

TULSA PUBLIC SCHOOLS

PROJECT MANUAL

MacArthur Elementary Library Addition
Divisions 2 through 16 and Appendix 'A'

BID DOCUMENTS

SPECIFICATIONS

for

Library Addition
MacArthur Elementary- TPS

May 6, 2011

Facilities Bond Projects Office
Room 201
Charles C. Mason Education Service Center
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CONSTRUCTION DOCUMENTS

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SECTION 07511
MULTI-PLY COLD PROCESS BUILT-UP ROOFING SYSTEM

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes the following:
1. Cold process built-up roof system with aggregate ballast.
 2. Roofing insulation. Refer to Section 03521 - Lightweight Insulating Concrete Roof Deck for Alternate #1.
 3. Flashing Assemblies.
 4. Roof Expansion Joint Assemblies
 5. Walkway Protection Landings.
- B. Related Sections include the following:
1. Division 3, Section "Lightweight Insulating Concrete Roof Deck" for Alternate #1 that replaces the rigid roofing insulation with the lightweight insulating concrete.
 2. Division 6 Section "Miscellaneous Carpentry" for wood blocking, curbs, cants, and nailers.
 3. Division 7 Section "Sheet Metal Flashing and Trim" for metal roof penetration flashing, flashing, and counterflashing.
 4. Division 7 Section "Roof Accessories."
 5. Division 7 Section "Joint Sealants."
 6. Division 15 Sections for roof drains.

1.02 DEFINITIONS

- A. Roofing Terminology: Refer to ASTM D1079 for definitions of terms related to roofing work not otherwise defined in this Section.

1.03 PERFORMANCE REQUIREMENTS

- A. General: Install a watertight, cold process built-up and base flashing roofing system with compatible components that will not permit the passage of liquid water and will withstand wind loads, thermally induced movement, and exposure to weather without failure.
- B. UL Listing: Provide built-up roofing, base flashing, and component materials that comply with requirements of Underwriter's Laboratory (U.L.) 790 Class A Fire Resistance and U.L. 1897 Class 90 Wind Resistance ratings. Roofing system shall be listed in the current U.L. "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with U.L. markings.
1. Roofing system shall comply with the following:
 - a. U.L. 790 Fire Classification: Class A.
 - b. U.L. 1897 Wind Classification: Class 1A-90

1.04 SUBMITTALS

- A. Product Data: For each type of roofing product specified. Include data substantiating that materials comply with requirements.
- B. Shop Drawings: Include plans, sections, details, and attachments to other work, for the following:
1. Base flashing, cants, and membrane terminations.
 2. Tapered insulation, including slopes.
 3. Crickets, saddles, and tapered edge strips, including slopes.

- C. Samples for Verification: Of the following products:
1. 12-by-12-inch square of roofing insulation.
 2. Roof membrane and base ply samples.
 3. 12-by-12-inch square of walkway pad.
 4. 6 insulation fasteners of each type, length, and finish.
- D. Installer Certificates: Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install specified roofing system and is eligible to receive the roofing manufacturer's warranty. Roof contractor shall be experienced applying the specified roofing system and shall provide a list to the Project Architect seven (7) days prior to the bid date a list of five (5) projects where the specified roof system has been applied. Roof contractor shall provide a company name, phone number and contact person.
- E. Manufacturer Certificates: Signed by roofing system manufacturer certifying that the roofing system complies with requirements specified in the "Performance Requirements" Article. On request, submit evidence of complying with requirements.
- F. Qualification Data: For firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- G. Product Test Reports: Based on evaluation of tests performed by manufacturer and witnessed by a qualified independent testing agency, indicate compliance of components of roofing system with requirements based on comprehensive testing of current product compositions.
1. Indicate compliance of bulk roofing asphalt materials delivered to Project with requirements. Include quantity and statistical and descriptive data for each product. Submit certificate with each load before it is used.
 2. Written verification from roofing material manufacturer that the specified roofing system meets or exceeds ASTM 2523 for Testing Load Strain Properties of the Roofing Membrane. Minimum standards are listed in product section of these specifications.
- H. Maintenance Data: For roofing system to include in the maintenance manuals specified in Division 1.
- I. Warranty: Sample copy of roofing manufacturer's proactive Ten (10) year roofing preventative maintenance service agreement stating obligations, remedies, limitations, and exclusions of service agreement.
- J. Inspection Report: Copy of roofing system manufacturer's inspection report of completed roofing installation.
- K. Notarized documentation that roof system manufacturer has a history of producing/manufacturing this roofing system for at least as long as the manufacturer's longest warranty, and not less than the specified warranty.
- L. The Tulsa Public Schools is desirous of working with a financially strong organization, which has the ability to protect and insulate the school from both product liability and warranty claims relating to roofing that could be brought before the building owner during the course of the roofing warranty period. As financial strength of suppliers are a requirement of the building owner proof of such must be shown. To this end, the following information is required by the building owner, to be submitted to the Project Architect: The manufacturer must present to the building owner a certificate of insurance for product liability with minimum limits of \$ 25 million.
- M. To help ensure ethical conduct and reduce the potential for conflict of interest, and to provide full disclosure, the roof material manufacturer shall provide an affidavit from a company officer

which shall include the confirmation that all field employees in their organization have signed an ethics policy agreeing they will conduct business in an ethical manner.

- N. Roof system manufacturer shall provide the Project Architect names of at least four (4) qualified applicators to install the specified roofing system.
- O. Letter from roof system manufacturer that the technical service inspector overseeing the project for the specification compliance and installation quality is employed by the roof system manufacturer and have been an employee for a minimum of five (5) years. Technical service representative shall be prepared to respond to problems associated with roofing project within a two (2) hour period. In addition, field representative shall be available upon the Project Architects request during roofing activities and weekends.
- P. Letter from the roofing contractor shall agree to participate in allowances and adjustments for five (5) years of the warranty period when it is determined that defects area a result of application and workmanship errors. All defects noted during this time period will be corrected by the roof contractor at their own expense.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer to perform Work of this Section who has specialized in installing roofing similar to that required for this Project; who is approved, authorized, or licensed by the roofing system manufacturer to install manufacturer's product; and who is eligible to receive the standard roofing manufacturer's warranty.
- B. Fire-Test-Response Characteristics: Provide roofing materials with the fire-test-response characteristics indicated as determined by testing identical products per test method indicated below by UL, or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
 - 1. Exterior Fire-Test Exposure: Class A; complying with Underwriters Laboratory (U.L.) Class 790.
- C. Preliminary Roofing Conference: Before starting roof deck construction, conduct conference at Project site. Meet with the same participants and review the same items listed for the pre-installation conference. In addition, review status of submittals and coordination of work related to roof construction. Notify participants at least 5 working days before conference.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store roofing materials in a dry, warm, well-ventilated, weathertight location according to roofing system manufacturer's written instructions. Store rolls of felt and other sheet materials on end on pallets or other raised surfaces. Do not double-stack rolls.
 - 1. Handle and store roofing materials and place equipment in a manner to avoid significant or permanent damage to deck or structural supporting members.
- B. Do not leave unused felts and other sheet materials on the roof overnight or when roofing work is not in progress unless protected from weather and moisture and unless maintained at a temperature exceeding 40 deg F.
- C. Deliver and store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer.
- D. Protect roofing insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

1.07 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with roofing work only when existing and forecasted weather conditions permit roofing to be installed according to manufacturers' written instructions and warranty requirements.

1.08 WARRANTY/SERVICE AGREEMENT

- A. Upon project completion and the acceptance by the Project Architect and roof system manufacturer, the roofing manufacturer shall provide a Ten (10) year roof maintenance and program covering yearly roof inspections, proactive preventative maintenance and housekeeping of the roof as well as a 24 hour a day leak reporting response and tracking service. The specific areas covered shall be provided on the manufacturer's sample agreement form.

PART 2 – PRODUCTS

2.01 ROOF SYSTEM MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Multi-ply cold process modified bitumen Built-up Roofing System with roofing aggregate ballast:
 - a. Tremco, Inc., or approved equal.
 - 2. Roofing Aggregate Ballast: Hard, durable opaque, washed free of clay, loam, sand, or other foreign substances. Do not use crushed gravel, white dolomite (marble chips), Joplin chats, scoria, limestone, volcanic rock, crushed oyster and clamshells, crushed brick tile, or cinders. ASTM D 1863-86, size six (6).

2.02 ROOFING PLY MATERIALS

- A. Roofing base Ply Sheet: Trilaminare reinforced high strength ply sheet manufactured of polyester/fiberglass/polyester reinforcement carriers utilized by Tremco or approved equal.

Thickness:	.048 in.	ASTM D 146-97
Tear Strength	345 lbf MD	ASTM D 4073
	333 lbf/XMD	
Breaking strength	220 lbf/in MD	ASTM D 146-78
	235 lbf/in XD	

- B. ASTM 2523 – Testing Load Strain Properties of the Roofing Membrane

MD 744 lbf. MD

XMD 761 lbf. XMD

2.03 FLASHING MATERIALS

- A. Flashing Sheet: 4 mil SBS mineral surfaced polyester reinforced flashing membrane by Tremco or approved equal.

2.04 ASPHALT MATERIALS

- A. Asphalt Primer: ASTM D41.
- B. Cold Process Modified Bitumen Adhesive: An environmentally friendly, low volatile, modified, cold process adhesive used in the construction of cold process built-up roofs manufactured by Tremco or approved equal.

2.05 AUXILIARY MEMBRANE MATERIALS

- A. General: Furnish auxiliary materials recommended by roofing system manufacturer for intended use and compatible with built-up roofing.
 - 1. Furnish liquid-type auxiliary materials that meet VOC limits of authorities having jurisdiction.
- B. Asphalt Roofing Cement: ASTM D4586, asbestos free, of consistency required by roofing system manufacturer for application.
- C. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions of FM 4470; designed for fastening base sheets and base flashing and for back-nailing ply felts to substrate; tested by manufacturer for required pullout strength; and acceptable to roofing system manufacturer.
- D. Wood Nailer Strips: Furnish wood nailer strips; fire retardant; pressure treated; size required, and complying with requirements of Division 6 Section "Miscellaneous Carpentry."
- E. Cants: Perlite board, complying with ASTM C728.
- F. Miscellaneous Accessories: Provide miscellaneous accessories recommended by roofing system manufacturer for intended use.
- G. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions of FM 4470, designed for fastening thermal barrier to substrate.

2.06 INSULATION MATERIALS (Refer to Section 03521 for Alternate #1)

- A. General: Provide preformed, roofing insulation boards that comply with requirements, selected from manufacturer's standard sizes and of thickness indicated.
- B. Provide preformed, tapered insulation boards where indicated for sloping water to drainage outlets. Fabricate with the following taper:
 - a. 1/4 inch per 12 inches, unless otherwise indicated on Drawings.
 - b. Minimum thickness, 3/4 inch.
 - 1. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drainage outlets. Fabricate to slopes indicated.
- C. Polyisocyanurate Board Insulation: Rigid, cellular polyisocyanurate thermal insulation with core formed by using HCFCs as blowing agents complying with ASTM C1289, classified by facer type as follows:
 - 1. Facer Type: Asphalt impregnated with organic/fiberglass facer.
 - 2. Minimum bottom layer thickness: 2".

- D. Asphalt impregnated fiberboard Cover Insulation Board: ASTM C-208 manufactured by Celotex or approved equal. Minimum top layer thickness: 1/2".

2.07 INSULATION ACCESSORIES

- A. General: Furnish roofing insulation accessories recommended by insulation manufacturer for intended use and compatible with sheet roofing material.
- B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions of FM 4470, designed for fastening roofing insulation to substrate, tested by manufacturer for required pullout strength, and acceptable to roofing system manufacturer.
- C. Cover Board: Rigid, cellulosic-fiber insulation board, complying with ASTM C208, Type II, Grade 2, 1/2 inch thick.
- D. Substrate Joint Tape: 6 or 8 inches wide, coated, glass-fiber joint tape.
- E. Insulation Adhesive: An environmentally friendly, UL approved solvent free, elastomeric adhesive for securing insulation to deck substrate.

2.07 ROOF EXPANSION JOINT ASSEMBLIES

- A. Roof Expansion Joint Assemblies: Architectural Art Manufacturing, Model #L010 or equal system approved by roofing manufacturer to meet all requirements of the specified roofing system.

PART 3 – EXECUTION

3.01 ROOF INSTALLATION

- A. Verify conditions are satisfactory to receive work.
- B. Do not begin roofing until all unsatisfactory conditions are corrected. Beginning work constitutes acceptance of conditions.
- C. Verify that work of other trades penetrating roof deck or requiring men and equipment to traverse roof deck has been approved by the Project Architect, manufacturer and roofing contractor.
- D. Check projections, curbs and deck for inadequate anchorage, foreign material, moisture or unevenness that would prevent the quality and execution of a new roofing system.

3.02 EXAMINATION

- A. Examine substrates, areas, and conditions under which roofing will be applied, with Installer present, for compliance with requirements.
- B. Verify that roof openings and penetrations are in place and set and braced and that roof drains are properly clamped into position.
- C. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at roof penetrations and terminations and match the thicknesses of insulation required.

- D. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.03 PREPARATION

- A. Clean substrate of dust, debris, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections. Prime walls with water based asphalt primer as specified by roof system manufacturer and allow to dry tack free.
- B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

3.04 GENERAL INSTALLATION REQUIREMENTS

- A. Install multi-ply cold process built-up roofing membrane system according to roofing system manufacturer's written instructions and applicable recommendations of ARMA/NRCA's "Quality Control Guidelines for the Application of Cold Process Built-Up Roofing."
- B. Where roof slope exceeds 1 inch per 12 inches, run sheets of built-up roofing membrane parallel with slope. Backnail top ends of sheets to nailer strips.
- C. Cant Strips: Install and secure preformed 45-degree cant strips at junctures of built-up roofing membrane system with vertical surfaces or angle changes greater than 45 degrees.
- D. Cooperate with inspecting and testing agencies engaged or required to perform services for installing built-up roofing membrane system.
- E. Coordinate installing roofing system components so insulation and roofing plies are not exposed to precipitation or left exposed at the end of the workday or when rain is forecast.
- F. Provide cutoffs at end of each day's work to cover exposed ply sheets and insulation with a course of coated felt with joints and edges sealed.
- G. Complete terminations and base flashing and provide temporary seals to prevent water from entering completed sections of roofing system.
- H. Remove and discard temporary seals before beginning work on adjoining roofing.
- I. Substrate-Joint Penetrations:
Prevent roofing asphalt from penetrating substrate joints, entering building, or damaging roofing system components or adjacent building construction. If mopping is applied directly to substrate, tape substrate joints.

3.05 INSULATION INSTALLATION

- A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.
- B. Comply with roofing system manufacturer's written instructions for installing roofing insulation.
- C. Install tapered insulation under area of roofing to conform to slopes indicated and to Shop Drawings.
- D. Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.

- E. Install one or more layers of insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2 inches or greater, install required thickness in 2 or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.
- F. Trim surface of insulation where necessary at roof drains so completed surface is flush with ring of drain.
- G. Nailer Strips: Where roof slopes are greater than 1 inch per 12 inches, mechanically fasten to deck 4-inch nominal- wide, wood nailer strips of same thickness as insulation, spaced not more than 20 to 21 feet apart. Run nailers perpendicular to slope of roof.
- H. Install insulation with long joints of insulation in continuous straight lines with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation.
- I. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
- J. Attachment of Insulation: Mechanically attach both layers simultaneously to steel deck at one (1) fastener every two (2) sq. ft. Install additional fasteners to ensure board is firm under foot.
- K. Install tapered crickets and saddles between drains, wall transistions and along high sides of curbs to divert water to drainage outlets. Set tapered panels in insulation adhesive.
- L. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Loosely butt cover boards together and fasten to roof deck according to roofing system manufacturer's written instructions.

3.06 ROOF MEMBRANE INSTALLATION

- A. Install ply felts according to roofing system manufacturer's written instructions, starting at low point of roofing system. Align ply felts without stretching. Shingle side laps of ply felts uniformly to achieve required number of membrane plies throughout. Shingle in direction to shed water. Extend ply felts over and terminate beyond cants.
- B. Install Three (3) plies of the specified trilaminate base ply in alternate applications of cold process modified adhesive applied strictly to manufacturer's recommendations and warranty requirements.
- C. Application: Embed each ply felt in an application of cold process modified adhesive at the rate of 2 gallons per 100 sq. ft., to form a uniform membrane without ply felts touching each other. Where asphalt adhesive exudes out beyond the selvage edge, embed loose granules into adhesive.
- D. Membrane Walkways: Install another ply felt, approximately 36 inches wide and in lengths not exceeding 10 feet, leaving a space of 6 inches between strips. Adhere walkways in same type of material used to build up roof membrane.

3.07 FLASHING AND STRIPPING INSTALLATION

- A. Install base flashing over cant strips and other sloping and vertical surfaces, at roof edges, and at penetrations through roof, and secure to substrates according to roofing system manufacturer's written instructions and as follows:
 1. Prime substrates with asphalt primer if required by roofing system manufacturer.

- B. Flashing Sheet Application: Shall be one of the methods below, as recommended by roofing manufacturer.
1. Adhere base and SBS flashing sheet to substrate in a solid application of sheeting adhesive. Ensure complete bond and continuity without wrinkles or voids. Lap sheeting ends four (4) inches.
 2. Seal vertical edges of membrane with two (2) course of reinforcing membrane embedded between alternate applications of asphalt mastic.
 3. Extend base flashing up walls or parapets a minimum of 8 inches above roof membrane and 4 inches onto field of roof membrane.
 4. Mechanically fasten top of base flashing securely at terminations and perimeter of roofing. Seal top termination of base flashing.
- C. Install stripping where metal flanges and edgings are set on built-up roofing according to roofing system manufacturer's written instructions.
- D. Built-up Stripping: Install stripping of not less than 2 plies, one (1) trilaminate base ply and one (1) SBS membrane, setting each ply in a continuous application of cold process adhesive, extended onto roof membrane 6 inches and 8 inches, respectively.
- E. Roof Drains: Set 30-by-30-inch lead metal flashing in bed of asphalt roofing cement on completed built-up roofing membrane. Cover metal flashing with stripping, extending a minimum of 4 inches beyond edge of metal flashing onto field of roof membrane. Clamp roof membrane, metal flashing, and stripping into roof-drain clamping ring.
- F. Stripping Material: Install not less than 2 plies of roof membrane felt, each set in a continuous coating of cold process adhesive.
- G. Install prefabricated roofing control (expansion) joints in accordance with manufacturer's instructions. Expansion joint materials shall consist of 45 mil CSPE hypalon sheeting, 3" closed cell backer rod and nervastral vinyl barrier.
- H. At gas lines and equipment runners: All gas lines greater than 3" shall be resting on wood blocking and resting on 1/4" steel plate and protection pad consisting of trilaminate base ply/walktred set in the specified adhesive. Spacing shall be 4' o.c. Remaining piping smaller than 3" shall be resting on new 4 X 4 redwood runners and installed over trilaminate/walktred set in the specified adhesive.

3.08 MEMBRANE PROTECTION LANDINGS

- A. Install walkway landings around access doors, ladders and working sides of mechanical Equipment. Set landings in heavy pads of asphalt mastic.

3.09 SURFACING TREATMENT

- A. Coat flashing surfaces, lead, drain screens, galvanized metal, walktreds etc., with two (2) coats of aluminized heat reflective coating applied at an approximate rate of 130 sq. ft. per gallon. Coat flashings neatly.

3.10 FIELD QUALITY CONTROL

- A. Roofing manufacturer's representative, roofing applicator, and Architect shall inspect work as follows:
1. Work in progress a minimum of two job visits per week with written field inspection reports on the roof contractors progress and quality of installation. Reports shall be submitted to the Project Architect.

2. A pre-final inspection shall be conducted upon completion of all roofing ply sheets before flood coat and aggregate are applied.
 3. The final inspection will be performed by roofing manufacturer before issuance of Ten (10) year manufacturer's preventative maintenance service agreement.
 4. Notify Architect minimum 48 hours in advance of manufacturer's job visits.
- B. Correct deficiencies in or remove and replace roof membrane that inspections and test reports indicate does not comply with specified requirements.
 - C. Repair roof membrane that does not comply with specified requirements by re-adhering test specimens back in place and by applying additional plies, equal to the original number of plies specified, over test specimens according to roofing system manufacturer's written instructions.
 - D. Test Cuts: Before flood coating and surfacing built-up roofing membrane, test specimens will be removed to evaluate problems observed during quality-assurance inspections of roof membrane as follows:
 1. Approximate quantities of components within roof membrane will be determined according to ASTM D3617.
 2. Test specimens will be examined for interply voids according to ASTM D3617 and to comply with the criteria established in Appendix 3 of ARMA/NRCA'S "Quality Control Guidelines for the Application of Built-up Roofing."
 3. Additional testing, at Contractor's expense, may be performed to determine that corrected Work complies with specified requirements.
 - E. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion and submit report to Project Architect.
 - F. Notify Architect 48 hours in advance of the date and time of inspection.

3.11 PROTECTING AND CLEANING

- A. Protect built-up roofing membrane from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Project Architect.
- B. Correct deficiencies in or remove built-up roofing that does not comply with requirements, repair substrates, reinstall roofing, and repair base flashing to a condition free of damage and deterioration at the time of Substantial Completion and according to warranty requirements.

END OF SECTION 07511

SECTION 07620

SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Manufactured Products:

- a. Refer to Division 4, "Unit Masonry" for manufactured through-wall flashing and counterflashing.
- b. Manufactured reglets and counterflashing.

2. Formed Products:


- a. Formed roof drainage sheet metal fabrications.
- b. Formed low-slope roof sheet metal fabrications.
- c. Formed steep-slope roof sheet metal fabrications.
- d. Formed equipment support flashing.

B. Related Sections:

- 1. Division 6 Section "Miscellaneous Carpentry" for wood nailers, curbs, and blocking.
- 2. Division 7 Section "Modified Bituminous-Membrane Roofing" for installing sheet metal flashing and trim integral with membrane roofing.
- 3. Division 7 Section "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.

1.3 PERFORMANCE REQUIREMENTS

- A. General: Sheet metal flashing and trim assemblies as indicated shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
- B. Thermal Movements: Provide sheet metal flashing and trim that allows for thermal movements from ambient and surface temperature changes.

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1. Temperature Change (Range): 120 deg F, ambient; 180 deg F material surfaces.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.
- B. Maintenance Data: For sheet metal flashing, trim, and accessories to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.
- B. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or shown on Drawings.
- C. Copper Sheet Metal Standard: Comply with CDA's "Copper in Architecture Handbook." Conform to dimensions and profiles shown unless more stringent requirements are indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

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

1.7 WARRANTY

- A. Special Warranty on Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.

- c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
2. Finish Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SHEET METALS

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.
 1. Exposed Coil-Coated Finishes:
 - a. Three-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 2. Color: As selected by Architect from manufacturer's full range.
 3. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).
 - B. Metallic-Coated Steel Sheet: Restricted flatness steel sheet, metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
 1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation; structural quality.
 2. Surface: Smooth, flat and mill phosphatized for field painting at exposed locations and with manufacturer's standard clear acrylic coating on both sides at locations not exposed to view..
 3. Exposed Coil-Coated Finish:
 - a. Three-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 4. Color: As selected by Architect from manufacturer's full range.
 5. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).

2.2 UNDERLAYMENT MATERIALS

- A. Felt: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
- B. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils (0.76 to 1.0 mm) thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of

butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.

1. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F (116 deg C).
2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F (29 deg C).
3. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Carlisle Coatings & Waterproofing Inc.; CCW WIP 300HT.
 - b. Grace Construction Products, a unit of W. R. Grace & Co.; Ultra.
 - c. Henry Company; Blueskin PE200 HT.
 - d. Metal-Fab Manufacturing, LLC; MetShield.
 - e. Owens Corning; WeatherLock Metal High Temperature Underlayment.

- C. Slip Sheet: Building paper, 3-lb/100 sq. ft. (0.16-kg/sq. m) minimum, rosin sized.

2.3 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and recommended by manufacturer of primary sheet metal unless otherwise indicated.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal.
 1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
 - a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating.
 - b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
 - c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
 2. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329 or Series 300 stainless steel.
- C. Solder:
 1. For Zinc-Coated (Galvanized) Steel: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead or Grade Sn60, 60 percent tin and 40 percent lead.
- D. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
- E. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane, polysulfide, or silicone polymer sealant; low modulus; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

- F. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.
- G. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.
- H. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.4 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, geometry, metal thickness, and other characteristics of item indicated. Fabricate items at the shop to greatest extent possible.
 1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
 2. Obtain field measurements for accurate fit before shop fabrication.
 3. Form sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
 4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces exposed to view.
- B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.
- C. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant.
- D. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with butyl sealant concealed within joints.
- E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- F. Fabricate cleats and attachment devices of sizes as recommended by SMACNA's "Architectural Sheet Metal Manual" for application, but not less than thickness of metal being secured.
- G. Seams: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.

- H. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.
- I. Do not use graphite pencils to mark metal surfaces.

2.5 ROOF DRAINAGE SHEET METAL FABRICATIONS

- A. Hanging Gutters: Gutters at standing seam metal roofs to be installed by pre-engineered metal building manufacturer are not to be included here. Fabricate to cross section indicated, complete with end pieces, outlet tubes, and other accessories as required. Fabricate in minimum 96-inch- (2400-mm-) long sections. Furnish flat-stock gutter spacers and gutter brackets fabricated from same metal as gutters, of size recommended by SMACNA but not less than twice the gutter thickness. Fabricate expansion joints, expansion-joint covers, gutter bead reinforcing bars, and gutter accessories from same metal as gutters.
 - 1. Gutter Style: SMACNA designation D.
 - 2. Expansion Joints: Butt type with cover plate.
 - 3. Accessories: Continuous removable leaf screen with sheet metal frame and hardware cloth screen.
 - 4. Gutters with Girth up to 15 Inches: Fabricate from the following materials:
 - a. Galvanized Steel: 0.022 inch thick.
- B. Downspouts: Fabricate rectangular downspouts complete with mitered elbows. Furnish with metal hangers, from same material as downspouts, and anchors.
 - 1. Hanger Style: continuous cleat and hanger to SMACNA Standards. With metal straps at 36 inches on center max.
 - 2. Fabricate from the following materials:
 - a. Galvanized Steel: 0.022 inch thick.
- C. Parapet Scuppers: Fabricate scuppers of dimensions required with closure flange trim to exterior, 4-inch- (100-mm-) wide wall flanges to interior, and base extending 4 inches (100 mm) beyond cant or tapered strip into field of roof. Fabricate from the following materials:
 - 1. Galvanized Steel: 0.028 inch thick.
- D. Conductor Heads: Fabricate conductor heads with flanged back and stiffened top edge and of dimensions and shape indicated complete with outlet tubes, exterior flange trim, and built-in overflows. Fabricate from the following materials:
 - 1. Galvanized Steel: 0.028 inch thick.

2.6 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

- A. Roof-Edge Flashing (Gravel Stop) and Fascia Cap: Fabricate in minimum 96-inch- (2400-mm-) long, but not exceeding 10-foot- (3-m-) long, sections. Furnish with 6-inch- (150-mm-) wide, joint cover plates.
 - 1. Joint Style: Butt, with 6-inch- (150-mm-) wide, exposed cover plates.

2. Fabricate from the following materials:
 - a. Galvanized Steel: 0.028 inch thick.
- B. Copings: Fabricate in minimum 96-inch- (2400-mm-) long, but not exceeding 10-foot- (3-m-) long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and drill elongated holes for fasteners on interior leg. Miter corners, seal, and solder or weld watertight.
 1. Coping Profile: SMACNA figure designation 3-4A.
 2. Joint Style: Butt, with 12-inch- (300-mm-) wide, concealed backup plate and 6-inch- (150-mm-) wide, exposed cover plates.
 3. Fabricate from the following materials:
 - a. Galvanized Steel: 0.040 inch thick.
- C. Roof and Roof to Wall Transition Expansion-Joint Cover: Fabricate from the following materials:
 1. Galvanized Steel: 0.034 inch thick.
- D. Base Flashing: Fabricate from the following materials:
 1. Galvanized Steel: 0.028 inch thick.
- E. Counterflashing: Fabricate from the following materials:
 1. Galvanized Steel: 0.022 inch thick.
- F. Flashing Receivers: Fabricate from the following materials:
 1. Galvanized Steel: 0.022 inch thick.
- G. Roof-Penetration Flashing: Fabricate from the following materials:
 1. Galvanized Steel: 0.028 inch thick.
- H. Roof-Drain Flashing: Fabricate from the following materials:
 1. Copper: 12 oz./sq. ft.

2.7 STEEP-SLOPE ROOF SHEET METAL FABRICATIONS

- A. Apron, Step, Cricket, and Backer Flashing: Fabricate from the following materials:
 1. Galvanized Steel: 0.022 inch thick.
- B. Valley Flashing: Fabricate from the following materials:
 1. Galvanized Steel: 0.028 inch thick.
- C. Drip Edges: Fabricate from the following materials:
 1. Galvanized Steel: 0.022 inch thick.
- D. Eave, Rake, Ridge, and Hip Flashing: Fabricate from the following materials:
 1. Galvanized Steel: 0.022 inch thick.
- E. Counterflashing: Fabricate from the following materials:
 1. Galvanized Steel: 0.022 inch thick.

- F. Flashing Receivers: Fabricate from the following materials:
 - 1. Galvanized Steel: 0.022 inch thick.
- G. Roof-Penetration Flashing: Fabricate from the following materials:
 - 1. Galvanized Steel: 0.028 inch thick.

2.8 WALL SHEET METAL FABRICATIONS

- A. Through-Wall Flashing: Fabricate continuous flashings in minimum 96-inch- (2400-mm-) long, but not exceeding 12-foot- (3.6-m-) long, sections, under copings, at shelf angles, and where indicated. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches (150 mm) beyond each side of wall openings. Form with 2-inch- (50-mm-) high, end dams where flashing is discontinuous. Fabricate from the following materials:
 - 1. Copper: 16 oz./sq. ft.
- B. Opening Flashings in Frame Construction: Fabricate head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings. Form head and sill flashing with 2-inch- (50-mm-) high, end dams. Fabricate from the following materials:
 - 1. Galvanized Steel: 0.022 inch thick.
- C. Wall Expansion-Joint Cover: Fabricate from the following materials:
 - 1. Galvanized Steel: 0.028 inch thick.

2.9 MISCELLANEOUS SHEET METAL FABRICATIONS

- A. Equipment Support Flashing: Fabricate from the following materials:
 - 1. Galvanized Steel: 0.028 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of the Work.
 - 1. Verify compliance with requirements for installation tolerances of substrates.
 - 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLAYMENT INSTALLATION

- A. General: Install underlayment as indicated on Drawings.

- B. Felt Underlayment: Install felt underlayment with adhesive for temporary anchorage to minimize use of mechanical fasteners under sheet metal flashing and trim. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches (50 mm).
- C. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Apply primer if required by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer rather than nails for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches (150 mm) staggered 24 inches (600 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm). Roll laps with roller. Cover underlayment within 14 days.

3.3 INSTALLATION, GENERAL

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
 - 1. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
 - 2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
 - 3. Space cleats not more than 12 inches (300 mm) apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
 - 4. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
 - 5. Install sealant tape where indicated.
 - 6. Torch cutting of sheet metal flashing and trim is not permitted.
 - 7. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by SMACNA.
 - 1. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene sheet.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches (600 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with sealant concealed within joints.
- D. Fastener Sizes: Use fasteners of sizes that will penetrate wood sheathing not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws and metal decking not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

- E. Seal joints as shown and as required for watertight construction.
1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch (25 mm) into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F (4 deg C).
 2. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."
- F. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches (38 mm), except reduce pre-tinning where pre-tinned surface would show in completed Work.
1. Do not solder metallic-coated steel sheet.
 2. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

3.4 ROOF DRAINAGE SYSTEM INSTALLATION

- A. General: Install sheet metal roof drainage items to produce complete roof drainage system according to SMACNA recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.
- B. Hanging Gutters: Join sections with riveted and soldered joints or with lapped joints sealed with sealant. Provide for thermal expansion. Attach gutters at eave or fascia to firmly anchored gutter brackets and straps spaced not more than 36 inches (900 mm) apart. Provide end closures and seal watertight with sealant. Slope to downspouts.
1. Fasten gutter spacers to front and back of gutter.
 2. Loosely lock straps to front gutter bead and anchor to roof deck.
 3. Anchor and loosely lock back edge of gutter to continuous cleat.
 4. Install gutter with expansion joints at locations indicated, but not exceeding, 50 feet apart. Install expansion-joint caps.
 5. Install continuous gutter screens on gutters with noncorrosive fasteners, removable for cleaning gutters.
- C. Downspouts: Join sections with 1-1/2-inch (38-mm) telescoping joints.
1. Provide hangers with fasteners designed to hold downspouts securely to walls. Locate hangers at top and bottom and at approximately 60 inches (1500 mm) o.c. in between.
 2. Connect downspouts to underground drainage system indicated.
- D. Splash Pans: Install where downspouts discharge on low-slope roofs Set in asphalt roofing cement compatible with roofing membrane.

- E. Parapet Scuppers: Install scuppers where indicated through parapet. Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.
 - 1. Anchor scupper closure trim flange to exterior wall and solder or seal with elastomeric sealant to scupper.
 - 2. If conductor head is indicated in the Drawings, solder or seal with elastomeric sealant exterior wall scupper flanges into back of conductor head.
- F. Conductor Heads: Anchor securely to wall with elevation of conductor head rim 1 inch) below scupper discharge.
- G. Expansion-Joint Covers: Install expansion-joint covers at locations and of configuration indicated. Lap joints a minimum of 4 inches (100 mm) in direction of water flow.

3.5 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal flashing and trim to comply with performance requirements, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
- B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in SMACNA's "Architectural Sheet Metal Manual" and as indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered 3-inch centers.
- C. Copings: Anchor to resist uplift and outward forces according to recommendations in SMACNA's "Architectural Sheet Metal Manual" and as indicated.
 - 1. Interlock exterior bottom edge of coping with continuous cleat anchored to substrate at 16-inch centers.
 - 2. Anchor interior leg of coping with washers and screw fasteners through slotted holes at 24-inch centers.
- D. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of 4 inches (100 mm) over base flashing. Install stainless-steel draw band and tighten.
- E. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches (100 mm) over base flashing. Lap counterflashing joints a minimum of 4 inches (100 mm) and bed with sealant. Secure in a waterproof manner by means of interlocking folded seam or blind rivets and sealant.
- F. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric sealant and clamp flashing to pipes that penetrate roof.

3.6 WALL FLASHING INSTALLATION

- A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.
- B. Through-Wall Flashing: Installation of through-wall flashing is specified in Division 4 Section "Unit Masonry Assemblies."
- C. Reglets: Installation of reglets is specified in Division 4 Section "Unit Masonry Assemblies."

3.7 MISCELLANEOUS FLASHING INSTALLATION

- A. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.

3.8 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

3.9 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder.
- C. Clean off excess sealants.
- D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of installation, remove unused materials and clean finished surfaces. Maintain in a clean condition during construction.
- E. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07620

SECTION 07720
ROOF ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:

1. Roof curbs.
2. Equipment supports.
3. Roof hatches.

- B. Related Sections include the following:

1. Division 5 Section "Metal Fabrications" for metal vertical ladders, ships' ladders, and stairs for access to roof hatches.
2. Division 6 Section "Rough Carpentry" for roof sheathing, wood cants, and wood nailers.
3. Division 7 steep-slope roofing Sections for ridge vents.
4. Division 7 low-slope roofing Sections for roofing accessories.
5. Division 7 Section "Sheet Metal Flashing and Trim" for shop- and field-fabricated metal flashing and counterflashing, roof expansion-joint covers, and miscellaneous sheet metal trim and accessories.

1.3 SUBMITTALS

- A. Product Data: For each type of roof accessory indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop drawing for ship's ladder and roof hatch.

1.4 QUALITY ASSURANCE

- A. Sheet Metal Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" details for fabrication of units, including flanges and cap flashing to coordinate with type of roofing indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Pack, handle, and ship roof accessories properly labeled in heavy-duty packaging to prevent damage.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify required openings for each type of roof accessory by field measurements before fabrication and indicate measurements on Shop Drawings.

1.7 COORDINATION

- A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.
 - 1. With Architect's approval, adjust location of roof accessories that would interrupt roof drainage routes or roof expansion joints.

PART 2 - PRODUCTS

2.1 METAL MATERIALS

- A. Galvanized Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coated.
- B. Prepainted, Metallic-Coated Steel Sheet: Steel sheet metallic coated by hot-dip process and prepainted by coil-coating process to comply with ASTM A 755/A 755M.
 - 1. Galvanized Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coated.
- C. Steel Shapes: ASTM A 36/A 36M, hot-dip galvanized to comply with ASTM A 123/A 123M, unless otherwise indicated.
- D. Steel Tube: ASTM A 500, round tube, baked-enamel finished.
- E. Galvanized Steel Tube: ASTM A 500, round tube, hot-dip galvanized to comply with ASTM A 123/A 123M.
- F. Galvanized Steel Pipe: ASTM A 53/A 53M.

2.2 MISCELLANEOUS MATERIALS

- A. Glass-Fiber Board Insulation: ASTM C 726, 1 inch (25 mm) thick.
- B. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, complying with AWPA C2; not less than 1-1/2 inches (38 mm) thick.

- C. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
- D. Polyethylene Sheet: 6-mil- thick, polyethylene sheet complying with ASTM D 4397.
- E. Felt: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
 - 1. Slip Sheet: Rosin-sized paper, minimum 3 lb/100 sq. ft.
- F. Fasteners: Same metal as metals being fastened, or nonmagnetic stainless steel or other noncorrosive metal as recommended by roof accessory manufacturer. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners.
- G. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, or PVC; or flat design of foam rubber, sponge neoprene, or cork.
- H. Elastomeric Sealant: ASTM C 920, polyurethane sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- I. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, and heavy bodied for hooked-type expansion joints with limited movement.
- J. Roofing Cement: ASTM D 4586, nonasbestos, fibrated asphalt cement designed for trowel application or other adhesive compatible with roofing system.

2.3 ROOF CURBS

- A. Roof Curbs: Provide metal roof curbs, internally reinforced and capable of supporting superimposed live and dead loads, including equipment loads and other construction to be supported on roof curbs. Fabricate with welded or sealed mechanical corner joints, with integral metal cant and integral formed mounting flange at perimeter bottom. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.
 - 1. Manufacturers:
 - a. Colony Custom Curbs.
 - b. Commodity Products Company, Inc.
 - c. Conn-Fab Sales, Inc.
 - d. Curbs Plus Inc.
 - e. Custom Curb, Inc.
 - f. LM Curbs.
 - g. Loren Cook Company.
 - h. Metallic Products Corporation.
 - i. Pate Company (The).
 - j. Roof Products & Systems Corporation.

- k. Roof Products, Inc.
 - l. Thaler Metal Industries Ltd.
 - m. ThyCurb; Div. of Thybar Corporation.
 - n. Uni-Curb, Inc.
 - o. Vent Products Company, Inc.
- 2. Load Requirements: Refer to Drawings.
 - 3. Material: Galvanized steel sheet, 0.079 inch thick.
 - a. Finish: Prime painted.
 - 4. Factory install wood nailers at tops of curbs.
 - 5. Factory insulate curbs with 1-1/2-inch- thick, glass-fiber board insulation.
 - 6. Curb height may be determined by adding thickness of roof insulation and minimum base flashing height recommended by roofing membrane manufacturer. Fabricate units to minimum height of 12 inches, unless otherwise indicated.
 - 7. Sloping Roofs: Where slope of roof deck exceeds 1:48, fabricate curb units with water diverter or cricket and with height tapered to match slope to level tops of units.

2.4 EQUIPMENT SUPPORTS

- A. Equipment Supports: Provide metal equipment supports, internally reinforced and capable of supporting superimposed live and dead loads, including equipment loads and other construction to be supported. Fabricate with welded or sealed mechanical corner joints, with integral metal cant and integral formed mounting flange at perimeter bottom. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

- 1. Manufacturers:
 - a. Colony Custom Curbs.
 - b. Commodity Products Company, Inc.
 - c. Conn-Fab Sales, Inc.
 - d. Curbs Plus Inc.
 - e. Custom Curb, Inc.
 - f. LM Curbs.
 - g. Loren Cook Company.
 - h. Metallic Products Corporation.
 - i. Pate Company (The).
 - j. Roof Products & Systems Corporation.
 - k. Roof Products, Inc.
 - l. Thaler Metal Industries Ltd.
 - m. ThyCurb; Div. of Thybar Corporation.
 - n. Uni-Curb, Inc.
 - o. Vent Products Company, Inc.
- 2. Material: Galvanized steel sheet, 0.079 inch thick.
 - a. Finish: Prime painted.

3. Factory-install continuous wood nailers 5-1/2 inches wide at tops of equipment supports.
4. Load requirements: refer to Drawings
5. Metal Counterflashing: Manufacturer's standard removable counterflashing, fabricated of same metal and finish as equipment support.
6. On ribbed or fluted metal roofs, form flange at perimeter bottom to conform to roof profile.
7. Fabricate units to minimum height of 12 inches, unless otherwise indicated.
8. Sloping Roofs: Where slope of roof deck exceeds 1:48, fabricate curb units with water diverter or cricket and with height tapered to match slope to level tops of units.

2.5 ROOF HATCHES

- A. Roof Hatches: Fabricate roof hatches with insulated double-wall lids and insulated double-wall curb frame with integral deck mounting flange and lid frame counterflashing. Fabricate with welded or mechanically fastened and sealed corner joints. Provide continuous weathertight perimeter gasketing and equip with corrosion-resistant or hot-dip galvanized hardware.
 1. Manufacturers:
 - a. Babcock-Davis; a Cierra Products Inc. Company.
 - b. Bilco Company (The).
 - c. Custom Curb, Inc.
 - d. Dur-Red Products.
 - e. Hi Pro International, Inc.
 - f. J. L. Industries, Inc.
 - g. Nystrom, Inc.
 - h. O'Keefe's, Inc.
 - i. Precision Ladders, LLC.
 - j. ThyCurb; Div of Thybar Corporation.
 2. Loads: Fabricate roof hatches to withstand 40-lbf/sq. ft. external and 20-lbf/sq. ft. internal loads.
 3. Type and Size: Single-leaf lid, 30 inches by 36 inches.
 4. Curb and Lid Material: Galvanized steel sheet, 0.079 inch thick.
 - a. Finish: Prime painted.
 5. Insulation: Glass-fiber board.
 6. Interior Lid Liner: Manufacturer's standard metal liner of same material and finish as outer metal lid.
 7. Exterior Curb Liner: Manufacturer's standard metal liner of same material and finish as metal curb.
 8. On ribbed or fluted metal roofs, form flange at perimeter bottom to conform to roof profile.
 9. Fabricate units to minimum height of 12 inches, unless otherwise indicated.

10. Sloping Roofs: Where slope or roof deck exceeds 1:48, fabricate hatch curbs with height constant.
 11. Hardware: Stainless-steel spring latch with turn handles, butt- or pintle-type hinge system, and padlock hasps inside and outside.
- B. Ladder-Assist Post: Roof-hatch manufacturer's standard device for attachment to roof-access ladder.
1. Operation: Post locks in place on full extension; release mechanism returns post to closed position.
 2. Height: 42 inches above finished roof deck.
 3. Material: Steel tube.
 4. Post: 1 5/8 inch diameter pipe.
 5. Finish: Manufacturer's standard baked enamel or powder coat.
 6. Color: As selected by Architect from the manufacturer's full range of colors.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of work.
1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored and is ready to receive roof accessories.
 2. Verify dimensions of roof openings for roof accessories.
 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install roof accessories according to manufacturer's written instructions. Anchor roof accessories securely in place and capable of resisting forces specified. Use fasteners, separators, sealants, and other miscellaneous items as required for completing roof accessory installation. Install roof accessories to resist exposure to weather without failing, rattling, leaking, and fastener disengagement.
- B. Install roof accessories to fit substrates and to result in watertight performance.
- C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
1. Coat concealed side of uncoated aluminum or stainless-steel roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
 2. Underlayment: Where installing exposed-to-view components of roof accessories directly on cementitious or wood substrates, install a course of felt

- underlayment and cover with a slip sheet, or install a course of polyethylene underlayment.
3. Bed flanges in thick coat of asphalt roofing cement where required by roof accessory manufacturers for waterproof performance.
- D. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.
 - E. Roof Curb Installation:
 1. Set roof curb so top surface of roof curb is level.
 - F. Equipment Support Installation:
 1. Set equipment support so top surface of equipment support is level.
 - G. Roof Hatch Installation:
 1. Check roof hatch for proper operation. Adjust operating mechanism as required. Clean and lubricate joints and hardware.
 - H. Seal joints with elastomeric sealant as required by manufacturer of roof accessories.
- 3.3 TOUCH UP
- A. Touch up factory-primed surfaces with compatible primer ready for field painting in accordance with Division 9 painting Sections.
 - B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.
- 3.4 CLEANING
- A. Clean exposed surfaces according to manufacturer's written instructions.

END OF SECTION 07720