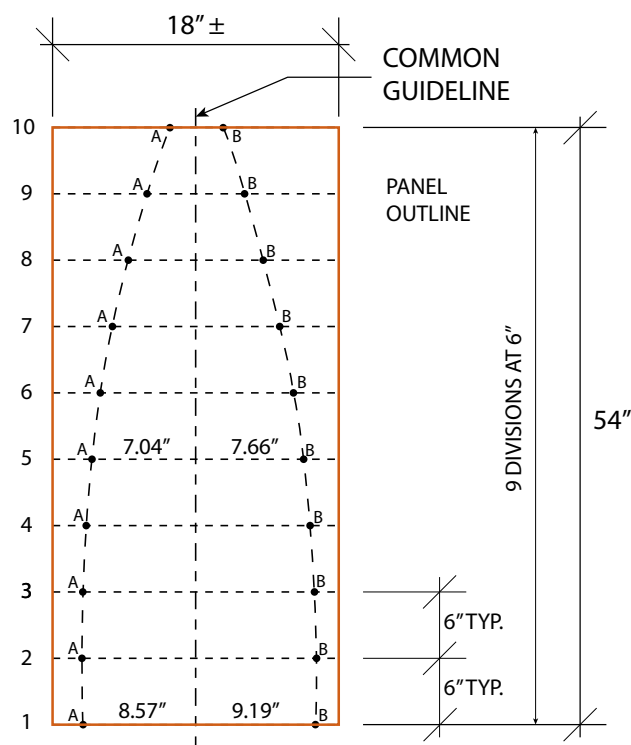


13.8D. Typical Panel Layout

Using a piece of metal at least 18 inches wide by 54 inches long, place a centerline along its length. This will become the guideline of the pattern for the dome panels. Starting at the base using the dividers place station marks at 6-inch intervals on the pattern centerline and number the stations 1 through 10 to correspond to the quarter dome layout in **Detail 13.8C**.

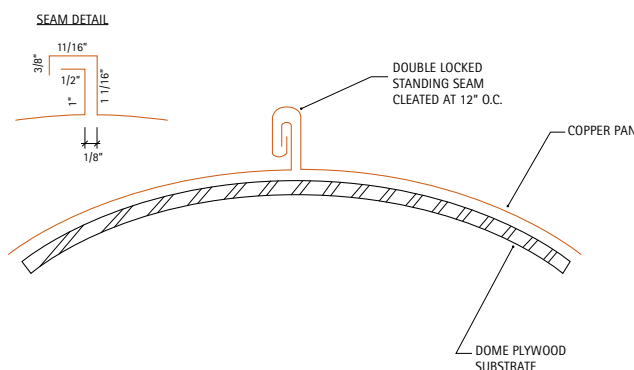


On the Quarter Dome Section draw horizontal lines, parallel to the base, from the station marks to the vertical axis. Measure the length of each of these station lines. This corresponds to the radius of the dome at this point. Using this radius calculate the circumference of the dome at this station and divide it by the number of panels, 16, to determine the width of the panel at this station. Adding the respective dimensions for the vertical legs and flanges at each side completes the width of the panel at each Station (See Table 13.8A above).

Panel dimensions are all determined from the common guideline. These are points "A" and "B" on the panel. Completing each station up the panel and connecting all the "A" points and all the "B" point leads to the panel pattern. This first pattern can be cut and used to trace and cut the remaining 7 panels.

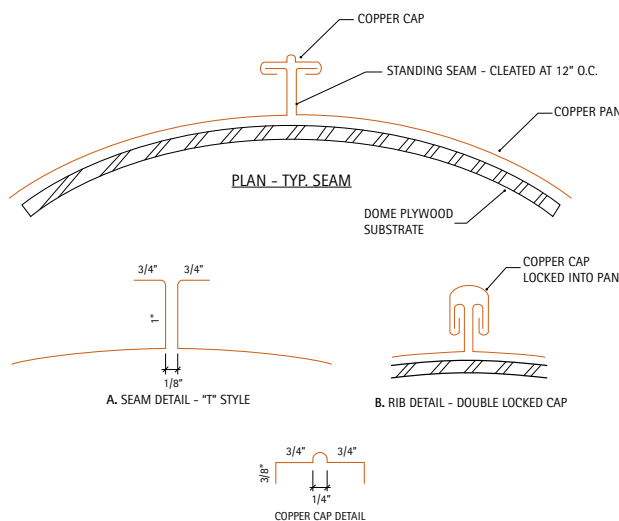
13.8E. Dome Assembly

When all 8 panels have been cut, the flanges are formed on each edge using beading machines. The panels are then curved with stretching tools to match the dome radius. The rib seam indicated is a double locked standing seam. The panels are cleated to the deck with cleats spaced at 12" O.C. For bolder seams, double locked batten seamed systems can also be used and their installation is only limited by the dome diameter.

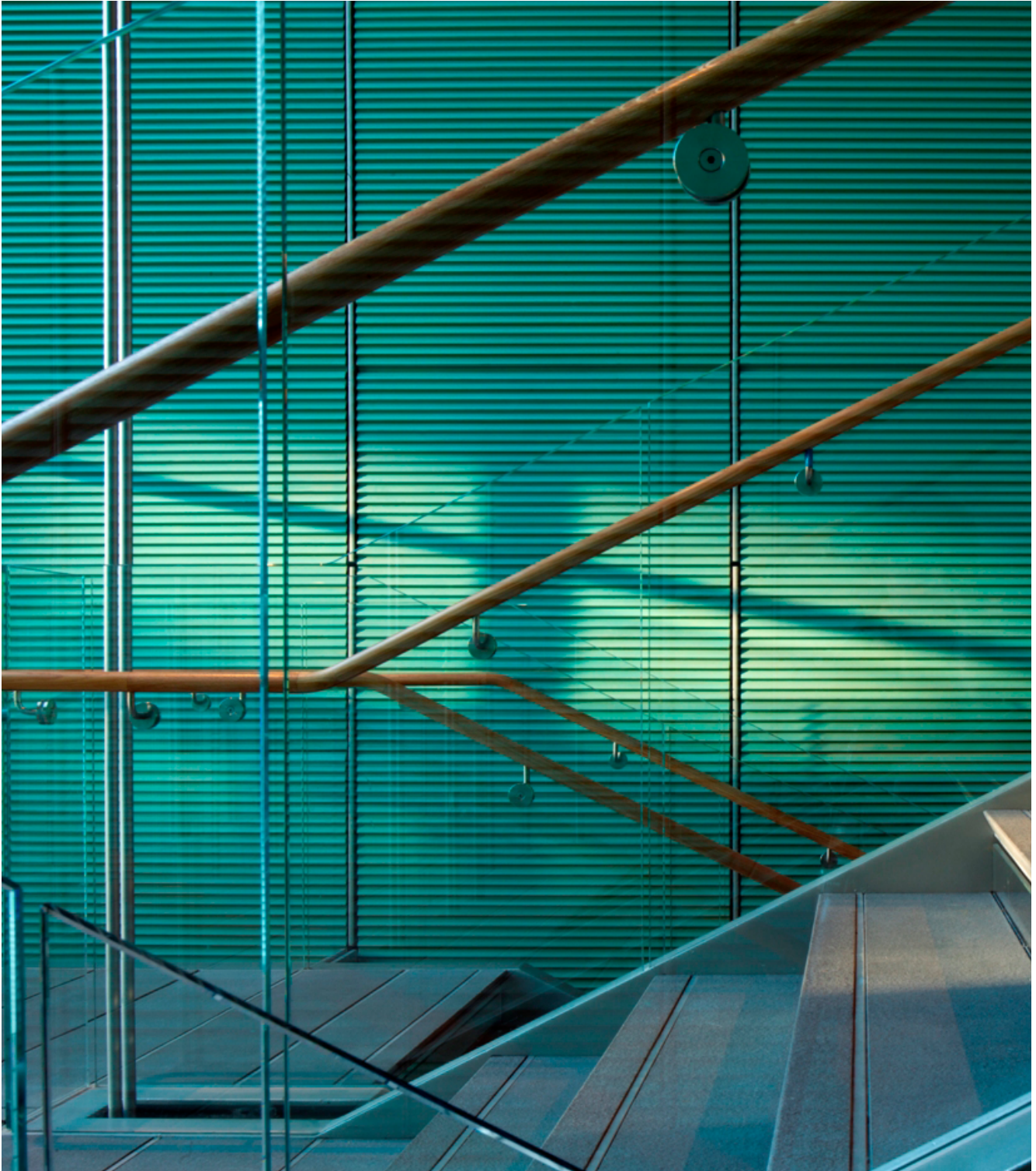


13.8F. Alternative Dome Assembly

- A. An alternative "T" style is shown where the cap is single locked into the upstanding leg flange of the pan, giving rise to a bold heavily shadowed seam.
- B. For a thinner ribbed seam detail, the cap in "A" can be folded and locked into the pan flange as shown. Cleats at 12" O.C. are used to fasten the panels before the caps are installed in both alt. "A" and "B".



SPECIFICATIONS AND TESTS



Isabella Stewart Gardner Museum, Photo Credit: Nic Lehoux, Renzo Piano Building Workshop

- **14. Architectural Specifications**

- **15. Structural Test Reports**

Specifications for copper construction are presented in this section. These documents conform to the CSI MasterFormat 2004 and are presented in an edit/delete format. Test reports on various copper systems are also included.

14. ARCHITECTURAL SPECIFICATIONS

- [14.1. Antimicrobial Copper](#)
- [14.2. Copper Wall Cladding](#)
- [14.3. Copper Roofing](#)
- [14.4. Manufactured Copper Roofing Specialties](#)
- [14.5. Copper Flashing and Trim](#)
- [14.6. Copper Gutters and Downspouts](#)
- [14.7. Copper Expansion Joint Cover Assemblies](#)

Specifications for copper construction are presented in this section. These documents conform to the CSI MasterFormat 2004 and are presented in an edit/delete format.

14.1. Antimicrobial Copper

SECTION 050405



[Download Word format](#) [8.6 Kb]

THIS SECTION IS **NOT** A STANDALONE SECTION. IT IS INTENDED TO BE USED WITH OTHER PRODUCT ORIENTED SECTIONS THAT CONTAIN ANTIMICROBIAL COPPER AS A BUILDING PRODUCT. TEXT IN **BOLD ORANGE** REQUIRES EDITING.

EVERY DAY PEOPLE MAKE CONTACT WITH A VARIETY OF TOUCH SURFACES. FROM SUBWAY GRAB RAILS TO DOORKNOBS, KEYBOARDS, AND TELEPHONES. TOUCH IS A FUNDAMENTAL PART OF DAILY LIVES. UNFORTUNATELY, THESE SAME OBJECTS ARE ALSO TOUCHED BY OTHERS WHO MAY LEAVE BEHIND INFECTIOUS BACTERIA ON THESE SURFACES, PUTTING THE NEXT USER AT RISK.

FREQUENTLY TOUCHED SURFACES IN HEALTHCARE FACILITIES, SUCH AS DOORKNOBS, PUSH PLATES, BED RAILS, FAUCET HANDLES, IV POLES AND SIMILAR ITEMS, HAVE BEEN FOUND TO SERVE AS RESERVOIRS FOR THE SPREAD OF PATHOGENIC MICROBES.

THE INHERENT ANTIMICROBIAL PROPERTIES OF SOLID COPPER ALLOYS ARE WELL DOCUMENTED, AND PRODUCTS MADE FROM THESE MATERIALS ARE CURRENTLY REGISTERED WITH U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA) TO MAKE PUBLIC HEALTH CLAIMS (E.G. "THIS SURFACE CONTINUOUSLY KILLS >99.9% OF MRSA WITHIN 2 HOURS"). THE POTENTIAL BENEFIT OF INCORPORATING PASSIVE, ANTIMICROBIAL SURFACES INTO THE BUILT ENVIRONMENT HAS BEEN QUANTIFIED BY A MULTI-SITE CLINICAL TRIAL FUNDED BY THE DEPARTMENT OF DEFENSE INVESTIGATING THE ABILITY OF ANTIMICROBIAL COPPER SURFACES TO REDUCE ENVIRONMENTAL MICROBIAL LEVELS AND SUBSEQUENT INFECTION RATES. SIX COPPER OBJECTS (BEDRAIL, I.V. POLE, NURSE'S CALL DEVICE, OVERBED TRAY TABLE, VISITOR'S CHAIR ARMS, AND DATA INPUT DEVICE) WERE INTRODUCED INTO PATIENTS' ROOMS, WHICH REPRESENTED LESS THAN 10% OF THE AVAILABLE SURFACE AREA IN THE ROOM. THE LIMITED INTRODUCTION OF THESE SIX COPPER OBJECTS REDUCED THE SITE-SPECIFIC LEVELS OF CONTAMINATION BY MORE THAN 83 PERCENT, CONSISTENTLY ACHIEVING THE RECOMMENDED TERMINAL CLEANING LEVEL (250 CFU/100CM²).

ANTIMICROBIAL COPPER (60% MINIMUM COPPER CONTENT) IS THE ONLY SOLID TOUCH SURFACE MATERIAL THAT HAS BEEN CLINICALLY TESTED AND REGISTERED WITH THE EPA AND THEREFORE ALLOWED TO HAVE PUBLIC HEALTH CLAIMS MADE IN THE USA. ANTIMICROBIAL COPPER IS THE MOST EFFECTIVE ANTIMICROBIAL TOUCH SURFACE MATERIAL, KILLING MORE THAN 99.9% OF SIX DISEASE CAUSING BACTERIA WITHIN TWO HOURS OF EXPOSURE.

DESIGNING HEALTHCARE SURFACES THAT ARE EASY TO CLEAN IS IMPORTANT. INCORPORATION OF SURFACE MATERIALS WITH INHERENT ANTIMICROBIAL PROPERTIES, USED IN SYNERGY WITH CURRENT DESIGN INTERVENTIONS AND HYGIENIC PRACTICES, OFFERS A NEW PARADIGM FOR HEALTHCARE DESIGN THAT WILL LEAD TO BETTER OUTCOMES AND LOWER COSTS.

ADDING ANTIMICROBIAL SURFACES INTO A CLINICAL SETTING IS LIKELY TO INCREASE THE INITIAL COST OF CONSTRUCTION OR COMPONENT PURCHASE, HOWEVER THE MAGNITUDE OF THE INITIAL INVESTMENT INCREASE IS COMPLETELY DEPENDENT ON THE NUMBER AND TYPES OF SURFACES AND COMPONENTS INCORPORATED. BUSINESS CASE ANALYSIS OF INCORPORATION OF THOSE SURFACES STUDIED IN THE CLINICAL TRIAL, AS WELL AS OTHER TYPICAL SURFACES (HANDRAILS, GRAB BARS, DOOR HARDWARE, PUSH PLATES, ETC.) SUGGESTS A POTENTIAL RETURN ON INVESTMENT TO THE FACILITY DUE TO REDUCTION OF HOSPITAL ACQUIRED INFECTION (HAI) TREATMENT COSTS, OF SIGNIFICANTLY LESS THAN ONE-YEAR.

U.S. ENVIRONMENTAL PROTECTION AGENCY PUBLIC HEALTH REGISTRATIONS 82012-1 THROUGH

82012-6. FEDERAL INSECTICIDE, FUNGICIDE, AND RODENTICIDE ACT. 2008. AVAILABLE FROM: [HTTP://WWW.EPA.GOV/OPP00001/FACTSHEETS/COPPER-ALLOY-PRODUCTS.HTM](http://www.epa.gov/opp00001/factsheets/copper-alloy-products.htm).

CURRENTLY, THERE ARE OVER 479 ALLOYS OF COPPER (60% COPPER AND GREATER) THAT WILL CONTINUOUSLY KILL SIX DIFFERENT DEADLY BACTERIA WITHIN 2 HOURS AT A 99.9% KILL RATE. THE LIST OF APPROVED ALLOYS CAN BE FOUND AT, [HTTP://WWW.ANTIMICROBIALCOPPER.ORG/US/ANTIMICROBIAL-COPPER-RANGE](http://www.antimicrobialcopper.org/us/antimicrobial-copper-range).

Part 1: General

1.1 SUMMARY

A. Section Includes:

1. Antimicrobial copper for human touch surfaces made of uncoated surface copper material as registered with the US Environmental Protection Agency (EPA).

ADD TO OR REMOVE FROM ITEMS BELOW USING ANTIMICROBIAL COPPER PRODUCTS. LISTING OF POTENTIAL ITEMS IS IN ARTICLE 2.1.

2. **Antimicrobial copper is being used on this Project for:**

- a. **Hand rails**
- b. **Grab bars**
- c. **Door hardware**
- d. **Bed rails**
- e. _____

LIST RELATED SECTIONS BELOW REFERENCING SECTIONS CONTAINING ANTIMICROBIAL COPPER PRODUCTS.

B. Related Sections:

1. **Section XXXXXX:** _____

1.2 DEFINITIONS

- A. **Antimicrobial Surface Material:** a solid, engineering material that has been approved by the US EPA under Section 3 of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA); and listed in the EPA's Pesticide Product Label System (PPLS). Any application and usage of solid antimicrobial surface materials must conform to EPA guidelines set forth in labeling and usage guidelines.

B. Six Bacteria Types Referenced in the Section:

1. ***E. coli*** O157:H7, a food-borne pathogen that has been associated with large-scale food recalls.

2. **Methicillin-Resistant *Staphylococcus Aureus* (MRSA)**, is a "staph" bacteria that is resistant to first-line antibiotics that usually cure staph infections; one of the most virulent strains of antibiotic-resistant bacteria and common in hospital- and community-acquired infections.
3. ***Staphylococcus Aureus***, the most common of all bacterial staphylococcus (i.e. staph) infections that can cause life-threatening diseases, including pneumonia and meningitis.
4. **Vancomycin-Resistant *Enterococcus Faecalis* (VRE)**, an antibiotic resistant organism responsible for 4% of all Healthcare-Associated Infections.
5. ***Enterobacter Aerogenes***, a pathogenic bacterium commonly found in hospitals that causes opportunistic skin infections and impacts other body tissues; and,
6. ***Pseudomonas Aeruginosa***, a bacterium that infects the pulmonary tracts, urinary tracts, blood, and skin of immuno-compromised individuals.

1.3 PERFORMANCE REQUIREMENTS

- A. Laboratory testing has shown that when cleaned regularly:
 2. Antimicrobial Copper surfaces continuously reduce bacterial* contamination, achieving 99.9% reduction within two hours of exposure.
 3. Antimicrobial Copper surfaces kill greater than 99.9% of Gram-negative and Gram-positive bacteria* within two hours of exposure.
 4. Antimicrobial Copper surfaces deliver continuous and ongoing antibacterial* action, remaining effective in killing greater than 99.9% of bacteria* within two hours.
 5. Antimicrobial Copper surfaces kill greater than 99.9% of bacteria* within two hours, and continues to kill more than 99% of bacteria* even after repeated contamination.
 6. Antimicrobial Copper surfaces help inhibit the buildup and growth of bacteria* within two hours of exposure between routine cleaning and sanitizing steps.

*Testing demonstrates effective antibacterial activity against the following six bacteria: Methicillin-Resistant *Staphylococcus Aureus* (MRSA), Vancomycin-resistant *Enterococcus Faecalis* (VRE), *Staphylococcus Aureus*, *Enterobacter Aerogenes*, *Pseudomonas Aeruginosa*, and *E. coli* O157:H7.

- B. Frequently touched surfaces, furnishings and equipment in health care patient environments shall be planned and designed to facilitate cleaning and disinfection. To supplement infection control practices, antimicrobial copper registered by EPA shall be permitted for use.

DELETE ITEMS BELOW NOT APPLICABLE TO PROJECT.

- C. **Plumbing Fixtures/Fittings:**
 1. Materials. Plumbing fixtures and fittings shall be nonabsorptive and acid-resistant. To supplement infection control practices, antimicrobial copper approved by EPA will be permitted for use.
 2. Sinks and hand-washing basins/countertops shall be made of porcelain, stainless steel, copper alloy, or solid surface materials.
- D. **Grab Bars:**

1. Provide in patient toilets, showers, bathtubs, and sitz baths with wall clearance of 1-1/2 inches.
2. Anchor grab bars, including those that are part of such fixtures as soap dishes, to sustain concentrated load of 250 pounds.
3. To supplement infection control practices, antimicrobial copper approved by EPA will be permitted for use.

E. Handrails:

1. As determined by functional program, handrails shall be provided to assist mobility-impaired persons. Return rail ends to wall.
2. Provide handrails or lean rails and fasteners smooth and free of rough edges.
3. Provide handrails or lean rails with eased edges and corners if mitered corner condition exists.
4. To supplement infection control practices, antimicrobial copper approved by EPA will be permitted for use.

F. Door Hardware:

1. Lever hardware shall be selected for ease of use.
2. Door and door hardware finishes shall be selected to withstand cleaning and impact damage.
3. To supplement infection control practices, antimicrobial copper approved by EPA will be permitted for use.

G. Refer to related sections for product performance requirements other than antimicrobial requirements.

REFER TO ACTUAL RELATED PRODUCT SECTION FOR SUBMITTAL REQUIREMENTS OTHER THAN ANTIMICROBIAL REQUIREMENTS.

1.4 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 01 Specifications Sections.
 1. Make submittals of this Section simultaneously with submittals of sections with components using antimicrobial copper specified in this Section.
- B. Product data for antimicrobial copper.
 1. Submit EPA registration number for each product showing material made from antimicrobial copper continuously kills >99.9% of MRSA within 2 hours.
- C. Informational Submittals
 1. Qualifications:
 - a. Proof of manufacturer EPA registration number.
 - b. Copy of EPA product labeling.
 2. Certifications: Copy of certifications required under Quality Assurance Article.

3. Manufacturer's installation and cleaning instructions

D. Closeout Submittals: Submit maintenance data for cleaning antimicrobial copper.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Registered with EPA as supplier of Antimicrobial Copper Alloys with EPA Registration Numbers.
- B. Certifications: Submit manufacturer's certification stating "If used as intended, this product is wear-resistant and the durable antibacterial properties will remain effective for as long as the product remains in place and is used as directed."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Packing, Shipping, Handling, and Unloading: Protect finish metal faces.
- B. Acceptance at Site: Examine each component and accessory as delivered and confirm that material and finish is undamaged. Do not accept or install damaged materials.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Antimicrobial Copper: EPA registration acknowledging the efficacy of Antimicrobial Copper products against the six disease-causing bacteria listed under PART 1 Article for Definitions.

LIST BELOW THE ALLOYS USED FOR THIS PROJECT - CLICK ON THIS HYPERLINK FOR LISTING OF APPROVED ALLOYS: [HTTP://WWW.ANTIMICROBIALCOPPER.ORG/US/ANTIMICROBIAL-COPPER-RANGE](http://www.antimicrobialcopper.org/us/antimicrobial-copper-range).

1. _____

- B. Surface materials for which public health claims are made based on antimicrobial properties shall be selected based on current U.S. EPA public health registration under the Federal Insecticide Fungicide and Rodenticide Act (FIFRA).
 - 1. Such registration must specifically include registration of public health claims.
 - 2. Product/material registration can be verified by visiting the EPA's Pesticide Product Label System
 - 3. Do not use materials or surfaces impregnated with antimicrobials which do not carry a public health registration but only indicate an approved article of use exemption to the FIFRA.

THE EPA REQUIRES THE FOLLOWING STATEMENT TO BE INCLUDED WHEN MAKING PUBLIC HEALTH CLAIMS RELATED TO THE USE OF ANTIMICROBIAL COPPER ALLOYS:

4. Antimicrobial copper surfaces are a supplement to and not a substitute for standard infection control practices; users must continue to follow all current infection control practices, including those practices related to cleaning and disinfection of environmental surfaces. Antimicrobial copper surfaces have been shown to reduce microbial contamination, but it does not necessarily prevent cross-contamination.
- C. Antimicrobial copper alloys are only intended for the manufacture and fabrication of touch surface components for use in hospitals, healthcare facilities, and various public, commercial, and residential buildings.
- D. Products made from Antimicrobial Copper Alloys are not approved for direct food contact or food packaging uses.
- E. The Antimicrobial Copper Alloys fabricated products listed below may be sold and distributed if they possess current EPA Registration Numbers.

EDIT LISTING BELOW TO SUIT PROJECT REQUIREMENTS.

F. Touch Surface Components - Healthcare Facilities:

1. Bedrails, footboards
2. Over-bed tables
3. Bed-side tables in hospitals, extended care facilities, senior housing etc. (knobs, pulls, handles; surfaces)
4. Handrails, (corridor/hallways) (Senior housing), automatic door push plates
5. Stair rails, handrails, tubular railing, and supports, rail fittings T's, elbows and brackets
6. Bedrails, assistance rails,
7. Toilet safety rails
8. Carts
 - a. Hospital carts (table surfaces, handles, legs)
 - b. Computer carts
 - c. Record carts
 - d. Phlebotomy carts
 - e. Other Carts (tables/surfaces, shelving, railings, handles, pulls)
 - f. Equipment carts (horizontal surfaces, frames, handles)
9. Door push plates, kick plates, mop plates, stretcher plates
10. Sinks: spigots, drains, sinks themselves
11. Faucet: handles, spigot, drain control lever
12. Water fountains: bubbler head, drain strainer, handle
13. Alcohol sanitizer dispenser, handle

14. Paper towel holders, facial tissue holders, toilet paper holders
15. Air hand dryer, controls and push buttons on air hand dryers
16. Hydrotherapy tanks (whirlpool tanks): shells, covers, headrests, drain fittings (outer surfaces without water contact)
17. Door handles, doorknobs (outer touch surfaces)
18. Grab bars in bathrooms showers and bathtubs
19. Panic bars on emergency room doors
20. Towel bars
21. Showerheads
22. Countertops and tabletops (non-food use only)
23. Hinges, locks, latches, and trim
24. Door stops, door pulls, and protector guards
25. Toilet and urinal hardware, levers, push buttons
26. Toilet seat inlay for lifting of seat
27. Closures
28. Vertical locking arms
29. Vertical cover guards
30. Protection bars
31. Light switches, switch plates
32. Visitor chairs: armrests, metal frames
33. Thermostat covers, control knobs and wheels
34. Telephone handsets and surfaces (housings), keypad
35. Kitchen surfaces (non-food contact only): table tops, counter tops, handles (microwave, refrigerator, stove), cabinet doors, cabinet hinges, pulls, backsplash, hoods, control knobs (appliances, fans)
36. Floor tiles
37. Ceiling tiles (non-porous)
38. Wall tiles
39. Instrument handles
 - a. Medical equipment knobs, pulls and handles for:
 - ii. Drug delivery systems
 - iii. Monitoring systems

- iv. Hospital beds
- v. Office equipment
- vi. Operating room equipment
- vii. Stands and fixtures
- b. Types of knobs: e.g., Prong, fluted, knurled, push/pull, T-handle, tapered, and ball knobs
- 40. Intravenous (IV) poles, bases, hangers, clips
- 41. Trays (instruments, non-food contact)
- 42. Pans (bed)
- 43. Walkers, wheelchair handles, and tubular components
- 44. Computer keyboards: keys, housings, computer mouse surfaces
- 45. Exercise and rehabilitation equipment, handles, bars
- 46. Physical therapy equipment: physical therapy tables, treatment chairs and portable taping tables
- 47. Chairs (shower chairs, patient chairs, visitor chairs): rails, backs, legs, seats
- 48. Lighting products: X-ray illuminators, operating rooms, patient examination rooms, surgical suites, and reading lamps for hospital rooms and assisted living facilities etc. Components can include bases, arms, housings, handles, hinges)
- 49. Headwall systems: the unit themselves, outlet covers, knobs and dials, lighting units (lamp housings and adjustable arms), CRT monitors with rotating knobs and levers and adjustments. Baskets, monitor housings, knobs, baskets, tables, IV poles
- 50. Critical care cart: Table top, drawer, drawer pull, lock, copper wire baskets for storage of equipment and charts.
- 51. Bedside lavatory: sink, faucet, handles, drawer pulls, toilet seat, toilet seat cover, toilet handle, door and cabinet facings, counter tops
- 52. Medical records: Chart holders, clipboards, filing systems
- 53. Storage Shelving: wire shelving etc. for medical supplies
- 54. Grab handles on privacy curtains
- 55. Lids of laundry hampers, trash canisters, and other containers
- 56. Bedside pitchers
- 57. Closet rods and hangers
- 58. Television controls: knobs, buttons, remote
- 59. Monitor (television, computer, etc.) housing
- 60. Cup Holder
- 61. Toothbrush holder

- 62. Soap holder
- 63. Magazine rack
- 64. Signage
- 65. Coat rack and hooks
- 66. Shower curtain rings
- 67. Radiator cover
- 68. Bracelets
- 69. Pens
- 70. Badge clips
- 71. Name tags
- 72. Patient gown snaps
- 73. Window sills, pulls and locks
- 74. Electrical wallplates

G. Community Facilities (including various public and commercial buildings)

- 1. Shopping cart handles, child seats, handrails
- 2. Cash registers: housing, keypads
- 3. ATM machines: keys, housing
- 4. Gym/Health club lockers, locker handles, locker shelving, trainers' tables,
- 5. Ice and water dispensers (outer surfaces without water contact)
- 6. Elevator: handrail, control panel, buttons, interior walls, floor tiles, exterior call button plate
- 7. Paper towel dispensers. Housing itself, (turn) handle, (push) handle
- 8. Soap holder
- 9. Soap dispenser (wall mounted): push bar and dispenser itself
- 10. Soap dispenser (sitting on counter): dispenser housing itself, push mechanism
- 11. Toilet paper dispenser (housing)
- 12. Windows (crank), Locking mechanism, pull handles
- 13. Window treatments (cord pulls), Venetian blinds (wands, cord pulls)
- 14. Jalousie Windows (crank)
- 15. Casement (cranks, levers, hinges)
- 16. Single and double-hung windows (locks and pulls)

17. Light switches, switch plates
18. Lids of laundry hampers, trash canisters, and other containers
19. Magazine rack
20. Signage
21. Coat rack and hooks
22. Shower curtain rings
23. Radiator cover
24. Bracelets
25. Badge clips
26. Name tags
27. Vending machines (non-food contact only)
28. Window sills
29. Electrical wallplates
30. Clip boards
31. Office supplies: paper clips, staplers, tape dispensers

H. Residential Buildings (including homes, apartments, apartment buildings and other residences)

1. Kitchen surfaces (non-food contact only): table tops, counter tops, handles (microwave, refrigerator, stove), cabinet doors, cabinet hinges, pulls, backsplash, hoods, control knobs (appliances, fans)
2. Bedrails, footboards
3. Handrails
4. Stair rails
5. Door push plates
6. Sinks: spigots, drains, sinks themselves
7. Faucet: handles, spigot, drain control lever o Paper towel holders, facial tissue holders, toilet paper holders
8. Door handles, doorknobs (outer touch surfaces)
9. Grab bars in bathrooms showers and bathtubs
10. Towel bars
11. Showerheads
12. Countertops and tabletops
13. Hinges, locks, latches, and trim

14. Door stops, door pulls, and protector guards
15. Toilet and urinal hardware, levers, push buttons
16. Toilet seat inlay for lifting of seat
17. Light switches, switch plates
18. Thermostat covers, control knobs and wheels
19. Telephone handsets and surfaces (housings), keypad
20. Floor tiles
21. Ceiling tiles (non-porous)
22. Wall tiles
23. Computer keyboards: keys, housings, computer mouse surfaces
24. Exercise equipment, handles, bars
25. Windows (crank), Locking mechanism, pull handles
26. Window treatments (cord pulls), Venetian blinds (wands, cord pulls)
27. Jalousie Windows (crank)
28. Casement (cranks, levers, hinges)
29. Single and double-hung windows (locks and pulls)
30. Television control knobs and buttons
31. Lids of laundry hampers, trash canisters, and other containers
32. Bedside pitchers
33. Closet rods and hangers
34. Television remote
35. Cup Holder
36. Toothbrush holder
37. Soap holder
38. Magazine rack
39. Coat rack and hooks
40. Shower curtain rings
41. Radiator cover
42. Window sills
43. Electrical wallplates

44. Baby cribs: rails, fittings, brackets, supports
45. Bowl stands
46. Office supplies: paper clips, staplers, tape dispensers
47. Monitor (television, computer, etc.) housing

I. Mass Transit Facilities

1. Handrails
2. Stair rails, tubular railing, and supports; elbows and brackets
3. Door push plates, kick plates
4. Door handles, door knobs (outer touch surfaces)
5. Grab bars and handles
6. Tiles: wall, floor, ceiling (non-porous)
7. Chairs and benches: rails, backs, legs, seats
8. Window sills, pulls, and handles
9. Signage
10. Vending machines (non-food contact only)

J. Other

1. Play area equipment (indoor only): bars, handles, chains, push plates, handrails, stair rails and risers, wheels, knobs, flooring
2. Chapel pews
3. Eye glass frames and protective eye wear
4. Pens
5. Combs
6. Ashtrays

FABRICATION

- A. Refer to related sections for actual product fabrication requirements.
- B. Labeling: Products fabricated with Antimicrobial Copper Alloys must bear current EPA approved fabricated product label similar to example below with one or more of the listed claims.

FRONT [This (touch surface) (product)]

made from

**Antimicrobial
Copper Alloys
Group I**

Active Ingredient:

Copper96.2%

Other..... 3.8%

[Total 100.0%]

See [Back/Side Panel][Insert] for Directions for Use

Net Weight: XXX lbs XXX ounces of [brand name]

BACK**ANTIMICROBIAL COPPER ALLOYS**

Laboratory testing has shown that when cleaned regularly this surface:

- Continuously reduces bacteria* contamination, achieving 99.9% reduction within 2 hours of exposure.
- Kills greater than 99.9% of Gram-negative and Gram-positive bacteria* within 2 hours of exposure.
- Delivers continuous and ongoing antibacterial* action, remaining effective in killing greater than 99.9% of bacteria* within 2 hours.
- Kills greater than 99.9% of bacteria* within two hours and continues to kill 99% of bacteria* even after repeated contaminations.
- Helps inhibit the buildup and growth of bacteria* within 2 hours of exposure between routine cleaning and sanitizing steps.
- [This product/component name] is made (out of)(from) a (copper)(touch) surface that continuously kills bacteria left behind [by dirty hands][on the surface] killing more than 99.9% of bacteria within 2 hours.

* Staphylococcus aureus, Enterobacter aerogenes, Methicillin-Resistant Staphylococcus aureus (MRSA), Escherichia coli O157:H7, Pseudomonas aeruginosa and, Vancomycin-Resistant Enterococcus faecalis (VRE).

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

Proper Care and Use. Clean and sanitize according to standard practice. Healthcare facilities must maintain the product in accordance with infection control guidelines. The use of this surface is a supplement to and not a substitute for standard infection control practices; users must continue to follow all current infection control practices, including those practices related to cleaning and disinfection of environmental surfaces. This surface has been shown to reduce microbial contamination, but does not necessarily prevent cross contamination.

This surface may be subject to recontamination and the level of active bacteria at any time will depend on the frequency and timing of recontamination and cleanliness of the surface (among other factors). In order to have proper antimicrobial effect, this product must be cleaned and maintained according to the directions for use.

Do not wax, paint, lacquer, varnish, or otherwise coat this product.

Routine cleaning to remove dirt and filth is necessary for good sanitation and to assure the effective antibacterial performance of this surface. Cleaning agents typically used for traditional hard, non-porous touch surfaces are permissible. The appropriate cleaning agent depends on the type of soiling and the measure of sanitization required. Normal tarnishing or wear of this surface will not impair antibacterial effectiveness.

Not approved for direct food contact or food packaging uses.

[Items exposed to outdoor environmental conditions are not representative of indoor laboratory test conditions, and, therefore, may impart reduced efficacy if not cleaned when visibly soiled.]

STORAGE AND DISPOSAL

Dispose of by recycling or put in trash.

WARRANTY STATEMENT

If used as intended, this product is wear-resistant and the durable antibacterial properties will remain effective for as long as the product remains in place and is used as directed.

EPA Reg. No. 82012-1 EPA Est. No. [Product Manufacturer Number] 82012-NY-001 Manufactured by: [Product Manufacturer Company Name and Address]

FINISHES

- A. Natural copper. No applied finish.
- B. Do not wax, paint, lacquer, varnish, or otherwise coat touch surfaces.
- C. Normal tarnishing or wear of surface will not impair antibacterial properties.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. General: Examine conditions and proceed with work when substrates are ready.

INSTALLATION

- 1. Refer to related sections for actual product installation requirements.

CLEANING

- A. Remove protective film (if any) from surfaces of copper promptly upon installation. Strip with care to avoid damage to finishes.
- B. Clean exposed copper surfaces, removing substances that might inhibit antimicrobial properties of metal.

CLOSEOUT ACTIVITIES

- A. Training: Instruct Owner's designated personnel of proper cleaning procedures that must be used following current infection control practices including those practices related to cleaning and disinfection of antimicrobial copper surfaces.

PROTECTION

- A. Protect antimicrobial copper from damage during construction period with temporary protective coverings that will not interfere with antimicrobial properties of copper and as approved by fabricator. Remove protective covering at time of Substantial Completion.
- B. Restore antimicrobial copper surfaces damaged during installation and construction so that no evidence remains of corrective work. Return items that cannot be refinished in field to shop; make required alterations and refinish entire unit; or provide new units.

USE FOLLOWING TO SCHEDULE ITEMS CONTAINED WITHIN SECTION THAT CAN BE EASILY DESCRIBED IN WORDS. SCHEDULE OR INDICATE ON DRAWINGS WHEN TOO COMPLICATED FOR WORD DESCRIPTION.

[SCHEDULE

A. [_____ : _____ .]

B. [_____ : _____ .]

C. [_____ : _____ .]]

END OF SECTION

14.2. Copper Wall Cladding

SECTION 074210



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THIS SECTION USES THE TERM "ARCHITECT." CHANGE THIS TERM AS NECESSARY TO MATCH THE ACTUAL TERM USED TO IDENTIFY DESIGN PROFESSIONAL AS DEFINED IN THE GENERAL AND SUPPLEMENTARY CONDITIONS.

WALL PANELS ARE PART OF A SYSTEM. COORDINATE WALL PANELS WITH SHEATHING AND AIR BARRIERS COVERING SHEATHING OR WALL SYSTEMS.

FLAT SEAM WALL PANELS ARE USUALLY INSTALLED WITH DRY JOINTS - NO SEALANT OR SOLDER.

PART 1-GENERAL

1.1 SUMMARY

A. Section Includes:

EDIT LIST BELOW TO SUIT PROJECT.

1. Horizontal siding.
2. Horizontal profiled wall cladding.
3. Flat-seam copper wall cladding.
4. Beveled panel cladding.
5. Corrugated panel cladding.
6. Standing seam cladding.
7. Batten seam cladding.
8. Horizontal seam (Bermuda) cladding.
9. Soffit panels and cladding.

RETAIN BELOW FOR FIELD PAINTING (ALSO FOR OTHER FINISHING).

B. Related Requirements:

1. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
2. Division 05 Sections for structural and light-gauge framing.
3. Division 06 Section for wall sheathing.
4. Division 07 Section "Thermal Insulation" for wall insulation.

5. Section 076110 - Copper Roofing.
6. Section 076210 - Manufactured Copper Roofing Specialties: Accessories on roof other than mechanical and structural items.
7. Section 076215 - Copper Flashing and Trim: Flashing and other trim not part of roofing.
8. Section 076220 - Copper Gutters and Downspouts: Gutters and downspouts associated with roofing.
9. Section 079514 - Copper Expansion Joint Cover Assemblies.

ABOVE MAY BE EDITED TO IDENTIFY SPECIFIC ITEMS SUCH AS REGLETS, RELIEF VENTS, ROOF EXPANSION ASSEMBLIES, ORNAMENTAL ITEMS, ETC.

10. Division 07 Section "Joint Sealants" for field-applied panel sealants.
11. Wood framing and decking is specified in a Division 06 Section.

DELETE ANY OF THE FOLLOWING PROVISIONS WHICH ARE NOT APPLICABLE TO THE TYPE OF WALL CLADDING REQUIRED.

1.2 COORDINATION

- A. Coordinate copper wall cladding with wall air retarders and rain drainage work, including, flashing, gutters, downspouts, trim and construction to provide permanently watertight, secure, and noncorrosive installation.

1.3 PERFORMANCE REQUIREMENTS

DESIGN PROFESSIONAL IS RESPONSIBLE FOR DESIGNING SYSTEM, INCLUDING ANCHORAGE, FASTENER SIZE, AND SPACING.

- A. Installation Requirements: Fabricator is responsible for installing system, including anchorage to substrate and necessary modifications to meet specified and drawn requirements and maintain visual design concepts in accordance with Contract Documents and following installation methods as stipulated in the "Copper in Architecture" handbook published by the Copper Development Association Inc. (CDA)
 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. Obtain Architect's approval of modifications.
 4. Provide concealed fastening wherever possible.
 5. 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.
 6. Obtain Architect's approval for connections to building elements at locations other than indicated in Drawings.
 7. 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.

1.4 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.
- B. Product data including copper manufacturer's specifications, installation instructions, and general recommendations for wall cladding applications. Include certification or other data substantiating that materials comply with requirements.

DELETE BELOW IF DETAILS OF NO IMPORTANCE OR COVERED ADEQUATELY BY WORKING DRAWINGS.

C. Shop Drawings:

1. Provide elevations showing seam layout and pattern.
2. Show manner of forming, joining, and securing copper cladding to Project substrate.
3. Show expansion joint details and waterproof connections to adjoining work and at obstructions and penetrations.

DELETE BELOW IF WORK is FULLY CONCEALED, TO BE UNFINISHED, OR FIELD PAINTED, OR IF EXPOSURE is OF NO VISUAL IMPORTANCE OR IS WELL-KNOWN.

- D. Samples consisting of 6-inch (150 mm) or 12-inch (300 mm) square specimens of specified copper wall cladding material.
- E. Certificates: Fabricator's certification that products furnished for Project meets or exceeds specified requirements.

1.5 CLOSEOUT SUBMITTALS

- A. Provide maintenance data in Operations and Maintenance manual for maintaining applied coatings on copper panels.

1.6 QUALITY ASSURANCE

- A. Fabricator's Qualifications: Company specializing in copper sheet metal wall cladding 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 wall cladding 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.

DELETE ENTIRE MOCK-UP PROVISION BELOW UNLESS THE EXPENDITURE IS JUSTIFIED BY AN EXTENSIVE, UNUSUAL, OR CRUCIAL APPLICATION OF COPPER WALL CLADDING.

- D. Mock-Up: Before proceeding with final purchase of materials and fabrication of copper wall cladding components, prepare a mock-up of work. Incorporate materials and methods of fabrication and installation identical with project requirements. Install mock-up at wall cladding area location directed by Architect. Retain accepted mock-up as quality standard for acceptance of completed copper wall cladding. If accepted, mock-up may be incorporated as part of copper wall cladding work.
 - 1. Mock-up area is indicated on Drawings.

DELETE EITHER ABOVE OR BELOW.

- 2. Provide mock-up of sufficient size and scope to show typical pattern of seams, fastening details, edge construction.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Packing, Shipping, Handling, and Unloading: Protect finish panel faces.
- B. Acceptance at Site: Examine each panel and accessory as delivered and confirm that finish is undamaged. Do not accept or install damaged panels.
- C. Storage and Protection:
 - 1. Stack pre-formed material to prevent twisting, bending, and abrasions.
 - 2. Provide ventilation.
 - 3. Prevent contact with materials which may cause discoloration or staining.

1.8 WARRANTY

- A. Warrant installed system and components to be free from defects in material and workmanship for period of 2 years.
- B. Include coverage against leakage and damages to finishes.

PART 2-PRODUCTS

2.1 MANUFACTURERS

DELETE THIS ARTICLE IF OWNER-IMPOSED OR OTHER PROJECT REQUIREMENTS PROHIBIT MENTION OF MANUFACTURERS' NAMES.

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering materials that may be incorporated in the Work include, but are not limited to, the following:

RETAIN ABOVE FOR NONPROPRIETARY OR BELOW FOR SEMIPROPRIETARY SPECIFICATION. REFER TO DIVISION-1 SECTION "MATERIALS AND EQUIPMENT."

- B. Manufacturers: Subject to compliance with requirements, provide materials by one of the following:

BELOW ARE EXAMPLES ONLY. RETAIN OR INSERT ONLY THOSE MANUFACTURERS BELOW WHOSE MATERIALS CORRESPOND WITH OTHER REQUIREMENTS AND WHOSE AVAILABILITY AND SUITABILITY FOR APPLICATION INDICATED HAVE BEEN VERIFIED.

1. Hussey Copper, Ltd.
2. Aurubis Buffalo, Inc.
3. PMX Industries Inc.
4. Revere Copper Products, Inc.

2.2 MATERIALS

- A. Copper Wall Cladding 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.

DELETE ABOVE OR BELOW OR EDIT AS APPROPRIATE. REFER TO MANUFACTURERS' LITERATURE FOR SELECTION OF THICKNESS APPROPRIATE TO APPLICATION INDICATED.

2. Weight: 20 oz. per sq. ft. (0.0270-inch thick) (0.69 mm) unless otherwise indicated.

- B. Miscellaneous Materials: Provide materials and types of fasteners, protective coatings, separators, sealants and accessory items as recommended by copper sheet manufacturer for copper wall cladding work, except as otherwise indicated.

REVISE BELOW WITH SPECIFIC REQUIREMENTS WHERE DESIRED FOR PROJECT.

- C. Accessories: Except as indicated as work of another specification Section, provide components required for a complete wall cladding system, including trim, copings, fascias, ridge closures, cleats, seam covers, battens, flashings, gutters, louvers, sealants, gaskets, vents, and closure strips. Match materials and finishes of wall cladding .

1. Sealing Tape: Pressure-sensitive 100 percent solids polyisobutylene compound sealing tape with release paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.

2. Joint Sealant: One-part, copper compatible elastomeric polyurethane, polysulfide, butyl or silicone rubber sealant as tested by sealant manufacturer for copper substrates. Refer to Division 07.

SELECT WALL CLADDING TYPE BELOW.

3. Cleats:
 - a. Concealed type as indicated in the "Copper in Architecture" handbook published by the Copper Development Association Inc. (CDA) for [wall panels] [flat-seam wall cladding] to resist negative wind pressure.
 - b. Fabricate cleats to allow thermal movement of copper wall cladding panels while preventing copper panel distortion due to negative wind pressure.
4. Trim, [Soffits,] Closure Pieces, and Accessories:
 - a. Same material, thickness, and finish as adjacent copper wall cladding panels, formed to required profiles.
 - b. Comply with standards conforming to recognized industry standard sheet metal practice.
5. Flashings: Formed copper sheet, minimum 16 oz. per sq. ft. (0.0216 inch thick) (0.55 mm) unless otherwise indicated; finished to match panels.
- D. Bituminous Coating: SSPC-Paint 12, Cold-Applied Asphalt Mastic (Extra Thick Film), nominally free of sulfur, compounded for 15-mil dry film thickness per coat.

COORDINATE WITH BUILDING AIR BARRIER SYSTEM. DELETE BELOW IF NOT REQUIRED.

- E. Building Paper: Grade D, 60-minute water resistance minimum, ASTM D779.

USE BELOW UNDER COPPER INSTALLED ON building paper SHEETS.

- F. Paper Slip Sheet: Minimum 4-lb. red rosin-sized building paper.
- G. Nails for Wood Substrates: Copper or hardware bronze, 0.109 inch minimum not less than 7/8-inch (22 mm) long barbed with large head.
- H. Screws & Bolts: Copper, bronze, brass, or passivated stainless steel (300 Series) of sufficient size and length to sustain imposed stresses.
 1. Neoprene (resilient) gasketed washers tested to be compatible with copper and exposed screw head color matched to adjacent panel where exposed. Use exposed fasteners only where absolutely necessary to attach trim and at corrugated metal panels.
- I. Fixed cleats: Same weight as wall cladding. 2-inch (50-mm) wide x 3-inch (75-mm) long.
- J. Rivets:
 1. Pop Rivets: 1/8-inch (3-mm) to 3/16-inch (4.5-mm) diameter, with solid brass mandrels.
 2. Provide solid copper rivet (tinner's rivets) where structural integrity of seam is required.

2.3 FABRICATION

- A. General Metal Fabrication: Shop-fabricate work to greatest extent possible. Comply with details shown and with recognized industry standards as shown in the "Copper in Architecture" handbook published by the Copper Development Association Inc. (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 or thicker material as sheet, interlockable with sheet in accordance with CDA recommendations.
 4. Flat Seam Panel Seams:
 - a. Fabricate seams for panels to be installed in overlapped, interlocking shingle manner.
 - b. 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.
 - c. Fabricate flat seam wall cladding from pans 18 inches (450 mm) by 24 inches (600 mm) in size.
 - d. Form interlocking seams with cleats folded into seam
 5. Flat Siding Panels:
 - a. Interlocking flat panel without stiffener ribs.
 - b. Factory tongue and groove type interlock to receive concealed fasteners.
 - c. Profile and size as indicated on Drawings.
 - d. Form interlocking seams with cleats folded into seam
 6. Beveled Metal Panel:
 - a. Overlapping and interlocking beveled panel.
 - b. Factory fabricated for concealed cleats and fasteners.
 - c. Profile and size as indicated on Drawings.
 - d. Form interlocking seams with cleats folded into seam
 7. Corrugated Panels: Overlapping panels for exposed fasteners.
 - a. Match selected profile.
 - b. Corrugations sizes as indicated.
 8. Standing Seam Panels:
 - a. Fabricate pans to interlock standing seam with center to center seam spacing as indicated on Drawings.

- b. Fabricate interlocking seams to heights and patterns indicated.
- c. Form interlocking seams with cleats folded into seam
- d. Form overlapping and interlocking transverse joints.

9. Batten Seam Panels:

- a. Fabricate pans to create center to center batten seam spacing as indicated on Drawings.
- b. Fabricate battens to sizes indicated.
- c. Form interlocking seams with cleats folded into seam
- d. Form overlapping and interlocking transverse joints.
- e. Provide ½-inch (13-mm) single lock seam at batten caps.

10. Horizontal Seam (Bermuda) Panels:

- a. Fabricate pans with long runs and pan size as indicated on Drawings.
- b. Form interlocking seams with cleats folded into seam.
- c. Seam height of ¾-inch (19-mm) offset from adjacent panel.
- d. Form overlapping transverse joints.

B. Seams: Fabricate seams in copper sheet with flat seams.

- 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 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.

2.4 FINISHES

- A. Natural weathering mill finished copper. No applied finish.
***** OR *****

REVIEW PAINT SELECTION WITH COATINGS MANUFACTURER, REFER TO DIVISION 09.

- B. To retard natural weathering, apply a uniform coating of high-grade paraffin oil, or a clear lacquer coat.

CLEAR COATINGS TO RETARD WEATHERING NOT RECOMMENDED DUE TO MAINTENANCE REQUIREMENTS.

- C. Clear Lacquer Coating:

1. Clear, Organic Coating: Clear, air-drying, acrylic lacquer specially developed for coating copper alloy products, equivalent to Incralac by StanChem applied by air spray in 2 coats per manufacturer's directions, with interim drying, to total thickness of 1.0 mil.

PART 3-EXECUTION

3.1 EXAMINATION

- A. General: Examine conditions and proceed with work when substrates are ready.
- B. Confirm that substrate system is even, smooth, sound, clean, dry, and free from defects.
- C. Verify wall openings, pipes, sleeves, ducts, and vents through wall assembly are solidly set, and fastener strips located.

3.2 PREPARATION

- A. Clean surfaces to receive copper wall cladding . Substrate to be smooth and free of defects. Drive all projecting nails or other fasteners flush with substrate.

COORDINATE WITH BUILDING AIR BARRIER SYSTEM OR USE BUILDING PAPER AS FOLLOWS.

- B. Building Paper:
 1. Weather lap sheets 2 inches (50 mm).
 2. Lap sheet 6 inches (150 mm) at ends.
 3. Attach to sheathing in accordance with sheathing manufacturer's recommendations to prevent leaks and sheathing deterioration.
 4. Provide 2 layers with joints shingled for overlaps.
- C. Install building paper and paper slip sheet on substrate under copper wall cladding to greatest extent possible unless otherwise recommended by manufacturer of sheet metal. Paper slip sheets must be installed over underlayment. Use adhesive for temporary anchorage to minimize use of mechanical fasteners under copper wall cladding. Lap joints 2 inch (50 mm) minimum.

3.3 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. 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, flashings, edge treatments, and other components of copper wall cladding 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.
3. Sealant-Type Joints: Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch (25 mm) into sealant. Form joints to conceal sealant completely. When ambient temperature is moderate at time of installation, 40 degrees to 70 degrees F (4 degrees to 21 degrees 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 degrees F (4 degrees C). Comply with requirements of Division 07 "Joint Sealant" Sections for handling and installing sealants.
4. 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. Except as otherwise shown, fold back sheet metal to form a hem on concealed side of exposed edges.
5. 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.

DELETE FLAT SEAM CLADDING TYPE BELOW IF NOT USED.

C. Flat Seam Wall Cladding:

1. Install copper work in accordance with the "Copper in Architecture " handbook published by the Copper Development Association Inc. (CDA) for flat seam joints.
2. Flat Seam Metal Wall Cladding Panels: Fasten system to substrate with concealed metal cleats and screws/nails at spacing required to resist negative wind pressure.
3. Align, level, and plumb system with structure.
4. Set panels with horizontal [diagonal] orientation.
5. Fasten cleats 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.
6. Fully seat adjacent panel to on two sides to achieve continuous engagement of seam joint.

DELETE STANDING SEAM CLADDING TYPE BELOW IF NOT USED.

D. Standing Seam Cladding:

1. Fold lower end of each pan under ¾-inch (19-mm). Slit fold one inch (25-mm) away from corner to form tab where pan turns up to make standing seam. Fold upper end of each pan over 2-inches (50-mm). Hook fold on lower end of upper pan into fold on upper end of underlying pan.
2. Apply pans beginning at bottom of wall.
3. Finish standing seams 1-inch (25-mm) [1 ½-inch (38-mm)] high. Bend up one side edge 1 ½-inch (38-mm) [2-inch (50-mm)] and other 1 ¾-inch (44-mm) [2 ¼-inch (66-mm)]. Make first fold ¼-inch (6-mm) wide single fold and second fold ½-inch (13-mm) wide, providing locked portion of standing seam with 5 plies in thickness.

DELETE BATTEN SEAM CLADDING TYPE BELOW IF NOT USED.

E. Batten Seam Cladding:

1. Turn up sides of sheets to extend above top of battens ½-inch (13-mm). Turn this ½-inch (13-mm) at right angles to battens.
2. Form cross seams with ¾-inch (19-mm) fold under on lower end and 2-inch (50-mm) fold over on upper end. Slit folds in cross seams at each corner 1-inch (25-mm) in from batten to form tab. Hook fold on lower end of pan into fold on upper end of underlaying pan.
3. Apply pans beginning at bottom of wall.
4. Place cover strips over battens, locking edges with flanges of pan malletted down against sides of battens. Cover batten ends with cap folded and locked into extensions of batten covers and vertical legs of pans.

DELETE HORIZONTAL SEAM CLADDING TYPE BELOW IF NOT USED.

F. Horizontal Seam (Bermuda) Panels:

1. Install wood nailers parallel to long seam.
2. Infill between nailers with tapered insulation or fiberboard.
3. Start panel installation at bottom of wall.
4. Interlock cleat into joints of adjacent panel.
5. Fasten cleats to wood nailers on 12-inch (300-mm) centers.
6. Install overlapping transverse joints in accordance with CDA "Copper in Architecture" handbook.

G. Fastening:

1. Provide expansion and contraction movement capability as necessary.
2. Permanently shim and fasten panel system to substrate system at spacing required by panel manufacturer.
3. Align, level, and plumb, within specified tolerances.
4. Use concealed fasteners for flat panels; exposed fasteners may only be used on portions of applied trim if necessary.
5. Locate and space exposed fasteners in true vertical and horizontal alignment, unless indicated otherwise by Architect.
6. Use proper tools to obtain controlled uniform compression for positive seal without rupture of resilient washer.

H. Install accessories, flashings, closures, and related trim to provide complete watertight system.

I. Coordinate installation of panels with adjacent construction to ensure watertight enclosure.

J. Tolerances:

1. Maximum offset from true alignment between adjacent members butting or in line: 1/8-inch (3-mm).

2. Maximum variation from plane or location indicated on Drawings: 1/4-inch (6-mm).
- K. Field adjust and align using adjustments within fastening methods.

3.4 CLEANING

- A. Remove protective film (if any) from exposed surfaces of copper wall cladding 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 clean water rinse. Use special care to neutralize and clean crevices.
- C. Clean exposed metal surfaces of substances that would interfere with normal oxidation and weathering.

3.5 PROTECTION

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

14.3. Copper Roofing

SECTION 076110



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THIS SECTION USES THE TERM "ARCHITECT." CHANGE THIS TERM AS NECESSARY TO MATCH THE ACTUAL TERM USED TO IDENTIFY DESIGN PROFESSIONAL AS DEFINED IN THE GENERAL AND SUPPLEMENTARY CONDITIONS.

ROOFING IS PART OF A SYSTEM. COORDINATE ROOF COVERING WITH ROOF DECK AND INSULATION SYSTEMS.

FLAT SEAM ROOFING RECOMMENDATIONS:

- SLOPES GREATER THAN 6:12 - DRY SEAMS WITHOUT SEALANT OR SOLDER.
- SLOPES GREATER THAN 3:12 UP TO 6:12 - SEALANT OR BUTYL TAPES CONCEALED IN SEAMS.
- FLAT AND SLOPES UP TO 3:12 - FULLY SOLDER SEAMS.

PART 1-GENERAL

1.1 SUMMARY

A. Section Includes:

EDIT LIST BELOW TO SUIT PROJECT.

1. Flat seam copper roofing.
2. Flat locked and soldered roofing.
3. Standing-seam copper roofing.
4. Batten-seam copper roofing.
5. Horizontal-seam (Bermuda type) copper roofing.
6. Custom-designed copper roofing.

RETAIN BELOW FOR FIELD PAINTING (ALSO FOR OTHER FINISHING).

B. Related Requirements:

1. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
2. Copper Roofing Finishes: Refer to the Division 09 "Painting" Sections for requirements for priming and finishing installed copper roofing; not work of this Section.
3. Division 05 Sections for structural and light-gauge framing.
4. Division 07 Section "Thermal Insulation" for roof insulation.

5. Section 074210 - Copper Wall Cladding.
6. Section 076210 - Copper Roofing Specialties: Accessories on roof other than mechanical and structural items.
7. Section 076215 - Copper Flashing and Trim: Flashing and other trim not part of roofing.
8. Section 076220 - Copper Gutters and Downspouts: Gutters and downspouts associated with roofing.
9. Section 079514 - Copper Expansion Joint Cover Assemblies.

ABOVE MAY BE EDITED TO IDENTIFY SPECIFIC ITEMS SUCH AS REGLETS, RELIEF VENTS, ROOF EXPANSION ASSEMBLIES, ORNAMENTAL ITEMS, ETC.

10. Division 07 Section "Joint Sealants" for field-applied panel sealants.
11. Wood framing and decking is specified in a Division 06 Section.

DELETE ANY OF THE FOLLOWING PROVISIONS WHICH ARE NOT APPLICABLE TO THE TYPE OF ROOFING REQUIRED.

1.2 COORDINATION

- A. 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.

1.3 PERFORMANCE REQUIREMENTS

DESIGN PROFESSIONAL IS RESPONSIBLE FOR DESIGNING SYSTEM, INCLUDING ANCHORAGE, FASTENER SIZE, AND SPACING.

- A. Installation Requirements: Fabricator is responsible for installing system, including anchorage to substrate and necessary modifications to meet specified and drawn requirements and maintain visual design concepts in accordance with Contract Documents and following installation methods as stipulated in the "Copper in Architecture" handbook published by the Copper Development Association Inc. (CDA)
 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. Obtain Architect's approval of modifications.
 4. Provide concealed fastening wherever possible.
 5. 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.
 6. Obtain Architect's approval for connections to building elements at locations other than indicated in Drawings.
 7. 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.

1.4 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.
- B. 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.

DELETE BELOW IF DETAILS OF NO IMPORTANCE OR COVERED ADEQUATELY BY WORKING DRAWINGS.

- C. 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.

DELETE BELOW IF WORK is FULLY CONCEALED, TO BE UNFINISHED, OR FIELD PAINTED, OR IF EXPOSURE is OF NO VISUAL IMPORTANCE OR IS WELL-KNOWN.

- D. Samples consisting of 6-inch (150 mm) or 12-inch (300 mm) square specimens of specified copper roofing material.
- E. Certificates: Fabricator's certification that products furnished for Project meets or exceeds specified requirements.

1.5 CLOSEOUT SUBMITTALS

- A. Provide maintenance data in Operations and Maintenance manual for maintaining applied coatings on copper panels.

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.

DELETE ENTIRE MOCK-UP PROVISION BELOW UNLESS THE EXPENDITURE IS JUSTIFIED BY AN EXTENSIVE, UNUSUAL, OR CRUCIAL APPLICATION OF METAL ROOFING.

E. Mock-Up: Before proceeding with final purchase of materials and fabrication of copper roofing components, prepare a 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. 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. Mock-up area is indicated on Drawings.

DELETE EITHER ABOVE OR BELOW.

2. Provide mock-up of sufficient size and scope to show typical pattern of seams, fastening details, edge construction, and finish texture and color.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Packing, Shipping, Handling, and Unloading: Protect finish panel faces.

B. Acceptance at Site: Examine each panel and accessory as delivered and confirm that finish is undamaged. Do not accept or install damaged panels.

C. Storage and Protection:

1. Stack pre-formed material to prevent twisting, bending, and abrasions.
2. Provide ventilation.
3. Prevent contact with materials which may cause discoloration or staining.

1.8 WARRANTY

A. Warrant installed system and components to be free from defects in material and workmanship for period of 2 years.

B. Include coverage against leakage and damages to finishes.



PART 2-PRODUCTS

2.1 MANUFACTURERS

DELETE THIS ARTICLE IF OWNER-IMPOSED OR OTHER PROJECT REQUIREMENTS PROHIBIT MENTION OF MANUFACTURERS' NAMES.

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering materials that may be incorporated in the Work include, but are not limited to, the following:

RETAIN ABOVE FOR NONPROPRIETARY OR BELOW FOR SEMIPROPRIETARY SPECIFICATION. REFER TO DIVISION-1 SECTION "MATERIALS AND EQUIPMENT."

- B. Manufacturers: Subject to compliance with requirements, provide materials by one of the following:

BELOW ARE EXAMPLES ONLY. RETAIN OR INSERT ONLY THOSE MANUFACTURERS BELOW WHOSE MATERIALS CORRESPOND WITH OTHER REQUIREMENTS AND WHOSE AVAILABILITY AND SUITABILITY FOR APPLICATION INDICATED HAVE BEEN VERIFIED.

1. Hussey Copper, Ltd.
2. Luvata, Inc.
3. PMX Industries Inc.
4. Revere Copper Products, Inc.

2.2 MATERIALS

- 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.

DELETE ABOVE OR BELOW OR EDIT AS APPROPRIATE. REFER TO MANUFACTURERS' LITERATURE FOR SELECTION OF THICKNESS APPROPRIATE TO APPLICATION INDICATED.

2. Weight: 20 oz. per sq. ft. (0.0270-inch thick) (0.69-mm) unless otherwise indicated.

RETAIN BELOW FOR BATTEN ROOFING.

3. Batten Caps: 16 [20] oz. per sq. ft.

- B. Miscellaneous Materials: Provide materials and types of fasteners, solder, protective coatings, separators, sealants and accessory items as recommended by copper sheet manufacturer for copper roofing work, except as otherwise indicated.

REVISE BELOW WITH SPECIFIC REQUIREMENTS WHERE DESIRED FOR PROJECT.

- C. 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, gutters, louvers, 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, nonsag, nontoxic, nonstaining tape.
2. Joint Sealant: One-part, copper compatible elastomeric polyurethane, polysulfide, butyl or silicone rubber sealant as tested by sealant manufacturer for copper substrates. Refer to Division 07.

SELECT ROOFING TYPE BELOW.

3. Cleats:
 - a. Concealed type as indicated in the "Copper in Architecture " handbook published by the Copper Development Association Inc. (CDA) for flat seam [flat lock seam] [standing seam], [and batten seam] spaced on 12-inch (300-mm) centers.
 - b. Fabricate cleats to allow thermal movement of copper roof panels while preventing copper panel distortion due to wind uplift forces.
4. Trim, Closure Pieces, and Accessories:

DETERMINE IF SAME WEIGHT AS ROOF PANEL OR HEAVIER WEIGHT IS DESIRED FOR TRIM.

- a. Same material, thickness [heavier weight], and finish as adjacent copper roof panels, brake formed to required profiles.
 - b. Comply with standards conforming to recognized industry standard sheet metal practice.
- D. Bituminous Coating: SSPC-Paint 12, Cold-Applied Asphalt Mastic (Extra Thick Film), nominally free of sulfur, compounded for 15-mil dry film thickness per coat.

BASED ON ACTUAL ROOF DESIGN, DO NOT USE " PEEL AND STICK " SELF-ADHERING TYPE MEMBRANES IF A DOUBLE VAPOR BARRIER WILL BE CREATED IN THE ROOF/INSULATION ASSEMBLY.

- E. High Temperature Grade Water Barrier Underlayment: Cold applied, self-adhering membrane composed of a high density, cross laminated polyethylene film coated on one side with a layer of butyl rubber or high temperature asphalt adhesive. Provide primer when recommended by water barrier manufacturer.
1. Minimum Thickness: 30 mil.
 2. Tensile Strength: ASTM D 412 (Die C Modified); 250 psi.
 3. Membrane Elongation: ASTM D412 (Die C Modified); 250%.
 4. Permeance (Max): ASTM E96; 0.05 Perms.
 5. Acceptable Products:
 - a. Blueskin PE 200 HT, Henry.
 - b. Ultra, W.R. Grace Company.
 - c. CCW MiraDRI WIP 300 High Temperature, Carlisle Coatings and Waterproofing.

DELETE ABOVE AND RETAIN BELOW IF ALTERNATIVE UNDERLAYMENT IS USED.

- F. Roofing Felt Underlayment: Asphalt saturated felt weighing not less than 30 lbs per 100 square feet.

USE BELOW UNDER COPPER INSTALLED ON roofing felt underlayment.

G. Paper Slip Sheet: Minimum 4-lb. red rosin-sized building paper.

RETAIN BELOW IF BATTENS ARE INTENDED AS PART OF ROOFING WORK.

H. Batten Bars and Strips: If size is not indicated, provide battens of nominal 2-inch (50-mm) by 2 - inch (50 - mm) size [1 ½-inch (38-mm) by 1 ½-inch (38-mm) minimum].

1. Copper Batten Caps: 20-ounce cold-rolled copper.

DELETE IF NO BATTEN-TYPE ROOFING REQUIRING WOOD STRIPS OR IF BATTENS TO BE PART OF DIVISION-6 "CARPENTRY" WORK.

2. Wood Batten Strips: Fabricated to size indicated from lumber complying with requirements of Division 06 Section "Rough Carpentry" and preservative treated by pressure process using a chemical solution that is nonhygroscopic and noncorrosive to type of copper roofing.

INSERT OTHER MATERIALS AS NEEDED FOR ROOFING WORK (ELASTOMERIC SEALANTS, INSULATION, SOLDER, REGLETS, GASKETS, ETC.)

I. Nails for Wood Substrates: Copper or hardware bronze, 0.109-inch minimum not less than 7/8-inch (22-mm) long barbed with large head.

J. Screws & Bolts: Copper, bronze, brass, or passivated stainless steel (300 Series) of sufficient size and length to sustain imposed stresses .

K. Cleats: 16 or 20 oz ounce cold rolled copper, as required to sustain loads 2-inch (50 mm) wide x 3-inch (75-mm) long.

L. Solder: ASTM B32; Provide 50-50 tin/lead or lead free alternative of similar or greater strength solder. Killed acid flux.

M. Flux: Muriatic acid neutralized with zinc or approved brand of soldering flux.

N. Rivets:

1. Pop Rivets: 1/8-inch (3-mm) to 3/16-inch (4.5-mm) diameter, with solid brass mandrels.

2. Provide solid copper rivet (tinner ' s rivets) where structural integrity of seam is required.

2.3 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 Panel Seams:

SELECT APPROPRIATE FLAT SEAM JOINT TYPE. REFER TO NOTE AT BEGINNING OF SECTION FOR USE OF SOLDER AND SEALANT IN SEAMS.

- a. Fabricate flat seams for solid soldered [sealant in] [dry] joints.
- b. Fabricate seams for panels to be installed in overlapped, interlocking shingle manner.
- 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.

6. Flat Locked Panel Seams:

SELECT APPROPRIATE FLAT SEAM JOINT TYPE. REFER TO NOTE AT BEGINNING OF SECTION FOR USE OF SOLDER AND SEALANT IN SEAMS.

FLAT LOCKED PANELS ARE LOCKED TO CLEATS BY USE OF MALLET TO ENGAGE SEAMS.

- a. Fabricate flat seams for solid soldered [sealant in] [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.

7. Standing Seam Panels:

- a. Fabricate pans to interlock standing seam with center to center seam spacing as indicated on Drawings.
- b. Fabricate interlocking seams to heights and patterns indicated.
- c. Form overlapping and interlocking transverse joints.

8. Batten Seam Panels:

- a. Fabricate pans to create center to center standing and batten seam spacing as indicated on Drawings.
- b. Fabricate battens to sizes indicated.
- c. Form overlapping and interlocking transverse joints.
- d. Provide 1/2 inch (13-mm) single lock seam at batten caps.

9. Horizontal Seam (Bermuda) Panels:

- a. Fabricate pans with long runs and pan size as indicated on Drawings.
 - b. Form interlocking seams with cleats folded into seam.
 - c. Seam height of 3/4-inch (19-mm) [] offset from adjacent panel.
 - d. Form overlapping transverse joints.
- 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.
***** OR *****

REVIEW PAINT SELECTION WITH COATINGS MANUFACTURER, REFER TO DIVISION 09.

- B. To retard natural weathering, apply a uniform coating of high grade paraffin oil, or a clear lacquer coat.

CLEAR COATINGS TO RETARD WEATHERING NOT RECOMMENDED DUE TO MAINTENANCE REQUIREMENTS.

- C. Clear Lacquer Coating:

1. Clear, Organic Coating: Clear, air-drying, acrylic lacquer specially developed for coating copper alloy products, equivalent to Incralac by StanChem applied by air spray in 2 coats per manufacturer's directions, with interim drying, to total thickness of 1.0 mil.

PART 3-EXECUTION

3.1 EXAMINATION

- A. General: Examine conditions and proceed with work when substrates are ready.
- B. Confirm that substrate system is even, smooth, sound, clean, dry, and free from defects.
- C. Verify roof openings, pipes, sleeves, ducts, and vents through roof are solidly set, cant strips and reglets in place, and nailing strips located.

3.2 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.

MOST SUBSTRATE CONDITIONS REQUIRE UNDERLAYMENT AND SLIP SHEETS. DELETE BELOW ONLY UPON RECOMMENDATION OF METAL MANUFACTURER FOR SPECIFIC PROJECT CONDITION.

- B. Water Barrier Underlayment:

1. Install high temperature grade water barrier on clean, dry roof substrate.
2. Remove dust, dirt, and loose fasteners.
3. Remove protrusions from the deck area.
4. Verify substrate has no voids, damaged, or unsupported areas.
5. Repair voids or unacceptable areas before installing membrane.
6. Prime substrates with manufacturer's approved primer if required for proper installation of membrane over substrate.
7. Install membrane in strict accordance with manufacturer's printed application procedures, precautions, and limitations.
8. Start application at low points and lap membrane shingle fashion to prevent water penetration.
9. Membrane Underlayment: Apply horizontally, lapping preceding layer not less than 4-inches (100 mm). End lap membrane not less than 6-inches (150-mm) .
 - a. Maximize adhesion to substrate by brooming or rolling membrane in place after placement.
 - b. Center membrane at valleys, hips, and ridges.

DELETE ABOVE AND RETAIN BELOW TO AGREE WITH UNDERLAYMENT SELECTION IN PART 2 ABOVE.

- C. Roofing Felt Underlayment:

1. Install underlayment over solid substrates with horizontal overlaps and endlaps staggered.
 2. Lay parallel to ridge line with 2 ½-inch (63-mm) sidelaps and 6-inch (150-mm) endlaps.
 3. Start application at low point, working up deck laying plies in shingle fashion.
 4. Fasten underlayment with copper roofing nails spaced on 12-inch (300-mm) centers maximum.
- D. Install underlayment and paper slip sheet on substrate under copper roofing to greatest extent possible unless otherwise recommended by manufacturer of sheet metal. 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 inch (50 mm) minimum.

3.3 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. 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. Sealant-Type Joints: Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch (25 mm) into sealant. Form joints to conceal sealant completely. When ambient temperature is moderate at time of installation, 40 degrees to 70 degrees F (4 degrees to 21 degrees C), set joint members for 50 percent movement either way. Adjust setting proportionately for installation at higher or lower ambient temperatures. Do not install sealant-type joints at temperatures below 40 degrees F (4 degrees C). Comply with requirements of Division 07 "Joint Sealant" Sections for handling and installing sealants.
4. 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.
5. 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.
6. 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.

SELECT ROOFING TYPE BELOW.

C. Flat Seam Roofing:

1. Install copper work in accordance with the "Copper in Architecture " handbook published by the Copper Development Association (CDA).
2. Flat Seam Metal Roof Panels: Fasten system to substrate with concealed metal cleats and screws/nails at spacings required to resist code required wind uplift.
3. Align, level, and plumb system with structure.
4. Fasten cleats 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 to on two sides to achieve continuous engagement of seam joint.

RETAIN ITEM BELOW IF SEAMS ARE SOLDERED.

6. [Apply flux and fully sweat seams with solder to achieve watertight installation].

7. Install ridge assembly and cleats to allow roof panels to thermally move.
8. Install expansion battens at 25 to 30 feet (7500 mm to 9000 mm) in both directions.

D. 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 to on two sides to achieve continuous engagement of seam joint.
6. Mallet or dress down engaged seams.

RETAIN ITEM BELOW IF SEAMS ARE SOLDERED.

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.

E. Standing Seam Roofing:

1. Fold lower end of each pan under 3/4 inch (19 mm). Slit fold 1-inch (25-mm) away from corner to form tab where pan turns up to make standing seam. Fold upper end of each pan over 2-inches (50 mm). Hook fold on lower end of upper pan into fold on upper end of underlying pan.
2. Apply pans beginning at eaves. Loose lock pans to valley flashing and edge strips at eaves and gable rakes.
3. Finish standing seams one inch (25-mm) 1 1/2-inch (38mm)] high. Bend up one side edge 1 1/2-inch (38-mm) [2-inch (50-mm)] and other 1-3/4 inch (44 mm) [2-1/4 (66mm)]. Make first fold 1/4-inch (6-mm) wide single fold and second fold 1/2-inch (13-mm) wide, providing locked portion of standing seam with 5 plies in thickness. Fold lower ends of seams at eaves over at 45 degree angle. Terminate standing seams at ridge and hips by turning down in tapered fold.
4. Form valleys of sheets not exceeding 10 '-0" (3000-mm) in length. Lap joints 8-inches (200 mm) in direction of drainage. Extend valley sheet minimum 6-inches (150-mm) under roofing sheets. At valley, double fold valley and roofing sheets and secure with cleats spaced 12-inch (300-mm) centers.

F. Batten Seam Roofing:

1. Turn up sides of sheets to extend above top of battens 1/2-inch (13-mm). Turn this 1/2-inch (13-mm) at right angles to battens.
2. Form cross seams with 3/4-inch (19-mm) fold under on lower end and 2-inch (50-mm) fold over on upper end. Slit folds in cross seams at each corner one inch (25-mm) in from batten to form tab. Hook fold on lower end of pan into fold on upper end of underlying pan.
3. Apply pans beginning at eaves.
4. Place cover strips over battens, locking edges with flanges of pan malletted down against sides of

battens. Cover batten ends with cap folded and locked into extensions of batten covers and vertical legs of pans.

5. At intersections of roof slope with ridge and hip battens, turn up edges of roof pans against sides of battens and terminate in ½-inch (13-mm) flange at top of battens. Install cover strips over top of hip and ridge battens.
6. Form valleys of sheets not exceeding 10' -0" (3000-mm) in length. Lap joints 8-inches (200-mm) in direction of drainage. Extend valley sheet minimum 6-inches (150-mm) under roofing sheets. At valley, double fold valley and roofing sheets and secure with cleats spaced 12-inch (300-mm) centers.
7. At eaves without gutters, hook pan over edge strip. Extend edge strip up under metal roofing 4-inches (100 mm) and secure with nails at 3-inch (75-mm) centers, at 1-inch (25-mm) from upper end.
8. Install batten flush with gable. Extend batten cover down exterior face and lock into edge strip.

G. Horizontal Seam (Bermuda) Panels:

1. Install wood nailers parallel to long seam.
2. Infill between nailers with tapered insulation or fiberboard.
3. Start panel installation at eave.
4. Interlock cleat into joints of adjacent panel.
5. Fasten cleats to wood nailers on 12-inch (300-mm) centers.
6. Install overlapping transverse joints in accordance with the "Copper in Architecture " handbook published by the Copper Development Association Inc. (CDA). Install accessories, flashings, closures, and related trim to provide complete watertight system.

H. Coordinate installation of panels with adjacent construction to ensure watertight enclosure.

3.4 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.

3.5 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.

14.4. Manufactured Copper Roofing Specialties

SECTION 076210



[Download Word Format](#) [55 Kb]

THIS SECTION USES THE TERM "ARCHITECT." CHANGE THIS TERM AS NECESSARY TO MATCH THE ACTUAL TERM USED TO IDENTIFY DESIGN PROFESSIONAL AS DEFINED IN THE GENERAL AND SUPPLEMENTARY CONDITIONS.

SECTION TYPICALLY INCLUDES ITEMS THAT ARE FACTORY FABRICATED - NOT FIELD FABRICATED.

PART 1-GENERAL

1.1 SUMMARY

EDIT EXAMPLES BELOW BY DELETING ITEMS NOT REQUIRED, ADDING OTHERS, OR REVISING TEXT TO CLARIFY DESCRIPTIONS.

- A. Section Includes: Copper roofing specialties and accessories of standard manufactured components. Includes accessories installed on and in roofing other than mechanical and structural items, such as:
1. Factory-manufactured curbset wall counterflashing and expansion joints.
 2. Factory-manufactured miscellaneous sheet copper fascia, copings, trim and accessories.

FOLLOWING ARE EXAMPLES OF SEVERAL POSSIBLE CROSS REFERENCES WHICH MAY BE NECESSARY TO CLARIFY WHAT WORK IS SPECIFIED WHERE.

- B. Related Requirements:
1. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to work of this Section.
 2. Integral masonry flashings are specified as masonry work in sections of Division 04.
 3. Roofing flashing and trim installed integral with roofing membrane are specified in roofing system sections as roofing work.
 4. Coordinate installation with mechanical equipment specified in Division 23.

1.2 COORDINATION

- A. Coordinate work of this section with interfacing and adjacent work for proper sequencing. Ensure weather resistance and durability of work and protection of materials and finishes.

1.3 PERFORMANCE REQUIREMENTS

DESIGN PROFESSIONAL IS RESPONSIBLE FOR DESIGNING SYSTEM, INCLUDING ANCHORAGE, FASTENER SIZE, AND SPACING.

- A. Installation Requirements: Installation contractor is responsible for installing system, including anchorage to substrate and necessary modifications to meet specified and drawn requirements and maintain visual design concepts in accordance with Contract Documents and following installation methods as stipulated by the manufacturer.
- B. Drawings are diagrammatic and are intended to establish basic dimension of units, sight lines, and profiles of units.
 - 1. Make modifications only to meet field conditions and to ensure fitting of system components.
 - 2. Obtain Architect's approval of modifications.
 - 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. Obtain Architect's approval for connections to building elements at locations other than indicated in Drawings.
 - 6. Accommodate building structure deflections in system connections to structure.
- C. 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.

1.4 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.
- B. Product Data: Manufacturer's technical product data, installation instructions, and general recommendations for each specified sheet material and fabricated product.

DELETE BELOW IF NONE OF WORK SUFFICIENTLY COMPLEX TO JUSTIFY SHOP DRAWINGS; EDIT TO DELETE NONAPPLICABLE UNITS. POSSIBLY INSERT PRODUCT-HANDLING ARTICLE WHERE SUBSTANTIAL VOLUME OF HIGHLY FINISHED WORK IS REQUIRED.

- C. Shop drawings showing layout, profiles, methods of joining, and anchorage details, including major trim systems. Provide layouts at 1/4-inch (1:50) scale and details at 3-inch (1:4) scale.

RETAIN ABOVE AND INSERT SPECIFIC DATA SUBMITTALS AS DESIRED.

- D. Samples of the following items:
 - 1. 6-inch (150-mm) or 12-inch (300-mm) square samples of specified sheet materials to be exposed as finished surfaces.

DELETE ABOVE AND BELOW IF NO CONTROL REQUIRED ON SHEET MATERIALS. DELETE BELOW IF VISUAL CONTROL OF TRIM UNITS, ETC. IS NOT DESIRED.

2. 6-inch (150-mm) or 12-inch (300-mm) long samples of factory-fabricated products exposed as finished work. Provide complete with specified factory finish.

1.5 CLOSEOUT SUBMITTALS

- A. Provide maintenance data in Operations and Maintenance manual for maintaining applied coatings on copper panels.

POSSIBLY INSERT QUALITY ASSURANCE ARTICLE HERE FOR LIMITATIONS ON FABRICATORS OR INSTALLERS OF COMPLEX SYSTEMS OF FLASHING, RAIN DRAINAGE, EXPANSION JOINTS, ETC.

1.6 QUALITY ASSURANCE

- A. Fabricator's Qualifications: Company specializing in copper sheet metal roof specialties 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 roof specialties 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.

DELETE ENTIRE MOCK-UP PROVISION BELOW UNLESS THE EXPENDITURE IS JUSTIFIED BY AN EXTENSIVE, UNUSUAL, OR CRUCIAL APPLICATION OF METAL ROOFING.

- D. Mock-Up: Before proceeding with final purchase of materials and fabrication of copper roof specialty components, prepare a mock-up of work. Incorporate materials and methods of fabrication and installation identical with project requirements. Install mock-up at location directed by Architect. Retain accepted mock-up as quality standard for acceptance of completed copper work. If accepted, mock-up may be incorporated as part of copper work.
 1. Mock-up area is indicated on Drawings.

DELETE EITHER ABOVE OR BELOW.

2. Provide mock-up of sufficient size and scope to show typical pattern of seams, fastening details, edge construction, and finish texture and color.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Packing, Shipping, Handling, and Unloading: Protect finish metal faces.
- B. Acceptance at Site: Examine each component and accessory as delivered and confirm that material and finish is undamaged. Do not accept or install damaged materials.
- C. Storage and Protection:
 1. Stack preformed material to prevent twisting, bending, and abrasions.
 2. Provide ventilation.

3. Prevent contact with materials which may cause discoloration or staining.

POSSIBLY INSERT HERE SPECIAL PROJECT WARRANTY REQUIREMENTS FOR EXTENSIVE/ ELABORATE (ESPECIALLY PREFAB) SYSTEMS.

PART 2-PRODUCTS

2.1 MATERIALS

- A. Copper: ASTM B 370; temper H00 (cold-rolled) except where temper 060 is required for forming; 16 oz. per sq. ft. (0.0216-inch thick) (0.55-mm) except as otherwise indicated.

INSERT OTHER PRIMARY MATERIALS AS REQUIRED FOR PROJECT. ACCESSORIES LISTED LATER IN THIS SECTION.

2.2 ACCESSORIES:

REVISE ABOVE IF CELLULAR PLASTIC OR OTHER TYPES DESIRED.

- A. Wood Nailers: Softwood lumber, pressure treated with water-borne preservatives for above-ground use, complying with AWPB LP-2; not less than 1-1/2-inch (38-mm) thick.
- B. Solder: ASTM B 32; Provide 50-50 tin/lead or lead free alternative of similar or greater strength solder. Killed acid flux.
- C. Flux: Muriatic acid neutralized with zinc or approved brand of soldering flux.
- D. Fasteners: Same metal as flashing/sheet metal or other non-corrosive metal as recommended by sheet manufacturer. Match finish of exposed heads with material being fastened.
- E. Bituminous Coating: SSPC-Paint 12, Cold-Applied Asphalt Mastic (Extra Thick Film), nominally free of sulfur, compounded for 15-mil dry film thickness per coat.
- F. Joint Sealant: One-part, copper compatible elastomeric polyurethane, polysulfide, butyl or silicone rubber sealant as tested by sealant manufacturer for copper substrates. Refer to Division 07.
- G. Sheet Copper Accessories: Provide sheet copper cleats, straps, anchoring devices, and similar accessory units as required for installation of work, matching or compatible with material being installed, noncorrosive, size and gauge required for performance.
- H. Roofing Cement: ASTM D 2822, asphaltic.
- I. High Temperature Grade Water Barrier Underlayment: Cold applied, self-adhering membrane composed of a high density, cross laminated polyethylene film coated on one side with a layer of butyl rubber or high temperature asphalt adhesive. Provide primer when recommended by water barrier manufacturer.
 1. Minimum Thickness: 30 mil.
 2. Tensile Strength: ASTM D 412 (Die C Modified); 250 psi.
 3. Membrane Elongation: ASTM D 412 (Die C Modified); 250%.

4. Permeance (Max): ASTM E96; 0.05 Perms.
5. Acceptable Products:
 - a. Blueskin PE 200 HT, Henry.
 - b. Ultra, W.R. Grace Company.
 - c. CCW MiraDRI WIP 300 High Temperature, Carlisle Coatings and Waterproofing.

DELETE ABOVE AND RETAIN BELOW IF ALTERNATIVE UNDERLAYMENT IS USED.

- J. Roofing Felt Underlayment: Asphalt saturated felt weighing not less than 30 lbs per 100 square feet.

USE BELOW UNDER COPPER INSTALLED ON ROOFING FELT UNDERLAYMENT.

- K. Paper Slip Sheet: Minimum 4-lb. red rosin-sized building paper.
- L. Rivets:
 1. Pop Rivets: 1/8-inch (3-mm) to 3/16-inch (4.5-mm) diameter, with solid brass mandrels.
 2. Provide solid copper rivet (tinner's rivets) where structural integrity of seam is required.

INSERT OTHER MATERIALS AS REQUIRED FOR PROJECT.

2.3 FABRICATION

- A. General Sheet Copper Fabrication: Provide materials of standard factory fabrication 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 substrates. Comply with material manufacturer instructions and recommendations for forming material. Form exposed sheet 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 of same material as sheet, interlockable with sheet in accordance with CDA recommendations.
- B. Seams: Fabricate nonmoving seams in sheet copper with flat-lock seams. Tin edges and cleats to be seamed, form seams, and solder. Use 1-inch (25-mm) wide lapped rivet and soldered joints where required.
- 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, nonexpansion 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 standard details.

INSERT SPECIFIC LISTING (BELOW) OF SEPARATIONS KNOWN TO BE REQUIRED FOR WORK AS DETAILED. ATTEMPT SHOULD BE MADE (IN DETAILING AND SELECTING MATERIALS) TO AVOID THIS NEED.

- E. Separations: Provide for separation of metal from noncompatible metal or corrosive substrates by coating concealed surfaces at locations of contact, with bituminous coating or other permanent separation as recommended by manufacturer/fabricator.
- F. Preformed Gravel Stop/Fascia:
 - 1. Copper water dam with fascia.
 - 2. Provide with continuous cleat mechanically fastened to be secured and engaged against roofing membrane.
 - 3. Secure to obtain wind uplift resistance to comply with code.
 - 4. Provide with flowover scupper [spillout scupper] [downspout starter].
 - 5. Provide with splice plates to conceal and weatherseal joints between sections of dam and fascia.
- G. Preformed Coping:
 - 1. Coping: 16 oz. per sq. ft. (0.0216-inch thick) (0.55-mm) unless otherwise indicated.
 - 2. Anchor Cleat: 20 oz. per sq. ft. (0.0270-inch thick) (0.69-mm) unless otherwise indicated.
 - 3. Gutter/Splice Plate: Anchor cleat with integral drainable gutter or manufacturer 's standard closed cell composition compressible material gasket between anchor plate and coping finish top match coping.
 - 4. Secure to obtain wind uplift resistance to comply with code.
 - 5. Slope coping towards roof.
 - 6. Provide gutter/splice plates at joints between sections of coping.
- H. Fabrication:
 - 1. Form sections true to shape, accurate in size, square, free from distortion and defects, to profiles indicated.
 - 2. Shop fabricate intersections, inside corners, and outside corners with miters welded in factory prior to finishing.
 - 3. [Shop fabricate radius curved corners].

2.4 FINISHES

- A. Natural weathering mill finished copper. No applied finish.
***** OR *****

REVIEW PAINT SELECTION WITH COATINGS MANUFACTURER, REFER TO DIVISION 09.

- B. To retard natural weathering, apply a uniform coating of high grade paraffin oil, or a clear lacquer coat.

CLEAR COATINGS TO RETARD WEATHERING NOT RECOMMENDED DUE TO MAINTENANCE REQUIREMENTS.

C. Clear Lacquer Coating:

1. Clear, Organic Coating: Clear, air-drying, acrylic lacquer specially developed for coating copper alloy products, equivalent to Incralac by StanChem applied by air spray in 2 coats per manufacturer's directions, with interim drying, to total thickness of 1.0 mil.

PART 3-EXECUTION

3.1 EXAMINATION

- A. General: Examine conditions and proceed with work when substrates are ready.
- B. Confirm that substrate system is even, smooth, sound, clean, dry, and free from defects.

3.2 INSTALLATION

- A. General: Except as otherwise indicated, comply with manufacturer's installation instructions and recommendations and with CDA "Copper in Architecture Handbook." Anchor units of work securely in place by methods indicated, providing for thermal expansion of copper units; conceal 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 weatherproof.
 1. Install units plumb, level, square, and free from warp or twist while maintaining dimensional tolerances and alignment with surrounding construction.
 2. Securely anchor roof specialties to supporting substrates with appropriate type fasteners.
 3. Coordinate with installation of roofing system and related flashings.
- B. Parapet Cap Water Barrier Membrane Underlayment:
 1. Clean substrate of dirt, dust, and materials which may impair adhesion.
 2. Apply primer, when required, in accordance with manufacturer's requirements.
 3. Apply to top of parapet wall under coping and gravel stops.
 4. Turn membrane down exterior wall face and parapet wall face 2 inches (50 mm).
 5. Install without fishmouths and wrinkles.
 6. Press tape into firm contact with substrate.
 7. Lap tape ends minimum of 2 inches (50 mm).

DELETE ABOVE AND RETAIN BELOW IF ALTERNATIVE UNDERLAYMENT IS USED.

- C. Underlayment: Where units are to be installed directly on cementitious or wood substrates, install a slip sheet of red rosin paper on a course of asphalt saturated felt.
- D. Bed flanges of work in a thick coat of bituminous roofing cement where required for waterproof performance.

E. Fascia:

1. Secure in place with concealed fasteners and cleats using methods as recommended by manufacturer and CDA to maintain sightlines and wind resistance.
2. Seal joints and splice plates watertight.

F. Coping:

1. Secure in place with concealed fasteners and cleats using methods as recommended by manufacturer and CDA to maintain sightlines and wind resistance.
2. Seal joints and splice plates watertight.

3.3 CLEANING

- A. Remove protective film (if any) from exposed surfaces of copper promptly upon installation. Strip with care to avoid damage to finishes.
- B. Clean exposed copper surfaces, removing substances that might cause corrosion of copper or deterioration of finishes.
- C. 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.
- D. Clean exposed metal surfaces of substances that would interfere with uniform oxidation and weathering.

3.4 PROTECTION

- A. Protection: Advise Contractor of required procedures for surveillance and protection of flashings and sheet copper work during construction to ensure that work will be without damage or deterioration other than natural weathering at time of Substantial Completion.

14.5. Copper Flashing and Trim

SECTION 076215



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THIS SECTION USES THE TERM "ARCHITECT." CHANGE THIS TERM AS NECESSARY TO MATCH THE ACTUAL TERM USED TO IDENTIFY DESIGN PROFESSIONAL AS DEFINED IN THE GENERAL AND SUPPLEMENTARY CONDITIONS.

PART 1-GENERAL

1.1 SUMMARY

EDIT EXAMPLES BELOW BY DELETING ITEMS NOT REQUIRED, ADDING OTHERS, OR REVISING TEXT TO CLARIFY DESCRIPTIONS.

A. Section Includes shop and field formed copper accessories and trim, such as:

1. Counterflashing and base flashing.
2. Wall flashing.
3. Gravel stops.
4. Copings.
5. Valley flashing.
6. Exposed trim/fascia units.
7. Miscellaneous accessories.
8. Laminated flashing.

FOLLOWING ARE EXAMPLES OF SEVERAL POSSIBLE CROSS REFERENCES WHICH MAY BE NECESSARY TO CLARIFY WHAT WORK IS SPECIFIED WHERE.

B. Related Requirements:

1. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to work of this Section.
2. Integral masonry flashings are specified as masonry work in sections of Division 04.
3. Roofing accessories installed integral with roofing membrane are specified in roofing system sections as roofing work.
4. Section 074210 - Copper Wall Cladding.
5. Section 076110 - Copper Roofing.
6. Section 076210 - Copper Roofing Specialties: Roof accessory units of premanufactured, set-on type.

7. Section 076220 - Copper Gutters and Downspouts: Gutters and downspouts associated with roofing.
8. Section 079514 - Copper Expansion Joint Cover Assemblies: Building expansion joint covers.."
9. Sealants are generally specified in Division 07 Section, "Joint Sealants."
10. Coordinate installation with HVAC mechanical equipment specified in Division 23.

1.2 COORDINATION

- A. Coordinate work of this section with interfacing and adjacent work for proper sequencing. Ensure weather resistance and durability of work and protection of materials and finishes.

1.3 PERFORMANCE REQUIREMENTS

DESIGN PROFESSIONAL IS RESPONSIBLE FOR DESIGNING SYSTEM, INCLUDING ANCHORAGE, FASTENER SIZE, AND SPACING.

- A. Installation Requirements: Fabricator is responsible for installing system, including anchorage to substrate and necessary modifications to meet specified and drawn requirements and maintain visual design concepts in accordance with Contract Documents and following installation methods as stipulated in the "Copper in Architecture" handbook published by the Copper Development Association Inc. (CDA).
 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. Obtain Architect's approval of modifications.
 4. Provide concealed fastening wherever possible.
 5. 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.
 6. Obtain Architect ' s approval for connections to building elements at locations other than indicated in Drawings.
 7. 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.

1.4 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.

- B. Product data for flashing, metal, and accessories: Manufacturer's technical product data, installation instructions and general recommendations for each specified sheet material and fabricated product.

DELETE BELOW IF NONE OF WORK SUFFICIENTLY COMPLEX TO JUSTIFY SHOP DRAWINGS; EDIT TO DELETE NONAPPLICABLE UNITS. POSSIBLY INSERT PRODUCT-HANDLING ARTICLE WHERE SUBSTANTIAL VOLUME OF HIGHLY FINISHED WORK IS REQUIRED.

- C. Shop drawings showing layout, profiles, methods of joining, and anchorage details, including major counterflashings, copings, trim/fascia units, and gravel stops systems. Provide layouts at ¼-inch (1:50) scale and details at 3-inch (1:4) scale.

RETAIN ABOVE AND INSERT SPECIFIC DATA SUBMITTALS AS DESIRED.

- D. Samples of the following flashing, sheet metal, and accessory items:
1. 6-inch (150-mm) or 12-inch (300-mm) square samples of specified sheet materials to be exposed as finished surfaces.

DELETE ABOVE AND BELOW IF NO CONTROL REQUIRED ON SHEET MATERIALS. DELETE BELOW IF VISUAL CONTROL OF TRIM UNITS, GUTTERS, DOWNSPOUTS, EXPANSION JOINT UNITS, ETC. IS NOT DESIRED.

2. 6-inch (150-mm) or 12-inch (300-mm) long samples of fabricated products exposed as finished work. Provide complete with specified finish.

1.5 CLOSEOUT SUBMITTALS

- A. Provide maintenance data in Operations and Maintenance manual for maintaining applied coatings on copper panels.

POSSIBLY INSERT QUALITY ASSURANCE ARTICLE HERE FOR LIMITATIONS ON FABRICATORS OR INSTALLERS OF COMPLEX SYSTEMS OF FLASHING, RAIN DRAINAGE, EXPANSION JOINTS, ETC.

1.6 QUALITY ASSURANCE

- A. Fabricator's Qualifications: Company specializing in copper flashing and trim 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 flashing and trim work 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.

DELETE ENTIRE MOCK-UP PROVISION BELOW UNLESS THE EXPENDITURE IS JUSTIFIED BY AN EXTENSIVE, UNUSUAL, OR CRUCIAL APPLICATION OF METAL ROOFING.

- D. Mock-Up: Before proceeding with final purchase of materials and fabrication of copper flashing and trim work components, prepare a mock-up of work. Incorporate materials and methods of fabrication and installation identical with project requirements. Install mock-up at location directed by Architect. Retain accepted mock-up as quality standard for acceptance of completed copper work. If accepted, mock-up may be incorporated as part of copper work.

1. Mock-up area is indicated on Drawings.

DELETE EITHER ABOVE OR BELOW.

2. Provide mock-up of sufficient size and scope to show typical pattern of seams, fastening details, edge construction, and finish texture and color.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Packing, Shipping, Handling, and Unloading: Protect finish metal faces.
- B. Acceptance at Site: Examine each component and accessory as delivered and confirm that material and finish is undamaged. Do not accept or install damaged materials.
- C. Storage and Protection:
 1. Stack preformed material to prevent twisting, bending, and abrasions.
 2. Provide ventilation.
 3. Prevent contact with materials which may cause discoloration or staining.

1.8 WARRANTY

- A. Warrant installed flashing, copings, gravel stops, and trim components to be free from defects in material and workmanship for period of 2 years.
- B. Include coverage against leakage and damages to finishes.

PART 2-PRODUCTS

2.1 FLASHING AND TRIM MATERIALS

- A. Copper: ASTM B 370; temper H00 (cold-rolled) except where temper 060 is required for forming;
 1. 16 oz. per sq. ft. (0.0216-inch thick) (0.55-mm) except as otherwise indicated.

2.2 LAMINATED COMPOSITION SHEET FLASHING

- A. Copper/Fiberglass Laminated Flashing.
 1. Description: Asphalt free copper fabric flashing, 3 [5] [7] ounce minimum weight.
 2. Material: Copper sheet with 060 temper conforming to ASTM B 370 bonded with a proprietary rubber based adhesive, between two layers of fiberglass fabric weighing not less than 0.3 oz per sq. ft. per layer with a minimum of 20x20 threads per inch.
- B. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

RETAIN ABOVE FOR NONPROPRIETARY OR BELOW FOR SEMIPROPRIETARY SPECIFICATION. REFER TO DIVISION-1 SECTION "MATERIAL AND EQUIPMENT."

C. Products: Subject to compliance with requirements, provide one of the following:

1. Copper Sealtite 2000, Advanced Building Products, Inc.
2. Multi-Flash 500 Series Asphalt Free, York Manufacturing, Inc.

2.3 ACCESSORIES

- A. Solder: ASTM B 32; Provide 50-50 tin/lead or lead free alternative of similar or greater strength solder. Killed acid flux.
- B. Flux: Muriatic acid neutralized with zinc or approved brand of soldering flux.
- C. Fasteners: Same metal as flashing/sheet metal or other non-corrosive metal as recommended by sheet manufacturer. Match finish of exposed heads with material being fastened.
- D. Bituminous Coating: SSPC-Paint 12, Cold-Applied Asphalt Mastic (Extra Thick Film), nominally free of sulfur, compounded for 15-mil dry film thickness per coat.
- E. Joint Sealant: One-part, copper compatible elastomeric polyurethane, polysulfide, butyl or silicone rubber sealant as tested by sealant manufacturer for copper substrates. Refer to Division 07.

POSSIBLY INSERT SPECIFIC PERFORMANCE REQUIREMENTS BELOW OR ACCEPTABLE PRODUCT LISTING FOR CRUCIAL APPLICATIONS OF SEALANTS. (COORDINATE WITH DIV-7 SECTION "JOINT SEALERS.")

- F. Adhesives: Type recommended by flashing sheet manufacturer for waterproof/weather-resistant seaming and adhesive application of and compatibility with flashing sheet.
- G. High Temperature Grade Water Barrier Underlayment: Cold applied, self-adhering membrane composed of a high density, cross laminated polyethylene film coated on one side with a layer of butyl rubber or high temperature asphalt adhesive. Provide primer when recommended by water barrier manufacturer.
 1. Minimum Thickness: 30 mil.
 2. Tensile Strength: ASTM D 412 (Die C Modified); 250 psi.
 3. Membrane Elongation: ASTM D 412 (Die C Modified); 250%
 4. Permeance (Max): ASTM E96; 0.05 Perms.
 5. Acceptable Products:
 - a. Blueskin PE 200 HT, Henry.
 - b. Ultra, W.R. Grace Company.
 - c. CCW MiraDRI WIP 300 High Temperature, Carlisle Coatings and Waterproofing.

DELETE ABOVE AND RETAIN BELOW IF ALTERNATIVE UNDERLAYMENT IS USED.

- H. Roofing Felt Underlayment: Asphalt saturated felt weighing not less than 30 lbs per 100 square feet.

USE BELOW UNDER COPPER INSTALLED ON ROOFING FELT UNDERLAYMENT.

- I. Paper Slip Sheet: Minimum 4-lb. red rosin-sized building paper.
- J. Reglets: Units of type and profile indicated, compatible with copper, noncorrosive.
- K. Metal Accessories: Provide cleats, straps, anchoring devices, and similar accessory units as required for installation of work, noncorrosive, size and gauge required for performance.
- L. Roofing Cement: ASTM D 2822, asphaltic.
- M. Rivets:
 - 1. Pop Rivets: 1/8-inch (3-mm) to 3/16-inch (4.5-mm) diameter, with solid brass mandrels.
 - 2. Provide solid copper rivet (tinner 's rivets) where structural integrity of seam is required.

INSERT OTHER MATERIALS AS REQUIRED FOR PROJECT.

2.4 FABRICATION

- A. General Metal Fabrication: Shop-fabricate work to greatest extent possible. Comply with details shown and with applicable requirements of Copper Development Association (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 substrates. Comply with material manufacturer 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 of same material as sheet, interlockable with sheet in accordance with CDA recommendations.
 - 4. Fabricate corners from one piece with minimum 18-inch (450-mm) long legs; solder for rigidity if required; seal non-soldered weather joints with sealant.
- B. Seams: Fabricate nonmoving seams with flat-lock seams where possible. Tin edges and cleats to be seamed, form seams, and solder. Where soldered flat-lock seams are not possible, use soldered riveted lap seams joints for additional strength.
- 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, nonexpansion type joints are indicated or required for proper performance of work, form metal to provide for proper installation of elastomeric sealant, in compliance with CDA standards.

INSERT SPECIFIC LISTING (BELOW) OF SEPARATIONS KNOWN TO BE REQUIRED FOR WORK AS DETAILED. ATTEMPT SHOULD BE MADE IN DETAILING TO AVOID THIS NEED.

E. Separations: Provide for separation of metal from noncompatible metal or corrosive substrates 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 metal joints except those indicated or required to be expansive type joints.
2. Tin edges of copper sheets and cleats at soldered joints.
3. After soldering, carefully remove flux and other residue from surfaces. Neutralize acid flux by washing with baking soda solution, and then flushing clear water rinse. Wipe and wash solder joints clean.

VERIFY SEAM TYPE DESIRED FOR EACH USE AND MODIFY PARAGRAPH BELOW AS REQUIRED.

G. Seams:

1. Provide following seam types unless noted or detailed otherwise.
2. Flat: Drive cleat [Flat lock].
3. Corner: Double lock corner [Single lock corner].
4. Standing: Double lock standing [Single lock standing] lap seam.

H. Copper Thickness: Comply with CDA recommendations for copper size and shape.

SELECT FLASHING, COPING, FASCIA/GRAVEL STOP, SCUPPERS, OR CONDUCTOR HEADS BELOW AS APPROPRIATE FOR PROJECT.

I. Flashing and Counter Flashing:

1. Fabricate as indicated on Drawings and in accordance with the CDA "Copper in Architecture" handbook.
2. Hem exposed flashings on underside ½-inch (13-mm); miter and seam corners.
3. Fabricate vertical faces with bottom edge formed outward ¼-inch (6-mm) and hemmed to form drip.
4. Fabricate flashings to allow toe to extend minimum 2-inches (50-mm) over wall surfaces.

J. Coping: As indicated on Drawings and in accordance with the CDA "Copper in Architecture" handbook.

K. Fascia/Gravel Stop: As indicated on Drawings and in accordance with the CDA "Copper in Architecture" handbook.

L. Valley Flashing:

1. Fabricate valley flashing according to details and specified requirements.
2. Fabricate metal flashings at open valleys with a minimum 1-inch (25-mm) high standing rib at center of valley to break force of water flow.

M. Masonry Through Wall Flashings: Refer to Division 04 section on masonry.

2.5 FINISHES

- A. Natural weathering mill finished copper. No applied finish.
***** OR *****

REVIEW PAINT SELECTION WITH COATINGS MANUFACTURER, REFER TO DIVISION 09.

- B. To retard natural weathering, apply a uniform coating of high grade paraffin oil, or a clear lacquer coat.

CLEAR COATINGS TO RETARD WEATHERING NOT RECOMMENDED DUE TO MAINTENANCE REQUIREMENTS.

- C. Clear Lacquer Coating

1. Clear, Organic Coating: Clear, air-drying, acrylic lacquer specially developed for coating copper alloy products, equivalent to Incralac by StanChem applied by air spray in 2 coats per manufacturer's directions, with interim drying, to total thickness of 1.0 mil.

PART 3-EXECUTION

3.1 EXAMINATION

- A. General: Examine conditions and proceed with work when substrates are ready.
- B. Confirm that substrate system is even, smooth, sound, clean, dry, and free from defects.

3.2 INSTALLATION

- A. General: Except as otherwise indicated, comply with manufacturer's installation instructions and recommendations and with the "Copper in Architecture" handbook published by the Copper Development Association Inc. (CDA). Anchor units of work securely in place by methods indicated, providing for thermal expansion of units; conceal 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 weatherproof.
1. Install units plumb, level, square, and free from warp or twist while maintaining dimensional tolerances and alignment with surrounding construction.
 2. Apply asphalt mastic on copper surfaces of units in contact with dissimilar metals.
 3. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.
 4. Miter, lap seam and close corner joints with solder. Seal seams and joints watertight.
 5. Install expansion joints at frequency recommended by CDA. Do not fasten moving seams such that movement is restricted.
 6. Coordinate with installation of roofing system and roof accessories.
- B. Parapet Cap Water Barrier Membrane Underlayment:
1. Clean substrate of dirt, dust, and materials which may impair adhesion.

2. Apply primer, when required, in accordance with manufacturer's requirements.
3. Apply to top of parapet wall under coping and gravel stops.
4. Turn membrane down exterior wall face and parapet wall face 2 inches (50 mm).
5. Install without fishmouths and wrinkles.
6. Press tape into firm contact with substrate.
7. Lap tape ends minimum of 2 inches (50 mm).

DELETE ABOVE AND RETAIN BELOW IF ALTERNATIVE UNDERLAYMENT IS USED.

- C. Underlayment: Where installation is to be directly on cementitious or wood substrates, install red rosin paper slip sheet over layer of asphalt saturated felt.
- D. Bed flanges of work in a thick coat of bituminous roofing cement where required for waterproof performance.
- E. Install reglets to receive counterflashing in manner and by methods indicated. Where shown in concrete, furnish reglets to trades of concrete work for installation as work of Division 03 sections. Where shown in masonry, furnish reglets to trades of masonry work, for installation as work of Division 04 sections.

DELETE ABOVE IF NO REGLETS REQUIRED. ADJUST PROVISIONS OF TEXT TO CONFORM WITH LOCAL PRACTICE AND TRADE JURISDICTIONS.

F. Counterflashing and Reglets:

1. Fabricate counterflashings and reglets as 2 piece assemblies to permit installation of counterflashing after base flashings are in place.
 2. Fabricate reglets of same metal and thickness as counterflashings.
 3. Overlap roof base flashing 4 inches (100 mm) minimum.
 4. Install bottom edge tight against base flashing.
 5. Lap seam vertical joints 3 inches (75 mm) minimum and apply sealant.
- G. Install counterflashing in reglets, either by snap-in seal arrangement, lock seal in accordance with the "Copper in Architecture" handbook published by the Copper Development Association (CDA) , or by soldering in place for anchorage and filling reglet with mastic or elastomeric sealant, as indicated and depending on degree of sealant exposure.
- H. Install laminated flashing in accordance with manufacturer's recommendations. Where required, provide for movement at joints by forming loops or bellows in width of flashing. Locate cover or filler strips at joints to facilitate complete drainage of water from flashing. Seam adjacent flashing sheets with adhesive, seal and anchor edges in accordance with manufacturer's recommendations.
- I. Fasten flashing to curb nailers at maximum spacing of 3 inches (75 mm) O.C. Fabricate seams at joints between units with minimum 4-inch (100 mm) overlap, to form continuous, waterproof system in accordance with the "Copper in Architecture " handbook published by the Copper Development Association (CDA).
- J. Coping, and Fascia/Gravel Stops:
1. Space seams: 10'-0" (3000-mm) o.c. maximum.

2. Lock exterior edges over continuous cleats to secure to substrate.
3. Slope towards inside of parapet, ½-inch (13-mm) minimum, unless indicated otherwise.
4. Lock interior edges to substrate with cleats spaced at 12-inch (300-mm) centers.
5. Provide drainage system at seams to prevent water infiltration.

K. Valley Flashing:

1. Extend metal flashing a minimum of 12-inches (300-mm) onto roof deck on each side of valley.
2. If valley length exceeds 12-feet (3600-mm), increase width of valley flashing by 1-inch (25-mm) on each side per 96 inches (2400-mm) of valley length.

INSERT OTHER SPECIFIC INSTALLATION REQUIREMENTS FOR OTHER SYSTEMS AND SHEET METAL ACCESSORY ITEMS SPECIFIED AS WORK OF THIS SECTION.

3.3 CLEANING

- A. Remove protective film (if any) from exposed surfaces of copper promptly upon installation. Strip with care to avoid damage to finishes.
- B. Clean exposed copper surfaces, removing substances that might cause abnormal discoloration of metal.
- C. 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 with clear water rinse. Use special care to neutralize and clean crevices.
- D. Clean exposed metal surfaces of substances that would interfere with normal oxidation and weathering.

3.4 PROTECTION

- A. Advise Contractor of required procedures for surveillance and protection of flashings and sheet metal work during construction to ensure that work will be without damage or deterioration other than natural weathering at time of Substantial Completion.

14.6. Copper Gutters and Downspouts

SECTION 076220



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THIS SECTION USES THE TERM "ARCHITECT." CHANGE THIS TERM AS NECESSARY TO MATCH THE ACTUAL TERM USED TO IDENTIFY DESIGN PROFESSIONAL AS DEFINED IN THE GENERAL AND SUPPLEMENTARY CONDITIONS.

PART 1-GENERAL

1.1 SUMMARY

EDIT EXAMPLES BELOW BY DELETING ITEMS NOT REQUIRED, ADDING OTHERS, OR REVISING TEXT TO CLARIFY DESCRIPTIONS.

A. Section includes shop and field formed copper roofing accessories and trim, such as:

1. Built-in gutters.
2. Hung gutters.
3. Downspouts (rain drainage).
4. Through-wall scuppers and conductor heads.
5. Miscellaneous accessories such as downspout strainers and gutter covers.

FOLLOWING ARE EXAMPLES OF SEVERAL POSSIBLE CROSS REFERENCES WHICH MAY BE NECESSARY TO CLARIFY WHAT WORK IS SPECIFIED WHERE.

B. Related Requirements:

1. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to work of this Section.
2. Roofing accessories installed integral with roofing membrane are specified in roofing system sections as roofing work.
3. Section 076110 - Copper Roofing.
4. Section 076210 - Copper Roofing Specialties: Roof accessory units of pre-manufactured, set-on type.
5. Section 079514 - Copper Expansion Joint Cover Assemblies: Building expansion joint covers.
6. Sealants are generally specified in Division 07 Section, "Joint Sealants."
7. Coordinate installation of built-in gutters with Plumbing drain lines specified in Division 22.

1.2 COORDINATION

- A. Coordinate work of this section with interfacing and adjacent work for proper sequencing. Ensure weather resistance and durability of work and protection of materials and finishes.

1.3 PERFORMANCE REQUIREMENTS

DESIGN PROFESSIONAL IS RESPONSIBLE FOR DESIGNING SYSTEM, INCLUDING ANCHORAGE, FASTENER SIZE, AND SPACING.

- A. Installation Requirements: Fabricator is responsible for installing system, including anchorage to substrate and necessary modifications to meet specified and drawn requirements and maintain visual design concepts in accordance with Contract Documents and following installation methods as stipulated in the "Copper in Architecture" handbook published by the Copper Development Association (CDA).
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. Obtain Architect's approval of modifications.
 4. Provide concealed fastening wherever possible.
 5. 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.
 6. Obtain Architect's approval for connections to building elements at locations other than indicated in Drawings.
 7. 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.

1.4 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.
- B. Product data for gutters, downspouts, and accessories: Manufacturer's technical product data, installation instructions and general recommendations for each specified sheet material and fabricated product.

DELETE BELOW IF NONE OF WORK SUFFICIENTLY COMPLEX TO JUSTIFY SHOP DRAWINGS; EDIT TO DELETE NONAPPLICABLE UNITS. POSSIBLY INSERT PRODUCT-HANDLING ARTICLE WHERE SUBSTANTIAL VOLUME OF HIGHLY FINISHED WORK IS REQUIRED.

- C. Shop drawings showing layout, profiles, expansion provisions, gutter slopes, methods of joining, and anchorage details, including downspout strainers, gutter covers, scuppers, and conductor head, and

attachments to built-in plumbing drain lines, scuppers, and conductor head systems. Provide layouts at ¼-inch (1:50) scale and details at 3-inch (1:4) scale.

RETAIN ABOVE AND INSERT SPECIFIC DATA SUBMITTALS AS DESIRED.

D. Samples of the following flashing, sheet metal, and accessory items:

1. 6-inch (150-mm) or 12-inch (300-mm) square samples of specified sheet materials to be exposed as finished surfaces.

DELETE ABOVE AND BELOW IF NO CONTROL REQUIRED ON SHEET MATERIALS. DELETE BELOW IF VISUAL CONTROL OF TRIM UNITS, GUTTERS, DOWNSPOUTS, EXPANSION JOINT UNITS, ETC. IS NOT DESIRED.

2. 6-inch (150-mm) or 12-inch (300-mm) long samples of fabricated products exposed as finished work. Provide complete with specified finish.

1.5 CLOSEOUT SUBMITTALS

- A. Provide maintenance data in Operations and Maintenance manual for maintaining applied coatings on copper panels.

POSSIBLY INSERT QUALITY ASSURANCE ARTICLE HERE FOR LIMITATIONS ON FABRICATORS OR INSTALLERS OF COMPLEX SYSTEMS OF FLASHING, RAIN DRAINAGE, EXPANSION JOINTS, ETC.

1.6 QUALITY ASSURANCE

- A. Fabricator's Qualifications: Company specializing in copper gutter and downspout 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 gutter and downspout work 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 (CDA). Conform to dimensions and profiles shown.

DELETE ENTIRE MOCK-UP PROVISION BELOW UNLESS THE EXPENDITURE IS JUSTIFIED BY AN EXTENSIVE, UNUSUAL, OR CRUCIAL APPLICATION OF METAL ROOFING.

- D. Mock-Up: Before proceeding with final purchase of materials and fabrication of copper gutter and downspout work components, prepare a mock-up of work. Incorporate materials and methods of fabrication and installation identical with project requirements. Install mock-up at location directed by Architect. Retain accepted mock-up as quality standard for acceptance of completed copper work. If accepted, mock-up may be incorporated as part of copper work.
1. Mock-up area is indicated on Drawings.

DELETE EITHER ABOVE OR BELOW.

2. Provide mock-up of sufficient size and scope to show typical pattern of seams, fastening details, edge construction, and finish texture and color.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Packing, Shipping, Handling, and Unloading: Protect finish metal faces.
- B. Acceptance at Site: Examine each component and accessory as delivered and confirm that material and finish is undamaged. Do not accept or install damaged materials.
- C. Storage and Protection:
 - 1. Stack pre-formed material to prevent twisting, bending, and abrasions.
 - 2. Provide ventilation.
 - 3. Prevent contact with materials which may cause discoloration or staining.

1.8 WARRANTY

- A. Warrant installed gutters, downspouts, and trim components to be free from defects in material and workmanship for period of 2 years.
- B. Include coverage against leakage and damages to finishes.

PART 2-PRODUCTS

2.1 GUTTER AND DOWNSPOUT MATERIALS

- A. Copper: ASTM B 370; minimum temper H00 (cold-rolled) except where temper 060 is required for forming;
 - 1. Hung Gutters and Downspouts: 16 oz. per sq. ft. (0.0216-inch thick) (0.55-mm) except as otherwise indicated.
 - 2. Built-in Gutters: 20 oz. per sq. ft. (0.0270-inch thick) (0.69-mm) unless otherwise required by guidance indicated in the Copper Development Association (CDA) "Copper in Architecture Handbook" and other recognized industry practices.
- B. Gutter Cover Guards: 20-gage bronze mesh or fabricated units, with selvaged edges and noncorrosive fasteners. Select materials for compatibility with gutters and downspouts.
- C. Bronze wire ball downspout strainer meeting the Copper Development Association Inc details.

2.2 ACCESSORIES

- A. Solder: ASTM B 32; Provide 50-50 tin/lead or lead free alternative of similar or greater strength solder. Killed acid flux.
- B. Flux: Muriatic acid neutralized with zinc or approved brand of soldering flux.
- C. Fasteners: Same metal as flashing/sheet metal or other non-corrosive metal as recommended by sheet manufacturer. Match finish of exposed heads with material being fastened.

- D. Bituminous Coating: SSPC-Paint 12, Cold-Applied Asphalt Mastic (Extra Thick Film), nominally free of sulfur, compounded for 15-mil dry film thickness per coat.
- E. Joint Sealant: One-part, copper compatible elastomeric polyurethane, polysulfide, butyl or silicone rubber sealant as tested by sealant manufacturer for copper substrates. Refer to Division 07.
- F. Metal Accessories: Provide cleats, straps, hangers, anchoring devices, and similar accessory units as required for installation of work, noncorrosive, size and gage required for performance.
- G. Rivets:
 - 1. Pop Rivets: 1/8-inch (3-mm) to 3/16-inch (4.5-mm) diameter, with solid brass mandrels.
 - 2. Provide solid copper rivet (tinners' rivets) where structural integrity of seam is required.

2.3 FABRICATION

- A. General Metal Fabrication: Shop-fabricate work to greatest extent possible. Comply with details shown and with applicable requirements of Copper Development Association Inc. (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 substrates. Comply with material manufacturer 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, Spacers, Straps, and Hanger Brackets: Fabricate of same material as gutters and downspouts, interlockable with sheet in accordance with CDA recommendations.
 - 4. Fabricate corners from one piece with minimum 18-inch (450-mm) long returns; solder corners for rigidity.
- B. Seams: Fabricate nonmoving seams with 1-inch (25-mm) lapped riveted and soldered seams. Tin edges to be seamed, lap seams, rivet seams, and solder.
- C. Expansion Provisions: Follow CDA Copper in Architecture Handbook guidance and provisions to accommodate expansion and contraction of gutter systems.

INSERT SPECIFIC LISTING (BELOW) OF SEPARATIONS KNOWN TO BE REQUIRED FOR WORK AS DETAILED. ATTEMPT SHOULD BE MADE IN DETAILING TO AVOID THIS NEED.

- D. Separations: Provide for separation of metal from noncompatible metal or corrosive substrates by coating concealed surfaces at locations of contact, with bituminous coating or other permanent separation as recommended by manufacturer/fabricator.
- E. Solder:
 - 1. Solder metal joints except those indicated or required to be movement type joints in accordance with the "Copper in Architecture" handbook published by the Copper Development Association Inc. (CDA).
 - 2. Tin edges of copper sheets and cleats at soldered joints.

3. After soldering, remove flux. Wipe and wash solder joints clean with fresh water and baking soda to neutralize flux.

F. Copper Thickness: Comply with CDA recommendations for copper size and shape.

G. Gutters and Downspouts:

1. Fabricate as indicated on Drawings and in accordance with the "Copper in Architecture" handbook published by the Copper Development Association (CDA).
2. Fabricate front edge at least 1 inch (25-mm) lower than back edge.
3. Transverse Seams in Gutter Liners: lapped, riveted and soldered for watertight gutter condition.
4. Provide spacers, hanger brackets and straps, and fasteners as indicated and as recommended by CDA.
5. Fabricate gutters and downspouts to sizes and profiles shown on Drawings.

H. Through Wall Scupper: As indicated on Drawings and in accordance with the "Copper in Architecture" handbook published by the Copper Development Association (CDA). Fabricate scuppers of dimensions required with closure flange trim to exterior, 4 inches (100 mm) wide wall flanges to interior, and base extending 4 inches (100 mm) beyond cant or tapered strip into field of roof.

1. Fasten gravel guard angles to base of scupper.

I. Conductor Head: As indicated on Drawings and in accordance with CDA "Copper in Architecture" handbook. Coordinate with Section 076220 for connection to downspout.

2.4 FINISHES

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

REVIEW PAINT SELECTION WITH COATINGS MANUFACTURER, REFER TO DIVISION 09.

B. To retard natural weathering, apply a uniform coating of high grade paraffin oil, or a clear lacquer coat.

CLEAR COATINGS TO RETARD WEATHERING NOT RECOMMENDED DUE TO MAINTENANCE REQUIREMENTS.

C. Clear Lacquer Coating:

1. Clear, Organic Coating: Clear, air-drying, acrylic lacquer specially developed for coating copper alloy products, equivalent to Incralac by StanChem applied by air spray in 2 coats per manufacturer's directions, with interim drying, to total thickness of 1.0 mil.

PART 3-EXECUTION

3.1 EXAMINATION

- A. General: Examine conditions and proceed with work when substrates are ready.
- B. Confirm that substrate system is even, smooth, sound, clean, dry, and free from defects.

3.2 INSTALLATION

- A. General: Except as otherwise indicated, comply with manufacturer's installation instructions and recommendations and with the "Copper in Architecture" handbook published by the Copper Development Association (CDA). Anchor units of work securely in place by methods indicated, providing for thermal expansion of units; conceal 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 weatherproof.
 - 1. Install units plumb, level, square, and free from warp or twist while maintaining dimensional tolerances and alignment with surrounding construction; except install gutters with required slope.
 - 2. Apply asphalt mastic on copper surfaces of units in contact with cementitious materials and dissimilar metals.
 - 3. Fit gutters to downspouts and flashings for watertight connections. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.
 - 4. Miter, lap seam and close corner joints with solder. Seal seams and joints watertight with solder
 - 5. Install expansion joints at frequency recommended by the CDA "Copper in Architecture" handbook. Do not fasten moving seams such that movement is restricted.
 - 6. Coordinate with installation of roofing system and roof accessories.
- B. Gutters and Downspouts:
 - 1. Flash and seal gutter to downspout.
 - 2. Slope gutters not less than 1/8 inch per foot (1:100).
 - 3. Provide expansion joints at 48' -0" (14,400-mm) maximum, not more than 24 feet (7200 mm) from corners.
 - 4. Hang gutter with copper straps spaced 30-inches (750-mm) centers maximum. Closer spacing may be required to handle system loads.
 - 5. Integrate gutter flashing conditions with requirements of adjacent roofing for watertight installation.
- C. Install continuous gutter guards on gutters, arranged as hinged units to swing open for cleaning gutters. Install "beehive"-type strainer-guard at downspouts in open gutters; removable for cleaning downspouts.
- D. Install counterflashing as indicated to prevent water from migrating behind gutter system.
- E. Parapet Scuppers:
 - 1. Install scuppers where indicated through parapet.

2. Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.
 3. Anchor scupper closure trim flange to exterior wall and seal or solder to scupper.
 4. Loosely lock front edge of scupper with conductor head.
 5. Seal or solder exterior wall scupper flanges into back of conductor head.
- F. Conductor Heads: Flash and seal conductor head to scupper.

INSERT OTHER SPECIFIC INSTALLATION REQUIREMENTS FOR OTHER SYSTEMS AND SHEET METAL ACCESSORY ITEMS SPECIFIED AS WORK OF THIS SECTION.

3.3 CLEANING

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

3.4 PROTECTION

- A. Advise Contractor of required procedures for surveillance and protection of flashings and sheet metal work during construction to ensure that work will be without damage or deterioration other than natural weathering at time of Substantial Completion.

14.7. Copper Expansion Joint Cover Assemblies

SECTION 079514



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THIS SECTION USES THE TERM "ARCHITECT." CHANGE THIS TERM AS NECESSARY TO MATCH THE ACTUAL TERM USED TO IDENTIFY DESIGN PROFESSIONAL AS DEFINED IN THE GENERAL AND SUPPLEMENTARY CONDITIONS.

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

EDIT LIST BELOW TO SUIT PROJECT.

1. Copper roof expansion assemblies.
2. Seismic expansion assemblies.
3. Copper expansion joint assemblies in exterior walls.
4. Copper waterstops for exterior expansion joints.
5. Covers for floor expansion joints.
6. Copper gutters for under floor slab expansion assemblies.
7. Covers for wall and ceiling expansion joints.

B. Related Requirements: The following Sections contain requirements that relate to this Section.

LIST BELOW ONLY PRODUCTS, CONSTRUCTION, AND EQUIPMENT FOR THIS PROJECT THAT THE READER MIGHT EXPECT TO FIND IN THIS SECTION BUT ARE SPECIFIED ELSEWHERE. VERIFY THAT THE SECTION TITLES LISTED BELOW FOR THIS PROJECT'S SPECIFICATIONS ARE CORRECT.

1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
2. Expansion joints integrated into masonry assemblies: Coordinate with masonry work in sections of Division 04.
3. Division 06 Section "Rough Carpentry" for wood curbs for mounting roof expansion assemblies.
4. Division 07 Section for roofing system.
5. Section 074210 - Copper Wall Cladding.
6. Section 076110 - Copper Roofing.
7. Section 076210 - Copper Roofing Specialties: Roof accessory units of premanufactured, set-on type.

8. Section 076215 - Copper Flashing and Trim: Copper assemblies associated with roofing.
9. Section 076220 - Copper Gutters and Downspouts: Gutters and downspouts associated with roofing.

NEXT THREE PARAGRAPHS ARE FOR INTERIOR FINISH CONSTRUCTION. EDIT TO SUIT PROJECT.

10. Division 09 Section "Acoustical Ceilings" for ceiling assemblies.
11. Division 09 Section "Gypsum Board" for wall assemblies.
12. Division 09 Section "Plaster" for wall assemblies.
13. Copper Roofing Finishes: Refer to the Division 09 Section "Painting" for requirements for priming and finishing installed copper roofing.

DELETE PARAGRAPH ABOVE IF NO FIELD FINISHING REQUIRED.

1.2 COORDINATION

- A. Coordinate work of this section with interfacing and adjacent work for proper sequencing. Ensure weather resistance and durability of work and protection of materials and finishes.

1.3 PERFORMANCE REQUIREMENTS

A. General:

1. Provide roof [wall] expansion assemblies that, when installed, remain watertight within movement limitations specified.
2. Provide wall and roof expansion joints with exterior copper expansion joint moving cover and interior elastomeric moisture barrier membrane.

DESIGN PROFESSIONAL IS RESPONSIBLE FOR DESIGNING SYSTEM, INCLUDING ANCHORAGE, FASTENER SIZE, AND SPACING.

- B. Installation Requirements: Fabricator is responsible for installing system, including anchorage to substrate and necessary modifications to meet specified and drawn requirements and maintain visual design concepts in accordance with Contract Documents and following installation methods as stipulated in the "Copper in Architecture" handbook published by the Copper Development Association Inc. (CDA).

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. Obtain Architect's approval of modifications.
4. Provide concealed fastening wherever possible.
5. 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.
6. Obtain Architect's approval for connections to building elements at locations other than indicated in Drawings.

7. Accommodate building structure deflections in system connections to structure.

C. 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.

1.4 SCHEDULING

- A. Schedule delivery and installation of expansion joint assemblies to prevent damage and ensure timely integration with other units of Work.

1.5 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 01 Specifications Sections.
- B. Product data for each type of copper expansion assembly specified.
- C. Shop drawings showing fabrication and installation of copper expansion assemblies including plans, sections, details of components, anchorage details, intersections, transitions, and fittings and attachments to other units of Work

1.6 QUALITY ASSURANCE

DELETE THIS ARTICLE FOR MINOR APPLICATIONS.

- A. Installer Qualifications: Engage experienced Installer who has completed installation of copper expansion assemblies similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
- B. Fabricator's Qualifications: Company specializing in copper expansion joint and trim work with three years experience in similar size and type of installations.
- 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.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Packing, Shipping, Handling, and Unloading: Protect finish metal faces.
- B. Acceptance at Site: Examine each component and accessory as delivered and confirm that material and finish is undamaged. Do not accept or install damaged materials.
- C. Storage and Protection:

1. Stack pre-formed material to prevent twisting, bending, and abrasions.
2. Provide ventilation.
3. Prevent contact with materials which may cause discoloration or staining.

1.8 WARRANTY

- A. Special Warranty: Submit written warranty signed by expansion assemblies fabricator and Installer agreeing to repair or replace expansion assemblies that leak, deteriorate in excess of deterioration rates specified in manufacturer's published product literature, or otherwise fail to perform within specified warranty period.

REVISE WARRANTY TO PERIOD REQUIRED AND VERIFY AVAILABILITY.

- B. Warranty Period: 5 [] years after date of Substantial Completion.

PART 2-PRODUCTS

2.1 MANUFACTURERS

- A. Available products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

RETAIN ABOVE FOR NONPROPRIETARY OR BELOW FOR SEMIPROPRIETARY SPECIFICATION. REFER TO DIVISION-1 SECTION "MATERIALS AND EQUIPMENT."

- B. Products: Subject to compliance with requirements, provide one of the following:

1. Bellows Type, Metal-Flanged, Roof Expansion Joint Assemblies:
 - a. Roof Bellows, Balco Inc.
 - b. Expand-O-Flash, Johns Manville Corporation.

2.2 MATERIALS

- A. Copper: ASTM B3 70, temper H00 (cold-rolled) except where temper 060 is required for forming; minimum 16 oz. per sq. ft. (0.0216-inch thick) (0.55-mm thick) except as otherwise indicated.

2.3 ELASTIC SHEET, BELLOWS-TYPE ROOF EXPANSION ASSEMBLIES

DELETE TYPES OF UNITS AND MATERIALS NOT REQUIRED.

- A. General: Provide manufacturer's factory-fabricated units of sizes and types indicated, including prefabricated corner and joint-intersection units, splicing materials, adhesives, coatings, and other components as recommended by joint unit manufacturer for complete installation. Fabricate assemblies specifically for required applications (roof to roof, roof to wall, curb mounted).

- B. Metal-Flanged, Elastic Sheet, Bellows-Type Roof Expansion Assemblies: Provide assemblies consisting of exposed elastic sheet over foam bellows, securely anchored at both edges to 3- to 4-inch (75- to 100-mm) wide sheet metal nailing flanges, either flat or angle formed to fit curbs as required. Insulate bellows from below with adhesively applied, closed-cell, flexible rubber or plastic foam not less than 5/16 inch (8-mm) thick, and adhere to elastic sheet.

1. Metal Flanges: Copper, minimum 16 oz. (0.55-mm thick).

DELETE BELOW IF NOT REQUIRED.

2. Mortar Flanges: Where flanges will be embedded in concrete or mortar, provide manufacturer's standard perforated mortar flanges.
- C. Type: Copper flanged edges, 3-inch to 4-inch wide, formed to profiles as indicated to fit curbs and designed for nailing to curb substrate. Provide 16 oz. copper flanges.
- D. Looped Bellows Width: Sized by manufacturer for building joint size, exclusive of flanges.

INSERT CORRECT BUILDING EXPANSION JOINT WIDTH

- E. Building Expansion Joint Size: 2 [____] inches (50 [____] mm).

2.4 SEISMIC ROOF EXPANSION JOINT SYSTEM

- A. Seismic Seals: Two single-layered elastomeric profiles, one interior and one exterior, as classified under ASTM D2000, retained in a set of copper frames.

DELETE ARTICLE ABOVE OR BELOW OR BOTH ACCORDING TO PROJECT REQUIREMENTS.

2.5 INNER SEAL

- A. Moisture Barrier: Neoprene, EPDM, or chlorosulfonated polyethylene to capture and safely drain water infiltration under roof expansion assembly covers at locations indicated.

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 Inc. (CDA) and other recognized industry practices. Fabricate for waterproof and weather-resistant performance, with provisions for building movement expansion sufficient to permanently prevent leakage, damage, or deterioration of the work. Form work to fit substrates. Comply with material fabricator's instructions and recommendations for forming material. Form exposed copper work without 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. Edge Strips: Fabricate edge strips of same material as sheet, interlockable with sheet in accordance with CDA recommendations.

- B. Seams: Fabricate nonmoving seams with flat-lock seams. Tin edges and cleats to be seamed, 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, nonexpansion type joints are indicated or required for proper performance of work, form metal to provide for proper installation of elastomeric sealant, in compliance with CDA standards.

INSERT SPECIFIC LISTING (BELOW) OF SEPARATIONS KNOWN TO BE REQUIRED FOR WORK AS DETAILED. ATTEMPT SHOULD BE MADE IN DETAILING TO AVOID THIS NEED.

- E. Separations: Provide for separation of metal from noncompatible metal or corrosive substrates 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 copper joints except those indicated or required to be expansive type joints.
 - 2. Tin edges of copper sheets and cleats at soldered joints.
 - 3. After soldering, neutralize acid flux by washing with baking soda solution, and then flushing with clean water rinse. Wipe and wash solder joints clean.
- G. Copper Thickness: Comply with CDA recommendations for copper thickness.
- H. Copper Expansion Joint Covers: As indicated on Drawings and in accordance with CDA "Copper in Architecture" handbook.
- I. Masonry Expansion Joint Fillers: Coordinate with Division 04 section on masonry.

2.7 ACCESSORIES:

- A. Wood Nailers: Softwood lumber, pressure treated with water-borne preservatives for above-ground use, complying with AWPB LP-2; not less than 1-1/2-inch (38-mm) thick.
- B. Solder: ASTM B 32; Provide 50-50 tin/lead or lead free alternative of similar or greater strength solder. Killed acid flux.
- C. Flux: Muriatic acid neutralized with zinc or approved brand of soldering flux.
- D. Fasteners: Same metal as flashing/sheet metal or other non-corrosive metal as recommended by sheet manufacturer. Match finish of exposed heads with material being fastened.
- E. Bituminous Coating: SSPC-Paint 12, Cold-Applied Asphalt Mastic (Extra Thick Film), nominally free of sulfur, compounded for 15-mil dry film thickness per coat.
- F. Joint Sealant: One-part, copper compatible elastomeric polyurethane, polysulfide, butyl or silicone rubber sealant as tested by sealant manufacturer for copper substrates. Refer to Division 07.

- G. Sheet Copper Accessories: Provide sheet copper edge strips, cleats, straps, anchoring devices, and similar accessory units as required for installation of work, matching or compatible with material being installed, noncorrosive, size and gauge required for performance.
- H. Roofing Cement: ASTM D 2822, asphaltic.
- I. Rivets:
 - 1. Pop Rivets: 1/8-inch (3-mm) to 3/16-inch (4.5-mm) diameter, with solid brass mandrels.
 - 2. Provide solid copper rivet (tinner's rivets) where structural integrity of seam is required.

INSERT OTHER MATERIALS AS REQUIRED FOR PROJECT.

2.8 FINISHES

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

***** OR *****

REVIEW PAINT SELECTION WITH COATINGS MANUFACTURER, REFER TO DIVISION 09.

- B. To retard natural weathering, apply a uniform coating of high grade paraffin oil, or a clear lacquer coat.

CLEAR COATINGS TO RETARD WEATHERING NOT RECOMMENDED DUE TO MAINTENANCE REQUIREMENTS.

- C. Clear Lacquer Coating

- 1. Clear, Organic Coating: Clear, air-drying, acrylic lacquer specially developed for coating copper alloy products, equivalent to Incralac by StanChem applied by air spray in 2 coats per manufacturer's directions, with interim drying, to total thickness of 1.0 mil.

PART 3-EXECUTION

3.1 EXAMINATION

- A. General: Examine conditions and proceed with work when substrates are ready.
- B. Confirm that substrate system is even, smooth, sound, clean, dry, and free from defects.

3.2 INSTALLATION

- A. Comply with manufacturer's instructions for handling and installing copper expansion assemblies and materials, except where more stringent requirements are indicated.
- B. Coordinate installation of copper expansion assembly materials and associated work so that complete assemblies comply with assembly performance requirements.
- C. Extend roof expansion assemblies over curbs, parapets, cornices, gutters, valleys, fascia, and other elements in the construction profile, with factory-fabricated transitions to provide continuous, uninterrupted, waterproof roof expansion assemblies.

- D. Provide uniform profile throughout length of each installation; do not stretch elastic sheets.

DELETE BELOW IF ONLY WALL UNITS OR ADHESIVELY APPLIED UNITS ARE REQUIRED.

- E. Fasten anchorage flanges securely to curbs and cant strips as recommended by manufacturer but at a maximum spacing of 6 inches (150 mm) O.C.

DELETE OR REVERSE BELOW TO MATCH PROJECT REQUIREMENTS.

- F. Anchor expansion assemblies in the manner indicated, complying with manufacturer's instructions.
- G. Expansion Joints:
1. Anchor expansion joint units in manner indicated, complying with manufacturer's and CDA instructions. Provide counterflashing with not less than 4-inch (100-mm) overlap over roof membranes.
 2. Splice sections in accordance with manufacturer ' s instructions producing a watertight installation.
 3. Utilize shop fabricated intersections and transitions wherever possible. Field fabricate where shop fabricated sections are not possible.
 4. Maintain uniform profile.

DELETE FOLLOWING IF BELLOWS NOT USED.

5. Do not stretch or compress bellows.

3.3 CLEANING

- A. Remove protective film (if any) from exposed surfaces of copper promptly upon installation. Strip with care to avoid damage to finishes.
- B. Clean exposed copper surfaces, removing substances that might cause discoloration of metal.
- C. 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 clean water rinse. Use special care to neutralize and clean crevices.
- D. Clean exposed metal surfaces of substances that would interfere with normal oxidation and weathering.

3.4 PROTECTION

DELETE THIS ARTICLE FOR MINOR WORK.

- A. Provide final protection and maintain conditions in a manner acceptable to manufacturer and Installer that ensures that copper expansion assemblies are without damage or deterioration at the time of Substantial Completion.

15. STRUCTURAL TEST REPORTS

- [15.1. Standing Seam Roof Panel Test](#)
- [15.2. Batten Seam Roof Panel Test](#)
- [15.3. Uplift Resistance of Roof Assemblies
Test-Standing Seam](#)
- [15.4. Uplift Resistance of Roof Assemblies
Test-Flat Locked Seam](#)

15.1. Standing Seam Roof Panel Test

Report Number: C.C.L. Performance Test Report #90-1056

Report Date: 1 February 1991 Revised: 7 March 1991

Introduction

A Mock-Up Test Specimen consisted of a 16 oz. copper, cold rolled temper, 1" high standing seam roof section, sloped to a 4" in 12" pitch. The specimen was tested in accordance with SMACNA Roof Panel Test clarifications at the direction of SMACNA. The following text is an abbreviated description of the testing procedures, refer to original document for a complete report.

Specimen Description

Substrate	15/32" CDX Plywood
Cleats	5" in length, double nailed, 12" o.c.
Nails	1 1/4" Ring Shank, two per cleat.
Seams	20 3/4" o.c. in Center Pans, 15 1/4" in End Pans

Test Date: 14 January 1991

Preload - Prior to testing, the specimen was subjected to a positive static pressure differential of **26.0 p.s.f.**, 50% of the assumed design load. The load was maintained for 10 seconds then released. No visible deformation or damage to the specimen was observed after the load was released.

Air Infiltration Test Similar to ASTM E283-84 - The exterior face of the specimen was covered with an impervious visqueen material. Edges and corners were sealed to allow no air movement through the specimen. The exterior face of the specimen and chamber were subjected to a positive static pressure differential of **5.20 p.s.f.** The measured amount of air infiltration through the chamber was **92.0 c.f.m.** The impervious material was removed and the same test was performed and measured for gross air infiltration at the rate of **111.5 c.f.m.** The net amount of air infiltration through the specimen was the difference between the specimen with the impervious material (chamber only) and the specimen without it.

Net Air Infiltration: 19.5 c.f.m.

Air Exfiltration Test Similar E283-84 - The exterior face of the specimen was covered with an impervious visqueen material. Edges and corners were sealed to allow no air movement through the specimen. The exterior face and chamber were subjected to a negative static pressure differential of **5.20 p.s.f.** The measured amount of air exfiltration through the chamber was **141.0 c.f.m.** The impervious material was removed and the same test was performed and measured for gross air exfiltration at the rate of **144.5 c.f.m.** The net amount of air exfiltration through the specimen was the difference between specimen with impervious material (chamber only) and specimen without it.

Net Air Exfiltration: 3.5 c.f.m.

Static Water Penetration Test Similar to ASTM E331.86 - Water was applied with complete and continuous coverage to the exterior face panel of the test specimen, at a minimum rate of five gallons per hour, per square foot. Simultaneously, a negative static pressure differential of **10.4 p.s.f.** from below the roof was applied against the face. The combined application of water and pressure was maintained for a period of 15 minutes.

RESULTS: Specimen passed the test. No uncontrolled water penetration was observed during or at the conclusion of the test.

Dynamic Water Penetration Test Similar to AAMA 501.1-83 - Water was applied with complete and continuous coverage to the exterior face panel of the test specimen, at a minimum rate of five gallons per hour, per square foot. Simultaneously, the panel was subjected to an 80-85 m.p.h. slipstream airflow generated by a device situated approximately 20 feet away from the front eave on the specimen. The combined application of water and wind was maintained for a period of 15 minutes.

RESULTS: Specimen passed the test. No water penetration was observed during or at the conclusion of test.

Uniform Structural Deflection Test - A specially designed "lift-off-chamber" was installed over the test specimen. All structural test loads were applied from the exterior face of the panel. Dial indicator gauges were installed to measure deflection and residual deformation at ends and midspan of the panel. The tests were performed for both negative and positive static pressure of **26.0 p.s.f.**, equal to 50% of assumed design load. The load was held for 10 seconds then released. The same test was performed for negative and positive static pressure of **40 p.s.f.**, **60 p.s.f.**, and **90 p.s.f.** Dial indicators were set to zero before each new load was applied.

RESULTS: Specimen passed the test. No deformation or damage was observed.

The Uniform Structural Test to Failure - This test was performed but not as a requirement to previous testing. The test specimen was subjected to an increasing negative load until maximum capabilities of the blower system were reached or failure of the specimen occurred. At a negative static pressure of **190.0 p.s.f.**, excessive deflection was observed at the panel midspan. Isolated areas of the standing seams had folded over after the panel exceeded "limitations of cavity" between the specimen and the chamber support steel.

RESULTS: No other deformation, damage, fastener pullout or disengagement of specimen was observed.

15.2. Batten Seam Roof Panel Test

Report Number: C.C.L. Performance Test Report #91-9218

Report Date: 26 September 1991

Introduction

A Mock-Up Test Specimen consisted of a 16 oz. copper, cold rolled temper, 1 ½" high batten seam roof section, sloped to a 4" in 12" pitch. The specimen was tested in accordance with SMACNA Roof Panel Test clarifications at the direction of SMACNA. The following text is an abbreviated description of the testing procedures, refer to original document for a complete report.

Specimen Description

Substrate	15/32" CDX Plywood
Wood Battens	1 ½" x 1 ½" at 20"o.c.
Fasteners	2 ½" x .120" Copper Ring Shank, Nails, 12" o.c. for Edge Battens, 8" o.c. for Field Battens.

Test Date: 28 August 1991

Preload - Prior to testing, the specimen was subjected to a positive static pressure differential of **26.0 p.s.f.**, 50% of the assumed design load. The load was maintained for 10 seconds then released. No visible deformation or damage was observed in the specimen after the load was released.

Test Date: 23 September 1991

Air Infiltration Test Similar to ASTM E283-84 - The exterior face of the specimen was covered with an impervious visqueen material and sealed at the edges and corners. The complete perimeter joint (specimen to chamber) was taped over to eliminate this joint from the test specimen. A positive static pressure differential of **5.20 p.s.f.** was applied to the face of the specimen and chamber. The measured amount of air infiltration through the chamber was **52.0 c.f.m.** The impervious material was removed and the same test was performed and measured for gross air infiltration at the rate of **66.5 c.f.m.** The net amount of air infiltration through the specimen was the difference between the specimen with the impervious material (chamber only) and the specimen without it.

Net Air Infiltration: 14.5 c.f.m.

Air Exfiltration Test Similar E283-84 - The exterior face of the specimen was covered with an impervious visqueen material and sealed at the edges and corners. The complete perimeter joint (specimen and chamber) was taped over to eliminate this joint from the test specimen. A negative static pressure differential of **5.20 p.s.f.** was applied to the face of the specimen. Upon achieving a negative pressure of **5.0 p.s.f.** the tape covering the perimeter joint lost adhesion.

Net Air Exfiltration: No results.

Static Water Penetration Test Similar to ASTM E331-86 - Water was applied with complete and continuous coverage to the exterior face panel of the test specimen, at a minimum rate of five gallons per hour, per square foot. Simultaneously, a negative static pressure differential of **10.4 p.s.f.** (from below the roof) was applied against the face. The combined application of water and pressure was maintained for a period of 15 minutes.

RESULTS: Specimen passed the test. No "uncontrolled" water penetration was observed during or at the conclusion of test.

Dynamic Water Penetration Test Similar to AAMA 501.1-83 - Water was applied with complete and continuous coverage to the exterior face panel of the test specimen, at a minimum rate of five gallons per hour, per square foot. Simultaneously, the panel was subjected to an 80-85 m.p.h. slipstream airflow generated by a device situated approximately 20 feet away from the eave in front of the specimen. The combined application of water and wind was maintained for a period of 15 minutes.

RESULTS: Specimen passed the test. No water penetration was observed during or at the conclusion of test.

Uniform Structural Deflection Test - Dial indicator gauges were installed to measure deflection and residual deformation of the metal roof panel. The test was performed for both negative and positive static pressure of **26.0 p.s.f.**, equal to 50% of assumed design load. The load was held for ten seconds then released. The same test was performed for both conditions with a static pressure of **40 p.s.f.**, **60 p.s.f.**, and **90 p.s.f.** Additional tests were performed in the positive mode for **90p.s.f.**, **125.0 p.s.f.**, and **150.0 p.s.f.** Dial indicators were set to zero before each new load was applied.

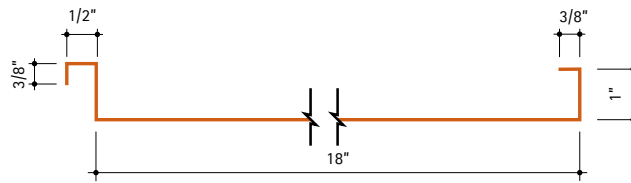
RESULTS: Specimen passed the test. No deformation or damage was observed.

15.3. Uplift Resistance of Roof Assemblies Test-Standing Seam

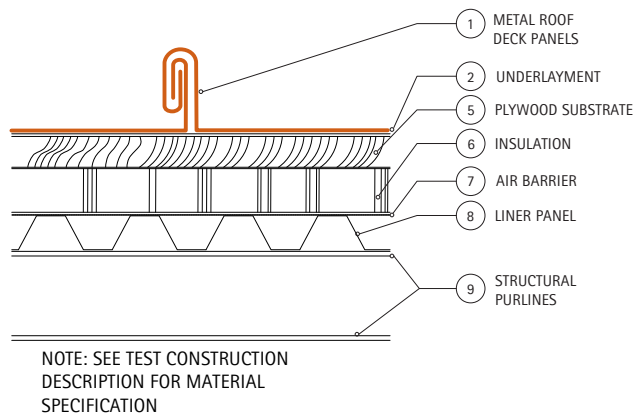
Standing Seam Copper Roof Construction

Refer to UL Construction No. 496

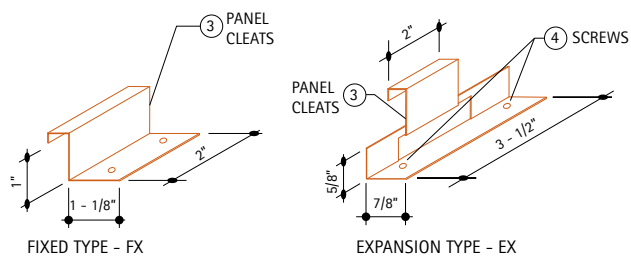
15.3A. Typical Panel Profile



15.3B. Test Panel Cross Section



15.3C. Cleats



UL Test Procedure 580 - UL 90 Rating

1. Metal Roof Deck Panels

Copper 16 oz. per sq. ft. .020 in. thickness min. 1" high standing seams brake formed to the dimensions indicated, spaced at 18" O.C. Copper 99.9% pure cold rolled temper per ASTM designation B-370. All brakes to have a minimum radius of 2 metal thicknesses.

2. Underlayment

4 to 6 lb. Rosin sized building paper fastened with copper roofing nails over 30 lb. Asphalt saturated felt fastened with copper roofing nails.

3. Roof Panels Fasteners (Panel Cleats)

Copper cleats fixed type (FX) 16 oz. per sq. ft., .020 in. thick min. cold rolled temper. Cleats 2" min. width spaced 16" O.C. along the panel seams. Copper cleats expansion type (EX), 16 oz. per sq. ft. min., .020 in thick cold rolled temper. Cleats fabricated of two components: a fixed and a sliding tab. Fixed tab to be 3 1/2" wide, 1 1/2" deep with a slot 2" wide, 3/16" high. Sliding tab to be 1 3/16" wide, 1" high with a 1/2" high retaining leg.

4. Cleat Fasteners (Screws)

Fasteners used to attach panel cleats to plywood substrate to be no. 10-12 x 3/4", #2 Phillips drive, flat head stainless steel wood screws, two per cleat.

5. Plywood Substrate

3/4" plywood type CDX, fire retardant treated, fastened to structural liner panel with no. 13-11 x #3 Phillips drive, truss-head stainless steel screws with an "S" point.

6. Insulation

Min. 1" rigid polyisocyanurate insulation boards.

7. Air Barrier

Min. 6 mil polyethleyne. installed between insulation and liner panel.

8. Liner Panel

1 1/2" deep 20 gauge min. intermediate ribbed steel deck. Minimum yield strength 33,000 psi. Liner fastened to supports with TEK-5 self tapping screws at every valley.

9. Structural Purlins

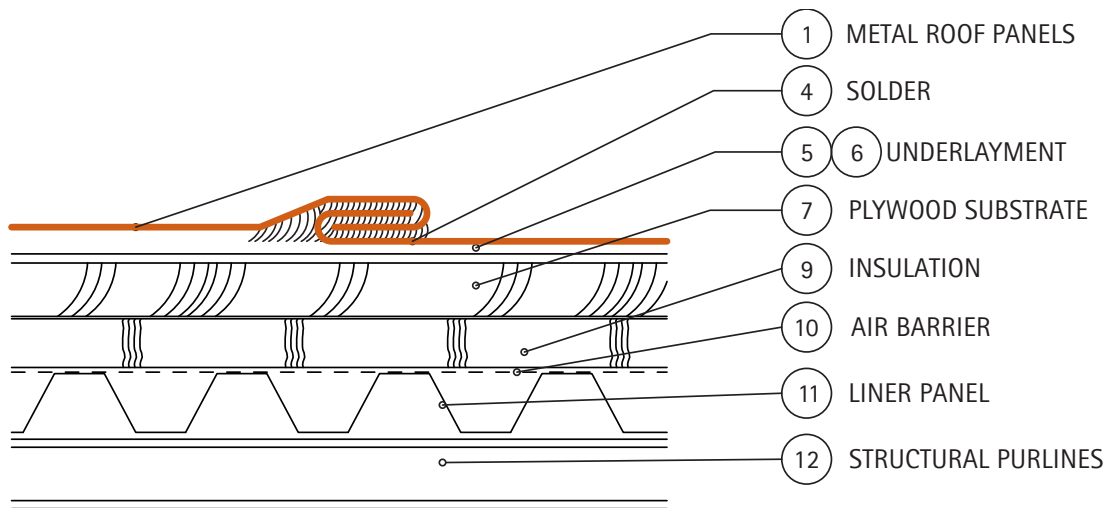
Minimum thickness 14 gauge steel, 50,000 psi min. yield strength. Spacing of purlins at 5'-0" O.C. maximum.

15.4. Uplift Resistance of Roof Assemblies Test-Flat Locked Seam

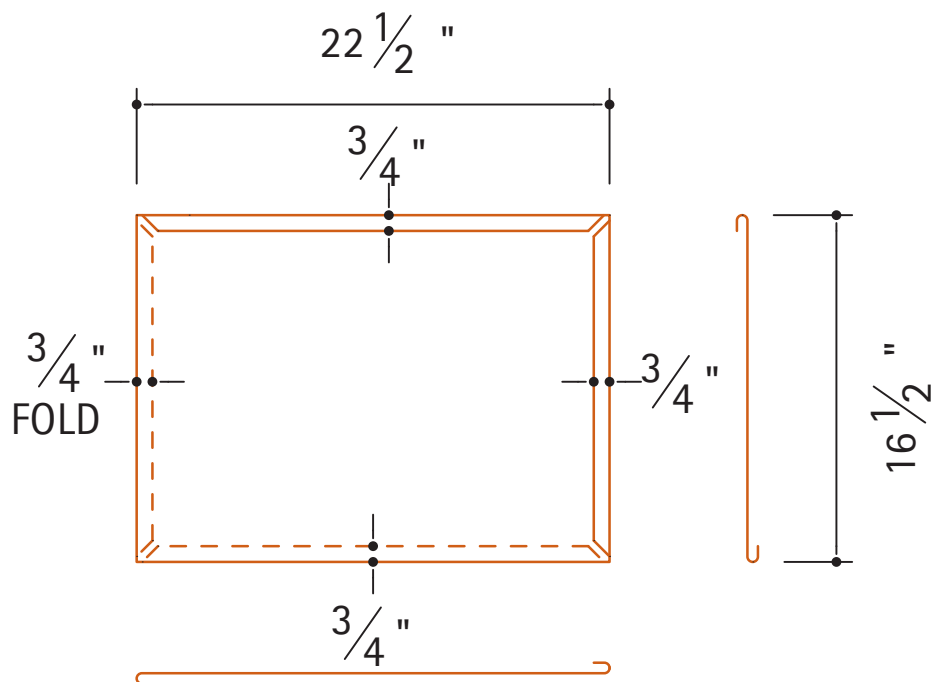
Flat Locked and Soldered Roof Construction

Refer to UL Construction No. 550

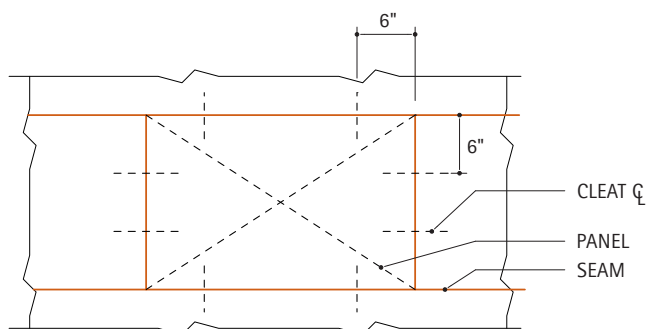
15.4A. Test Panel Cross Section



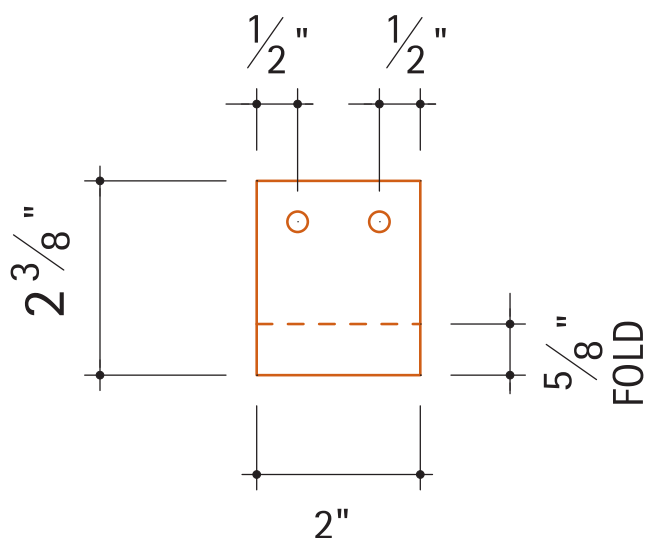
15.4B. Typical Roofing Panel



15.4C. Typical Cleat Location



15.4D. Typical Cleat



UL Test Procedure 580 - UL 90 Rating

1. Metal Roof Deck Panels

Copper panel, max. width 16 1/2", 22 1/2" long with 3/4" wide field formed folds. Fabricated from 16 oz., 0.021" thick, 99.9% pure cold rolled copper per ASTM B370. Corners cut off at a 45-degree angle. All sides of panels to be pre-tinned with 50/50 tin/lead solder. All seams to be hammered down with rubber mallet. Seams to be completely soldered, including panel cleats (Item 2).

2. Roof Panels Cleats

One-piece assembly, fabricated from 16 oz, 0.0215" thick, 99.9% pure, cold rolled copper per ASTM B370. Width 2", length 3" with two 1/8" diameter guide holes for screws. Cleats to be folded into panel folds. Two cleats to be used at each panel side located along panel seams, 6" from edge.

3. Cleat Fasteners (Screws)

For attaching panel cleats (Item 2) to plywood (Item 7) to be no. 10-12 by $\frac{3}{4}$ " long, #2 Phillips drive, flat head, stainless steel wood screws, two per cleat.

4. Solder

50/50tin/lead bar stock, $\frac{7}{32}$ " x $\frac{7}{32}$ ".

5. Red Rosin Paper

Rosin paper 36" wide, 4lb. minimum. Side laps 3" wide, fastened with copper nails, random spacing.

6. Underlayment

One ply of Type 30 asphalt saturated felt. Side laps 4", fastened with copper nails, random spacing.

7. Plywood

APA rated sheathing, exposure 1, nominal $\frac{3}{4}$ " thick (actual $\frac{23}{32}$ "), square edged.

8. Fasteners (Screws)

Fasteners used to attach plywood (Item 7) to steel deck liner panel (Item 11) to be no. 13-11, #3 Phillips drive truss head, coated steel screws with an "S" point.

9. Insulation

Polyisocyanurate, loose laid, 1" min. thickness, 2 $\frac{1}{2}$ " max. thickness with a glass fiber face bonded to each side. Butt joints staggered.

10. Air Barrier

Polychethylene sheeting loose laid 6 mil. Min. thickness installed between liner panel (Item 11) and insulation (Item 9).

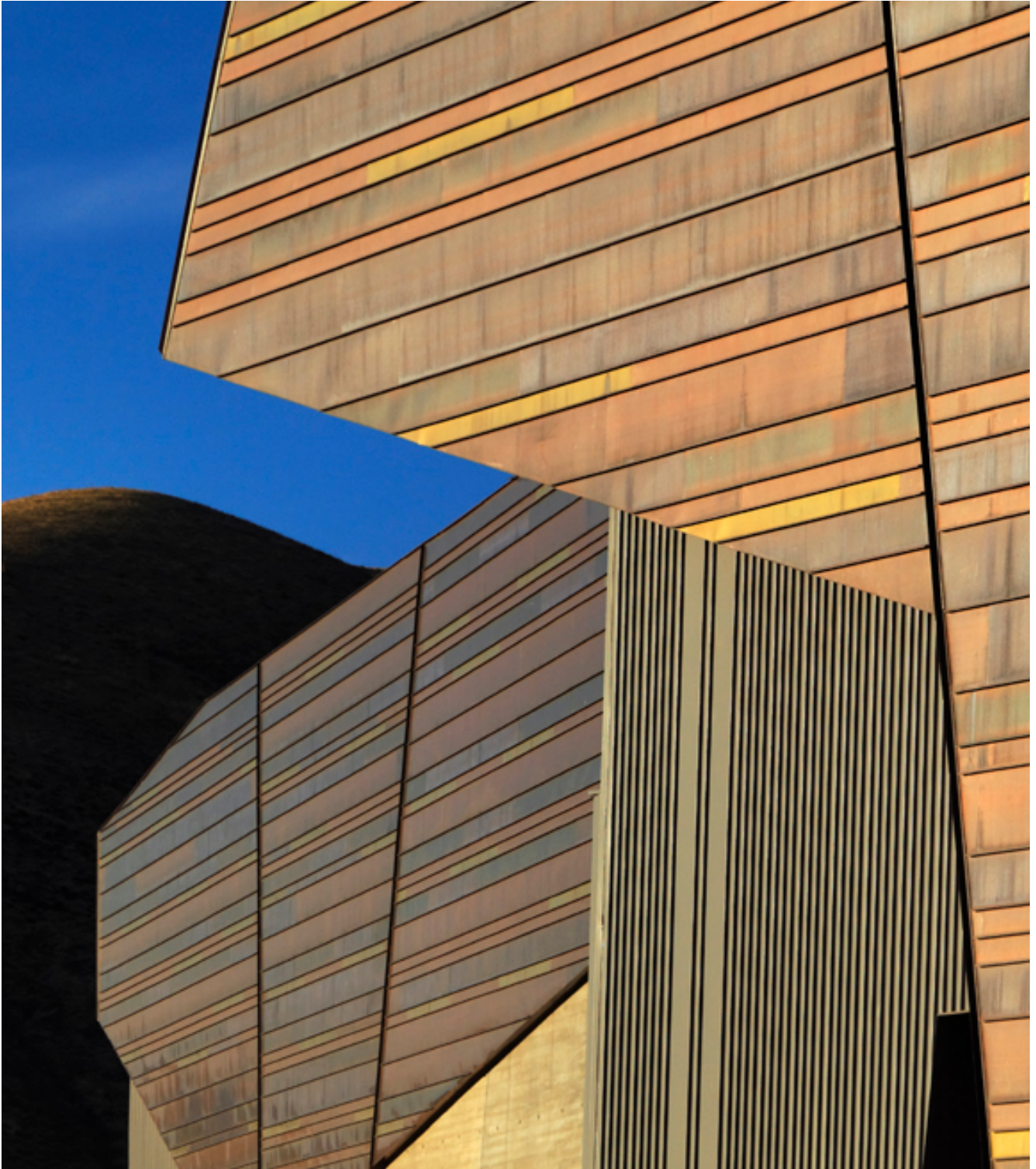
11. Liner Panels

Min. no. 22 MSG steel deck, 1 $\frac{1}{2}$ " min. depth, 36" wide, with overlapping side joints (33,000 psi min. yield strength). Liner fastened to purlins (Item 12) with no. 12-24 x 1" long, self-drilling, self-tapping, hex-washer head, plated steel screws at each valley.

12. Purlins

No. 16 MSG min. steel, (50,000 psi min yield strength), spaced 5'-1" O.C. maximum

GLOSSARY, INDEX AND REFERENCES



Natural History Museum of Utah, Photo Credit: ©Jeff Goldberg/Esto

16. GLOSSARY

Aggregate: (1) Crushed stone, crushed slag, or water-worn gravel used for surfacing a built-up roof; (2) Any granular mineral material.

Apron Flashing: Copper flashing that covers the intersection at a sloping roof with a vertical wall, such as the lower side of a chimney.

Area Divider: A raised, double wood member attached to a properly flashed wood base plate that is anchored to the roof deck. It is used to relieve the stresses of thermal expansion and contraction in a roof system where no expansion joints have been provided.

Asphalt: A dark brown to black cementitious material in which the predominating constituents are bitumens, which occur in nature or are obtained in petroleum processing.

Base Flashing: The flashing at the joint between a roofing surface and a vertical surface.

Base Ply: The first ply of roofing material in a roof membrane assembly.

Base Sheet: A saturated or coated felt placed as the first ply in built-up roof membranes.

Bitumen: The generic term for an amorphous, semi-solid mixture of complex hydrocarbons derived from coal-tar pitch or asphalt.

Bituminous Coating: A paint with a bitumen base, used in copper construction primarily to prevent direct contact of dissimilar metals.

Blind Nailing: Nailing in such a way that the nail heads are not visible on the finished work.

Blind Rivet: Riveting in such a way that the rivets are not visible on the finished work.

Brass: A copper alloy having zinc as its principal alloying element. For exact definition, see [UNS Standard Designations](#).

Bronze: Traditionally, a copper alloy having tin as its principal alloying element. For exact definition, see [UNS Standard Designations](#).

Building Paper: A heavy durable paper such as rosin sized paper, used in construction typically to improve thermal insulation and weather protection, and to act as a vapor barrier. In copper applications it is often used between the copper and underlayment to prevent bonding that could restrict copper movement. Same as Roofing Paper.

Built-Up Roof Membrane: A continuous, semi-flexible roof membrane assembly, consisting of piles of saturated felts, coated felts, fabrics or mats between which alternate layers of bitumen are applied, generally surfaced with mineral aggregate, bituminous materials, or a granule surfaced roofing sheet.

B.U.R.: Built-up roofing.

Cant Strip: (1) A bevelled strip of wood or other material that fits into the angle formed by the intersection of a horizontal surface and a vertical surface. The 45° slope of the exposed surface of the cant strip provides a gradual angular transition from the horizontal surface to the vertical surface to prevent the cracking of roofing applied over it. (2) A wood board or a formed copper strip which is laid so as to cant the first row of shingles on a roof.

Cap Flashing: Same as Counterflashing.

Caulking: A resilient mastic compound often having a silicone or rubber base, used to fill cracks and joints, that remains plastic for an extended period of time.

Cleat: A small strip of copper, usually 16 ounce material, used to fasten sheet copper components, such as roofing or flashing to the supporting understructure. Expansion cleats allow the components to move to account for thermal variations, fixed cleats do not.

C.M.U.: Concrete masonry unit or concrete block.

Collar Joint: The vertical joint between masonry wythes.

Composition Flashing: Base flashing that is constructed by extending the plies of a built-up roof.

Condensation: The conversion of water vapor or other gas to liquid as the temperature drops or the atmospheric pressure rises.

CONT.: Continuous.

Coping: The covering piece placed on top of a wall that is exposed to the weather. It is usually sloped to shed water.

Copper Cold Rolled: A strong yet still fairly malleable type of copper that is very well suited to building construction. It has a yield strength of 26,000-28,000 psi.

Copper Soft Temper: A type of extremely malleable copper used only for intricate ornamental applications. It is not recommended for general use in construction.

Counterflashing: Formed sheet copper secured on or into a wall, curb, pipe, rooftop unit or other surface to cover and protect the upper edge of a base flashing and its associated fasteners.

Course: (1) The term used for each application of material that forms the waterproofing system or the flashing; (2) a layer of masonry units running horizontally in a wall bonded with mortar.

Cricket: A small saddle-shaped projection on a sloped roof used to divert water around an obstacle such as a chimney.

Dampproofing: Treatment of a surface or structure to resist the passage of water in the absence of hydrostatic pressure.

Deck: The structural surface to which the roofing or waterproofing system is applied

Delamination: Separation of the plies in a roof membrane system or separation of laminated layers of insulation.

Dew Point: The temperature at which water vapor starts to condense in cooling air at the existing atmospheric pressure and vapor content.

Edge Sheets: Felt strips that are cut to widths narrower than the standard width of the full felt roll. They are used to start the felt-shingling pattern at a roof edge.

Edge Strip: A long narrow copper flashing used to protect the edge of a roof or other surface.

Erosion Corrosion: Where concentrated amounts of water hit a copper roof causing erosion of copper material.

Expansion Joint: A structural separation between two building elements designed to minimize the effect of the stresses and movements of a building's components and to prevent these stresses from splitting or ridging the roof membrane.

Exposure: The transverse dimension of a roofing element not overlapped by an adjacent element in any roof system.

Factory Square: 108 square feet (10 square meters) of roofing material. See **Square**.

Felt: A fabric manufactured from vegetable fibers (organic felts), or glass fibers (glass fiber felts). The manufacturing process involves mechanically interlocking the fibers of the particular felt material in the presence of moisture and heat.

Flashing: Sheet copper material placed in construction, such as in mortar joints, to prevent water penetration and/or to divert water which has already penetrated.

Full Collar Joint: A vertical joint between masonry wythes that has been grouted solid.

Gauge: The thickness of copper material. Can be designated by a number, or more commonly for copper, by the weight of material per square foot, in ounces.

Girth: The width of sheet copper material (in the flat) used to form a gutter.

Gravel: Coarse, granular aggregate, containing pieces approximately 5/8 inch to 1/2 inch in size and suitable for use in aggregate surfacing on built-up roofs.

Gravel Stop: A flanged copper device, designed to provide a continuous finished edge for roofing materials and to prevent loose aggregate from washing off the roof.

Headlap: The minimum distance, measured at 90 degrees to the eaves along the face of a shingle or felt, from the upper edge of a shingle or felt to the nearest exposed surface.

Hemmed Edge: The edge of sheet copper which has been folded under completely. All exposed sheet copper edges should have 1/2" nominal hem.

"High Yield" Copper: A specially developed sheet copper defined in ASTM B370 as cold rolled high yield temper copper. It's yield strength is 31,000-33,000 psi.

Hold Down: A method of fastening sheet copper that involves the use of a brass screw with a large copper or brass washer. The screw is tightened sufficiently to keep the metal flat, but not restrict its lateral movement. The entire assembly is usually covered with a copper cap, fully soldered to provide watertightness.

Line Corrosion: The linear degradation and pitting of copper placed under a drip edge. This is often the result of acidic moisture deposited on an inert (non-copper) which directs water to a valley or gutter. Under severe conditions, this concentration of acidic moisture can corrode copper flashing and gutters before they can form a copper sulfate patina. Protection from line corrosion is achieved by raising the shingle edges slightly by means of a cant, in order to break capillarity, or by providing a replaceable reinforcing strip between the shingle line and the copper valley flashing.

Max.: Maximum.

Membrane: A flexible or semi-flexible roof covering or waterproofing layer, whose primary function is the exclusion of water.

Min.: Minimum.

Muntz Metal: A copper-zinc metal having 60% copper and 40% zinc.

Nailer: A wood strip, attached to a surface, used as a base for nailing or attaching other material.

O.C.: On center.

Patina: The naturally protective coating that results from the mild corrosive attack of airborne sulfur compounds. The sulfate patina significantly increases the durability and service life of copper roofing and flashing.

Pea Gravel: Small diameter (1/4 to 3/8 inch) natural gravel, used in conjunction with through-wall flashing to help prevent debris from blocking the flow of moisture.

Pein: The end of a hammer opposite the flat hammering face. It may be cone-shaped, rounded, or sharply pointed; it is used to create a textured finish on copper and other materials.

Pitch: The tangent of the angle between the roof surface and the horizontal. It is measured in inches per foot. For copper construction pitch is ranked as follows:

Low Pitch: 3 to 6 inches per foot.

Steep Pitch: 6 inches and higher per foot.

Ply: A layer of felt in a built-up roof membrane system. A four-ply membrane system has four plies of felt.

Rake: The sloped edge of a roof at first or last rafter.

Raked Joint: A mortar joint which, during construction or at a later date, has been tooled to provide a deep recess. This recess is used as a reglet into which copper cap or counterflashing may be inserted.

Raggle: Same as Reglet.

Receiver: A copper flashing, built into a wall, that locks into the upper edge of base or counterflashing.

Reglet: A groove in a wall or other surface adjoining a roof surface for use in the attachment of counterflashing. Same as **Raggle**.

Ridging: An upward, "tenting" displacement of a roof membrane, frequently occurring over insulation joints, deck joints and base sheet edges.

Roofing Paper: Same as **Building Paper**.

Roof System: A system of interacting roof components (NOT including the roof deck), designed to weather-proof and, normally, to insulate a building's top surface.

Rosin Sized Paper: A heavy building paper impregnated with rosin.

Saturated Felt: A felt that has been partially saturated with low softening point bitumen.

Scupper: An opening in a wall or parapet that allows water to drain from a roof.

Sealant: A mixture of polymers, fillers, and pigments used to fill and seal joints. Used to prevent the penetration of water or air.

Seamer: Mechanical seamers are available for both standing seam and batten seam roof systems. They create precise, uniform seams without the hammer marks typical of manual seaming techniques.

Shingle: (1) A small unit of prepared roofing material designed to be installed with similar units in overlapping rows on inclines normally exceeding 25%; (2) to cover with shingles; (3) to apply any sheet material in overlapping rows like shingles.

Slip Sheet: A lightweight rosin sized paper inserted between sheet copper and underlayment to prevent bonding. See **Building Paper**.

Slope: See **Pitch**.

Square: The term used to describe 100 square feet of roof area. See **Factory Square**.

Sq. Ft.: Square feet.

Stack Vent: The extension (to the open air) of a soil or waste stack through the roof membrane.

Step Flashing: Discontinuous flashing in masonry walls which follows the elevation of a sloped roof, and is therefore inserted into successive courses, forming steps.

Substrate: The surface upon which the roofing or waterproofing membrane is applied (i.e., the structural deck or insulation).

Tapered Edge Strip: A tapered strip used to (1) elevate the roof at the perimeter and at curbs that extend through the roof; or (2) provide a gradual transition from one layer of insulation to another.

Through-Wall: A water-resistant membrane of sheet copper which extends through a wall and its cavities, positioned to divert moisture to the exterior.

TYP.: Typical.

Underlayment: A material, such as saturated No. 15 felt, placed on the roof deck to improve weather resistance.

U.O.N.: Unless otherwise noted.

Waterproofing: Treatment of a surface or structure to prevent the passage of water under hydrostatic pressure.

Weep: A small opening in a wall, through which accumulated moisture may drain to the exterior.

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