SECTION 076223 - FABRICATED GUTTERS AND DOWNSPOUTS

Use this section for heavy duty commercial type gutters. Use section 077123 for light duty gutters.

1. GENERAL
	* + 1. RELATED DOCUMENTS

Retain or delete this article in all Sections of Project Manual.

* + - * 1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
			1. SUMMARY
				1. Section Includes:

Formed roof-drainage sheet metal fabrications.

* + - 1. SUBMITTALS
				1. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the General Conditions.
				2. Manufacturer’s installation instructions shall be provided along with product data.
				3. Submittals shall be provided in the order in which they are specified and tabbed (for combined submittals).
				4. Product Data: For each type of product.

Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

* + - * 1. Sustainable Design Submittals:
				2. Shop Drawings: For roof specialties.

Show method of forming, jointing, and securing the gutters and downspouts. Include attachment to adjoining construction.

* + - * 1. Samples: For each type of roof specialty and for each color and texture specified.

Samples for Initial Selection: For each type of roof specialty indicated with factory-applied color finishes.

Samples for Verification:

Include Samples of each type of roof specialty to verify finish and color selection, in manufacturer's standard sizes.

Retain subparagraph below when necessary to verify fabrication techniques in absence of a mock-up requirement.

Include [**copings] [roof-edge specialties] [roof-edge drainage systems] [reglets and counterflashings**] made from 12-inch lengths of full-size components in specified material, and including fasteners, cover joints, accessories, and attachments.

* + - * 1. Qualification Data: For manufacturer.

Retain "Product Certificates" paragraph below to require submittal of product certificates from manufacturers.

Retain "Product Certificates" and "Product Test Reports" paragraphs below for each type of roof specialty if applicable.

Product Certificates: For each type of roof specialty.

Product Test Reports: For [**copings] [and] [roof-edge flashings**], for tests performed by a qualified testing agency.

Sample Warranty: For manufacturer's special warranty.

* + - 1. CLOSEOUT SUBMITTALS
				1. Maintenance Data: For roofing specialties to include in maintenance manuals.
			2. QUALITY ASSURANCE
				1. Manufacturer Qualifications: A qualified manufacturer offering products meeting requirements that are [**FM Approvals listed for specified class**] [**and**] [**SPRI ES-1 tested to specified design pressure**].

Retain "Source Limitations" paragraph below if required for Project. Coordinate with "Warranty" Article of this Section and requirements of Project roofing-membrane Section.

* + - * 1. Source Limitations: Obtain roof specialties approved by manufacturer providing roofing-system warranty specified in Section <**Insert Section number and title**>.
				2. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and set quality standards for fabrication and installation.

Retain one of first three subparagraphs below for large-scale mockup; insert other mockup requirements or revise if required. Indicate portion of building represented by mockup on Drawings, or draw mockup as separate element. Coordinate with mockup requirements of other Sections if applicable.

Build mockup of typical roof edge as shown on Drawings.

Build mockup of typical roof edge as part of Integrated Exterior Mockup.

Build mockup of typical roof edge, including [**fascia] [gutter] [and] [downspout] <Insert item**>, approximately [**10 feet] <Insert dimension**> long, including supporting construction, seams, attachments,[ underlayment,] and accessories.

Retain first subparagraph below if mockups are not only for establishing appearance factors.

Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

* + - 1. DELIVERY, STORAGE, AND HANDLING
				1. Do not store materials in contact with other materials that might cause staining, denting, or other surface damage. Store roof specialties away from uncured concrete and masonry.
				2. Protect strippable protective covering on roof specialties from exposure to sunlight and high humidity, except to extent necessary for the period of roof-specialty installation.
			2. FIELD CONDITIONS
				1. Field Measurements: Verify profiles and tolerances of roof-specialty substrates by field measurements before fabrication, and indicate measurements on Shop Drawings.
				2. Coordination: Coordinate roof specialties with flashing, trim, and construction of parapets, roof deck, roof and wall panels, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.
			3. WARRANTY

Retain "Special Warranty on Painted Finishes" Paragraph below for factory-coated metal. Delete if metal is left uncoated or field finished. Coordinate with finishes retained in Part 2.

* + - * 1. Special Warranty on Painted Finishes: Manufacturer agrees to repair finish or replace roof specialties that show evidence of deterioration of factory-applied finishes within specified warranty period.

Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:

Color fading more than 5 Delta E units when tested according to ASTM D2244.

Chalking in excess of a No. 8 rating when tested according to ASTM D4214.

Cracking, checking, peeling, or failure of paint to adhere to bare metal.

Finish Warranty Period: 20 years from date of Substantial Completion.

1. PRODUCTS
	* + 1. PERFORMANCE REQUIREMENTS
				1. General Performance: Roof specialties shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.
				2. Sheet Metal Standard for Flashing and Trim: Comply with SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.
				3. Sheet Metal Standard for Copper: Comply with CDA's "Copper in Architecture Handbook." Conform to dimensions and profiles shown unless more stringent requirements are indicated.
				4. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

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

* + - 1. ROOF-DRAINAGE SHEET METAL FABRICATIONS
				1. Hanging Gutters:

Fabricate to cross section required, complete with end pieces, outlet tubes, and other accessories as required.

Fabricate in minimum 96-inch-long sections.

Furnish flat-stock gutter brackets and [**flat-stock] [twisted**] gutter spacers and straps fabricated from same metal as gutters, of size recommended by cited sheet metal standard, but with thickness 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.[ **Shop fabricate interior and exterior corners**.]

Gutter styles in "Gutter Profile" subparagraph below are NRCA and SMACNA designations for shapes of formed rectangular hanging gutters. Delete designations and revise text if Drawings indicate profile in sufficient detail.

Gutter Profile: [**Style A] [Style B] [Style C] [Style D] [Style E] [Style F] [Style G] [Style H] [Style I] [Style J] [Style K] [Style L**] in accordance with cited sheet metal standard.

Expansion Joints: Butt type with cover plate.

Use “Copper” wire ball downspout strainer for copper and steel gutters. Use “Aluminum” wire ball downspout strainer for aluminum gutters.

Accessories: [**Continuous, removable leaf screen with sheet metal frame and hardware cloth screen] [[Copper][Aluminum]Wire-ball downspout strainer] [Valley baffles**].

Fabricate from the following materials:

Copper: 20 oz./sq. ft.

Aluminum: 0.032 inch thick.

Zinc-Tin Alloy-Coated Copper: 20 oz./sq. ft.

Galvanized Steel: 0.034 inch thick.

* + - * 1. Downspouts: Fabricate [**round**] [**rectangular**] [**open-face**] downspouts to dimensions indicated on Drawings, complete with mitered elbows. Furnish with metal hangers from same material as downspouts and anchors.[**Shop fabricate elbows.**]

Retain "Fabricated Hanger Style," "Manufactured Hanger Style," or "Hanger Style" subparagraph below to suit Project. Hanger styles in first two subparagraphs refer to SMACNA figure designations for shapes of fabricated and manufactured hangers; NRCA does not have numerical designations for hanger styles or as many hanger styles. Delete all three below if Drawings indicate cross section or profile in sufficient detail.

Fabricated Hanger Style: [**Fig. 1-35A] [Fig. 1-35B] [Fig. 1-35C] [Fig. 1-35D] [Fig. 1-35E] [Fig. 1-35F] [Fig. 1-35G] [Fig. 1-35H] [Fig. 1-35I] [Fig. 1-35J**] in accordance with SMACNA's "Architectural Sheet Metal Manual."

Manufactured Hanger Style: [**Fig. 1-34A] [Fig. 1-34B] [Fig. 1-34C] [Fig. 1-34D] [Fig. 1-34E**] in accordance with SMACNA's "Architectural Sheet Metal Manual."

Hanger Style: <**Insert description**>.

Fabricate from the following materials:

Copper: 16 oz./sq. ft.

Aluminum: 0.024 inch thick.

Zinc-Tin Alloy-Coated Copper: 16 oz./sq. ft.

Galvanized Steel: 0.028 inch thick.

* + - * 1. Conductor Heads: Fabricate conductor heads with flanged back and stiffened top edge and of dimensions and shape required, complete with outlet tubes[**, exterior flange trim,**] [**and**] [**built-in overflows**]. Fabricate from the following materials:

Copper: 16 oz./sq. ft.

Aluminum: 0.032 inch thick.

Zinc-Tin Alloy-Coated Copper: 16 oz./sq. ft.

Galvanized Steel: 0.028 inch thick.

* + - 1. MATERIALS
				1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A653, G90 coating designation.
				2. Aluminum Sheet: ASTM B209, alloy as standard with manufacturer for finish required, with temper to suit forming operations and performance required.
				3. Copper Sheet: ASTM B370, cold-rolled copper sheet, H00 or H01 temper.
			2. UNDERLAYMENT MATERIALS

Retain applicable paragraphs in this article for roof specialties applied directly over dissimilar metal or corrosive substrates. These underlayments are also used to resist leaks and to provide continuity of building water, air, and vapor barriers.

Type II (No. 30) felt or self-adhering sheet underlayment is generally used over wood blocking or sheathing when air- and moisture-tight construction is not required; verify need with roof-specialty manufacturer.

* + - * 1. Felt: ASTM D226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.

Slip sheet in "Slip Sheet" paragraph below is often used over other types of underlayment materials and may be required over a felt underlayment; verify need with roof-specialty manufacturer.

* + - * 1. Slip Sheet: Rosin-sized building paper, 3-lb/100 sq. ft. minimum.
			1. MISCELLANEOUS MATERIALS
				1. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:

Retain applicable subparagraphs below and revise to suit Project.

Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.

Fasteners for Copper Sheet: Copper, hardware bronze, or passivated Series 300 stainless steel.

Fasteners for Aluminum: Aluminum or Series 300 stainless steel.

Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A153 or ASTM F2329.

* + - * 1. Elastomeric Sealant: ASTM C920, elastomeric silicone polymer sealant of type, grade, class, and use classifications required by roofing-specialty manufacturer for each application.

Retain "Butyl Sealant" paragraph below for concealed sealant use in metal joints with limited movement.

* + - * 1. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type joints with limited movement.
				2. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D1187.
				3. Asphalt Roofing Cement: ASTM D4586, asbestos free, of consistency required for application.

Retain "Solder for Copper" paragraph below if required for copper components.

* + - * 1. Solder for Copper: ASTM B32, Grade Sn50, 50 percent tin and 50 percent lead.
				2. Radiant-Heating Electric Cables:

Self-regulating braided radiant-heat trace cables designed to supply a continuous maintained temperature of 150 degree F at any point along the length of cable. Cables must be able to be cut to length and terminated in the field.

Voltage: 120V.

Output: 5 watts per foot.

Clip fasteners.

* + - * 1. Splash Pad: Precast concrete, 3500 psi. Form splash pads with a sloped depressed center area. Approximate size, one foot wide x two feet long.
			1. FINISHES
				1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
				2. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
				3. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

Retain one of or more finish descriptions from four finishes paragraphs below corresponding to finish selections indicated under product descriptions above or on Drawings.

* + - * 1. Coil-Coated Galvanized-Steel Sheet Finishes:

High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with ASTM A755 and coating and resin manufacturers' written instructions.

Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions[ **for seacoast and severe environments**].

Concealed Surface Finish: Apply pretreatment and manufacturer's standard acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

* + - * 1. Coil-Coated Aluminum Sheet Finishes:

High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions[ for seacoast and severe environments].

Concealed Surface Finish: Apply pretreatment and manufacturer's standard acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

* + - * 1. Copper Sheet Finishes:

Retain one of or both finish subparagraphs below. Retain "Non-Patinated Finish" subparagraph for natural-color copper finish that weathers and changes color naturally over time. If retaining more than one finish, indicate locations of each on Drawings or by inserts.

Non-Patinated Finish: Mill finish.

Retain "Pre-Patinated Finish" subparagraph below for pre-patinated finishes, offered by some manufacturers, which reduce nonuniform weathering of exposed copper sheet. Verdigris is the ultimate, light-green color of aged copper.

Pre-Patinated Finish: Chemically treated according to ASTM B882.

1. EXECUTION
	* + 1. EXAMINATION
				1. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.
				2. Examine walls, roof edges, and parapets for suitable conditions for roof specialties.
				3. Verify that substrate is sound, dry, smooth, clean, sloped for drainage where applicable, and securely anchored.
				4. Proceed with installation only after unsatisfactory conditions have been corrected.
			2. INSTALLATION OF UNDERLAYMENT
				1. Felt Underlayment: Install with adhesive for temporary anchorage to minimize use of mechanical fasteners under roof specialties. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches.
				2. Slip Sheet: Install with tape or adhesive for temporary anchorage to minimize use of mechanical fasteners under roof specialties. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches.
			3. INSTALLATION, GENERAL
				1. Install sheet metal flashing and trim to comply with details indicated and recommendations of cited sheet metal standard that apply to installation characteristics required unless otherwise indicated on Drawings.

Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.

Provide uniform, neat seams with minimum exposure of solder and sealant.

Install roof specialties to fit substrates and to result in weathertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.

Torch cutting of roof specialties is not permitted.

Retain subparagraph below if required to prevent galvanic corrosion between graphite and aluminum.

Do not use graphite pencils to mark metal surfaces.

* + - * 1. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

Coat concealed side of [**uncoated aluminum] [and] [stainless steel**] roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.

Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof specialties for waterproof performance.

* + - * 1. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.

Space movement joints at a maximum of 10 feet with no joints within 18 inches of corners or intersections unless otherwise indicated on Drawings.

When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.

* + - * 1. Fastener Sizes: Use fasteners of sizes that penetrate [**wood blocking or sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws**] [**substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance**].
				2. Seal concealed joints with butyl sealant as required by roofing-specialty manufacturer.
				3. Seal joints as required for weathertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F.

Delete paragraphs below when specifying steel or aluminum gutters.

* + - * 1. Solder copper connections with one inch wide lapped, riveted, and soldered seams. Use 3/16 inch diameter rivets spaced 2 inches oc.
				2. Tinning and Soldering:

Use hand held soldering coppers only. The use of opened flame torch is not permitted.

Tin Surfaces of uncoated metal in contact with solder.

Wire brush surfaces of coated metals in contact with solder. Produce a clean and bright surface.

Apply flux as required.

Sweat solder thoroughly into seams, completely filling the full width of the seam.

Upon completion of soldering, remove traces of flux residue. If required, apply a neutralizing wash followed by a clean water wash.

Delete paragraph below when specifying copper gutters.

* + - * 1. Join steel sections with one inch wide lapped, riveted, and sealed seams. Seal seams with butyl tape sealant within the lap and polyester cloth embedded in silicone sealant over the entire joint. Use 3/16 inch diameter rivets spaced on inch oc.
			1. INSTALLATION OF ROOF-EDGE DRAINAGE-SYSTEM
				1. Connection to Existing Construction: Tie the items of Work in with the existing work to obtain watertight installation. Match the existing installation as much as practicable, unless otherwise specified. Repair and dress adjacent existing components as required to make secure and neat connections with new items.
				2. Install sheet metal roof-drainage items to produce complete roof-drainage system in accordance with cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.
				3. Hanging Gutters:

Join sections with [**riveted and soldered joints] [or] [joints sealed with sealant**].

Provide for thermal expansion.

Attach gutters at eave or fascia to firmly anchor them in position.

Provide end closures and seal watertight with sealant.

Slope to downspouts.

Fasten gutter spacers to front and back of gutter.

Anchor and loosely lock back edge of gutter to continuous [**cleat] [eave or apron flashing**].

Generally, retain only one of first two subparagraphs below; revise to suit Project.

Anchor gutter with gutter brackets spaced not more than 36 inches apart to roof deck unless otherwise indicated, and loosely lock to front gutter bead.

Install gutter with expansion joints at locations indicated on Drawings, but not exceeding, 48 feet apart. Install expansion-joint caps.

Install continuous gutter screens on gutters with noncorrosive fasteners, [**removable**] [**hinged to swing open**] for cleaning gutters.

* + - * 1. Downspouts:

Join sections with 1-1/2-inch telescoping joints.

Provide hangers with fasteners designed to hold downspouts securely to walls.

Locate hangers at top and bottom and at approximately 60 inches o.c.

Retain one of two subparagraphs below; delete both if indicated on Drawings.

Provide elbows at base of downspout to direct water away from building.

Connect downspouts to underground drainage system.

* + - * 1. Installation of Splash Pads: Install splash pads under discharge elbows unless otherwise indicated.
				2. Conductor Heads: Anchor securely to wall with elevation of conductor top edge 1 inch below gutter discharge.
			1. CLEANING AND PROTECTION

Retain paragraphs below that apply to roof specialties specified for Project. First paragraph below is not applicable to stainless steel or to painted or coated steel and aluminum.

* + - * 1. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
				2. Clean and neutralize flux materials. Clean off excess solder and sealants.
				3. Remove temporary protective coverings and strippable films as roof specialties are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof specialties in a clean condition during construction.
				4. Replace roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 076223