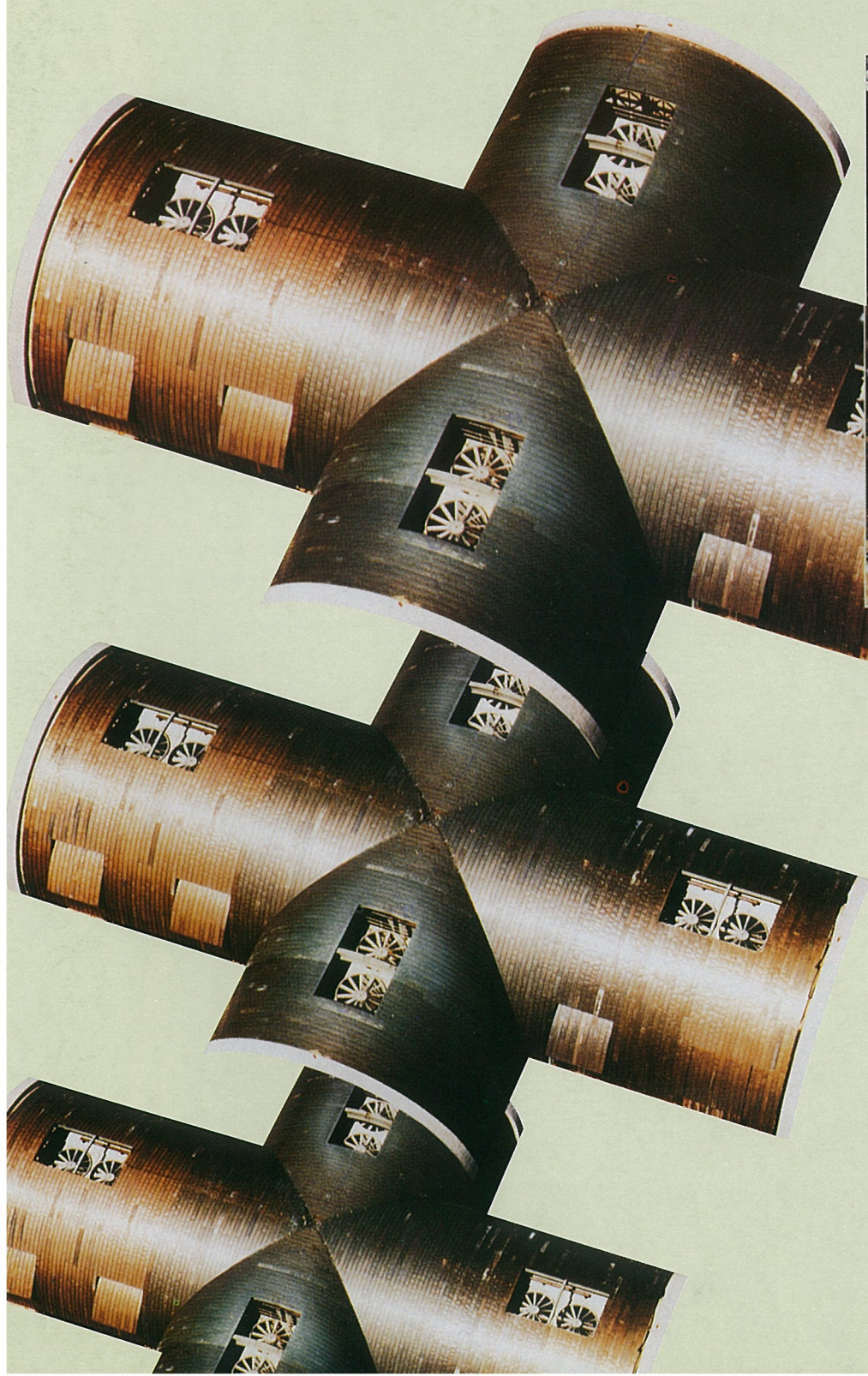


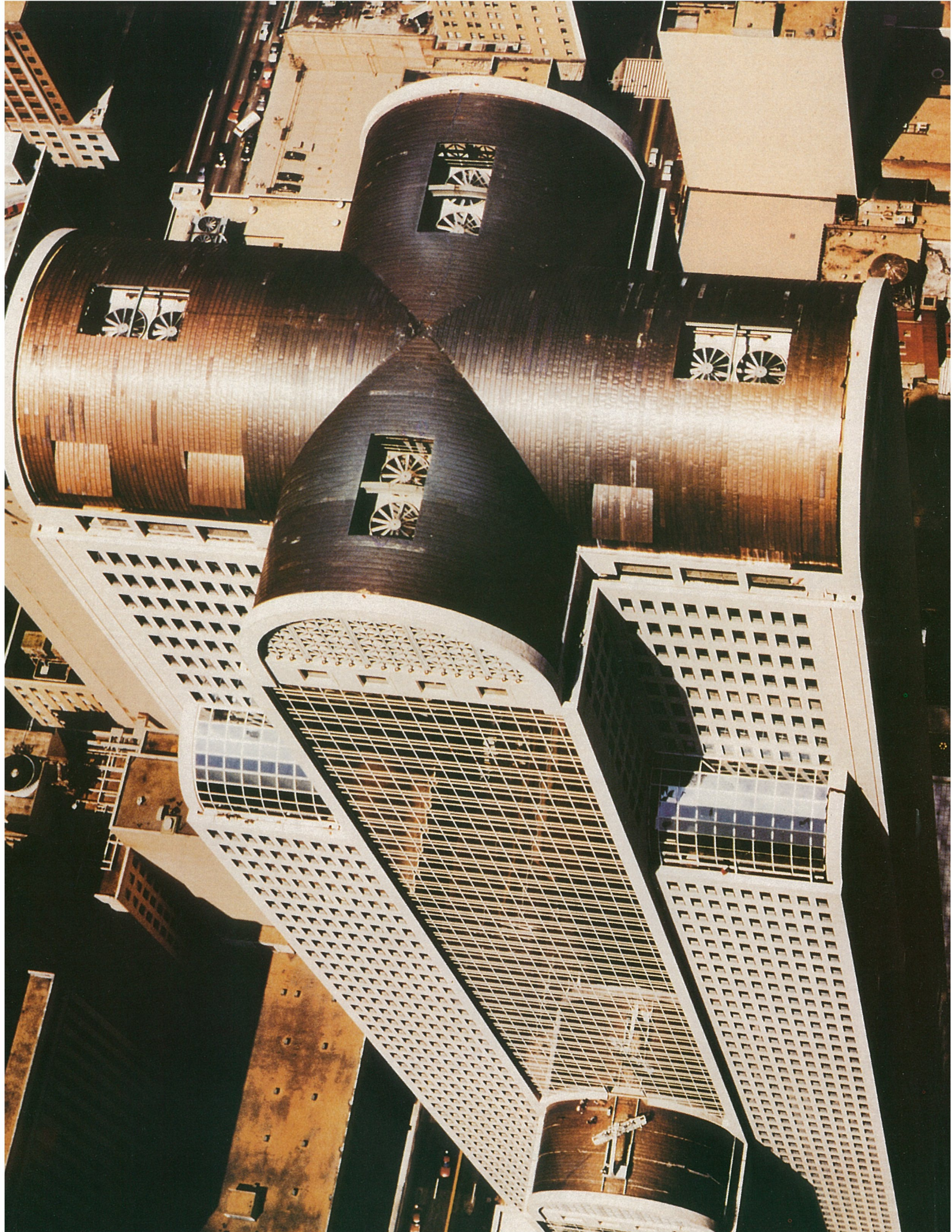


COPPER ROOFING DESIGN

A Folio of Contemporary Copper Roofing Decisions

COPPER DEVELOPMENT ASSOCIATION INC.





MOMENTUM PLACE

A 62-story office building, Dallas, Texas

Architect:

John Burgee Architects, New York, NY

Roofing Contractor:

Armetco Systems Inc., Irving, TX

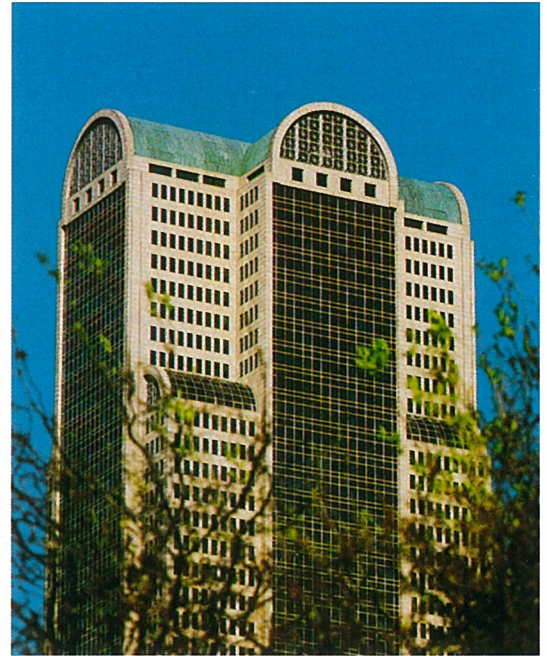
Intersecting Barrel Vaults

THE SIGNIFICANT COPPER ROOFING DESIGN DECISION

Momentum Place features over 26,000 square feet of curvilinear copper roof surface chosen to provide the desired esthetic and to confront the challenge of handling enormous volumes of water over time.

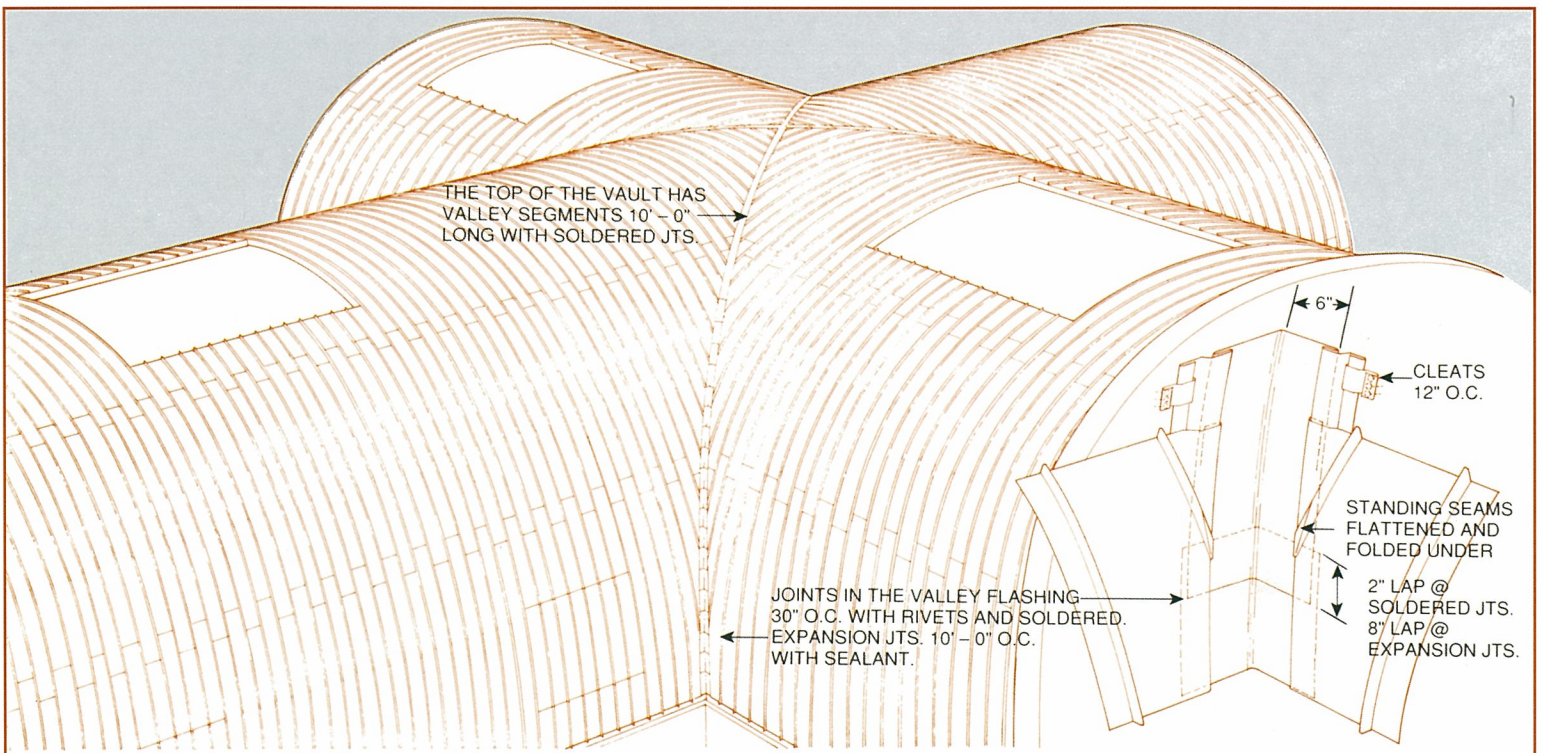
The roof surface is viewed from a wide variety of angles from the ground and above, with copper providing a long-term definitive appearance satisfying under all conditions.

The copper-clad intersecting barrel vaults each has a radius of over 34 feet. Due to the scale of the intersecting vaults, the constant curve and the changing angles of the valleys, potential leakage is a problem. To provide surface integrity, the copper valley flashing was installed in shorter (overlapping and soldered) lengths as it advances from the flat orientation at the peak to the vertical orientation at the gutter.



The desired patina coloration of the copper is advanced by induced oxidation.

DETAIL DRAWINGS



MOMENTUM PLACE SPECIFICATIONS: METAL ROOFING

The following is a synopsis of the architect's specifications for the copper roof. Key sub-sections have been condensed and included as a reference for the reader who may be considering similar copper roofing construction.

PART 1 - GENERAL

1.2 QUALITY ASSURANCE:

A. Installer: A firm with three years (or more) of successful experience installing metal roofing of the same type and quality.

B. Comply with details and recommendations of the following:

1. *CDA Copper Brass Bronze Design Handbook - Sheet Copper Applications.*

2. *CDA Copper Brass Bronze Design Handbook - Architectural Applications.*

3. *Revere Copper Products, Inc.; Copper and Common Sense.*

C. Design Criteria:

1. Wind Pressure Loads:

a. Design copper roof to sustain maximum wind pressure of 100 psf.

b. The roof panels and connections shall accommodate movements of the structure due to wind forces.

2. Thermal Movement: Provide for noiseless expansion and contraction of all materials and assemblies due to temperature changes between 10°F and 180°F without detriment to appearance or performance.

3. Water Infiltration: Drain to the exterior all water entering at joints and condensation occurring within the construction. Allow no uncontrolled water on interior faces of roof panels.

D. Mock-Up Testing

1. Furnish labor and materials to build and test a mock-up that actually represents job conditions including joints, sealants, anchors, finishes, etc.

2. Contractor shall submit definitive drawings describing the proposed scope or extent of the mock-up units. Fabrication will proceed only with architect's review and approval.

3. Construct mock-up in strict accordance with approved drawings in sequence and manner to be carried out in the field.

4. Air-infiltration, water leakage, structural performance tests as specified shall be performed on the mock-up.

9. As-built drawings with actual dimensions and thicknesses of component parts shall be submitted with test report and shall be updated to show revisions to mock-up.

E. Test Loads:

1. Design load: 100 psf positive/negative

Overload: 150 psf

2. Dead load shall be the actual weight of the materials.

3. Design pressure for mock-up shall be 100 psf.

4. Testing sequence for mock-up:

a. Air infiltration at 6.24 psf.

b. Static water infiltration at 20 psf.

c. Structural deflection test, positive and negative.

d. Repeat static water infiltration test, depending on previous test results.

1.3 REFERENCE STANDARDS

A. Comply with applicable provisions of the following reference standards, unless otherwise shown or specified:

ASTM B 32 - Solder Metal

ASTM B101 - Lead-Coated Copper Sheets

ASTM B 370 - Copper Sheet and Strip for Building Construction

ASTM C 920 - Elastomeric Joint Sealants

1.6 EXTENDED WARRANTY

A. Submit a warranty to repair or replace metal roofing work for a period of three years from date of completion if construction does not remain water-tight or free of material or workmanship defect affecting structure and appearance.

C. Defects shall include but not be limited to:

1. Failure to meet performance requirements.

2. Loose parts.

3. Leaking.

4. Wrinkling.

5. Buckling.

6. Non-uniformity of color or finish.

7. Galvanic action between roofing and dissimilar materials.

1.8 ALTERNATE: PRE-OXIDIZED PATINATION COPPER ROOFING

A. 4. Patination shall be to architect's selection of color determined at start of production. Process shall be of four stages, using chemical application and final sealer. Patina to be non-uniformity color pattern with vertical direction.

PART 2 - PRODUCTS

2.1 SHEET METAL MATERIALS

A. Sheet Copper: ASTM B 370, cold rolled temper, 20 oz. per sq. ft. weight, of size to suit seam locations and arrangements shown.

B. Sheet Lead-Coated Copper: ASTM B 101, type 1, class A; copper shall be coated on both sides with lead weighing 6 to 7-1/2 pounds per sq. ft. for each side.

C. Solder: ASTM B 32, composition 50% pig lead and 50% block tin; 40% pig lead and 60% block tin for lead-coated copper.

D. Flux: Rosin, muriatic acid neutralized with zinc or an approved soldering paste.

E. Cleats: Sheet copper, cold rolled, 2" wide by 3" long, one end locked into seam and other end triple nailed and folded back.

2.2 MISCELLANEOUS MATERIALS

B. Fastening and Anchoring Devices: Hard copper, brass or bronze:

1. Nails: Flat head, wire-slating type, not less than 12 gauge and 3/4" long.

2. Screws: Round heads with lead washers.

3. Expansion shields: Lead sleeves and washers.

C. Sealant: ASTM C 920, a one component silicone based material, movement capability $\pm 50\%$. Color, as selected by architect.

1. Approved manufacturers

a. General Electric; [copper compatible]

b. Dow Corning; [copper compatible]

PART 3 - EXECUTION

3.2 GENERAL REQUIREMENTS

A/B. Fabricate and install metal roofing work using skilled workmen in accordance with details as shown on approved drawings, and in strict accordance with manufacturer's directions and recommendations of Copper Development Association.

3.3 INSTALLATION

B. Copper Work

1. Roofing shall be of continuous double locked parallel standing seams and right angled offset clefted flat seams conforming to spacing, profiles and arrangements indicated on the final mock-up as-built drawings with revisions reflecting the final mock-up, complete with reglet and other terminations as may be required.

3. For roof slopes less than 3" per foot: A bead of silicone sealant shall be applied to the upper horizontal flange on the 1-1/2" leg of the preformed pan. Sealant shall be applied in the lock formed by the soldered locking strip at the transverse seam. The completed transverse seam shall be dressed down to a thickness not less than 1/8" with a continuous bead of sealant visible the full width of the pan. The lap of the vertical portion or upstanding legs of the pan shall also be set in sealant.

Copper Development Association Inc. provides information and technical assistance to architects, contractors and builders considering the use of copper and copper products in projects of any scale. This publication has been prepared for the use of such professionals and compiled from information sources CDA believes to be competent. However, recognizing that each roofing system must be designed and installed to meet the specific requirements of the application, CDA assumes no responsibility or liability of any kind in connection with this publication or its use by any person or organization and makes no representations or warranties of any kind hereby.

This publication is available through CDA along with many other publications covering a wide range of copper application subjects.

For further information, you can contact CDA at 1-800-CDA-DATA.



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