

#### **A. General:**

1. Separate dissimilar metals by painting each metal surface in area of contact with a bituminous coating, by applying rubberized asphalt or butyl underlayment to each metal surface, or by other permanent separation as recommended by manufacturers of dissimilar metals.
2. 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 leakproof construction. Provide for thermal expansion and contraction of the work, as indicated. Seal joints as shown and as required for leakproof construction. Shop-fabricate materials to greatest extent possible.
3. 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, and sealant. Except as otherwise shown, fold back sheet metal to form a hem on concealed side of exposed edges.
4. 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.
5. Tin uncoated copper surfaces and cleats at edges of sheets to be soldered, for a width of 1-1/2 inch (38 mm), using solder recommended for copper work.
6. 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, and sealant. Except as otherwise shown, fold back sheet metal to form a hem on concealed side of exposed edges.
7. 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.

8. Tin uncoated copper surfaces and cleats at edges of sheets to be soldered, for a width of 1-1/2 inch (38 mm), using solder recommended for copper work.

**B. Flat Lock Seam Roofing:**

1. Install copper work in accordance with CDA "Copper in Architecture Handbook."
2. Flat Seam Metal Roof Panels: Fasten system to substrate with concealed metal cleats and screws at spacings required by fabricator to resist code required wind uplift.
3. Align, level, and plumb system with structure.
4. Fasten cleats or nails using cleats mated to folded flat seams and fastener pattern to resist design loads with screws or barbed nails of sufficient length to penetrate substrate.
5. Fully seat adjacent panel on two sides to achieve continuous engagement of seam joint.
6. Mallet or dress down engaged seams.
7. Apply flux and fully sweat seams with solder to achieve watertight installation.
8. Install expansion battens at 25 to 30 feet (7500 mm to 9000 mm) in both directions.

### **3.3 JOINING**

- A. Solder seams where required to produce water tight joints. Completely remove flux after soldering is completed.
- B. Edges of copper required to be soldered shall be tinned with solder for a width of 38 mm (1-1/2 inches).
- C. Joints in copper up to 560 g (20 ounce) weight may be soldered.
- D. Jointing of copper over 560 g (20 ounce) weight shall be done by lapping, riveting and soldering. Space rivets 75 mm (3 inches) on center in two rows in a staggered position.

### **3.4 SEALING**

Where dowels, fastening devices and similar items penetrate roofing, make penetrations watertight by means of sealing compound. Sealing compound is specified in Section 07 92 00, JOINT SEALANTS.

### **3.5 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. Upon completion of each area of soldering, carefully remove flux and other residue from surfaces. Neutralize acid flux by washing with baking soda solution, and then flushing clear water rinse. Use special care to neutralize and clean crevices.
- C. Clean exposed metal surfaces of substances that would interfere with uniform oxidation and weathering.

### **3.6 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.

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