

SECTION 07 61 00
SHEET METAL ROOFING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Metal roofing.
 - 2. Underlayments.

1.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Metal roof panels shall comply with performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Delegated Design: Design metal roof panel assembly, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- C. Air Infiltration: Air leakage through assembly of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) of roof area when tested according to ASTM E 1680 at the following test-pressure difference:
 - 1. Test-Pressure Difference: Positive and negative 1.57 lbf/sq. ft. (75 Pa)
 - 2. Positive Preload Test-Pressure Difference: Greater than or equal to 15.0 lbf/sq. ft. (720 Pa) and the greater of 75 percent of building live load or 50 percent of building design positive wind-pressure difference.
 - 3. Negative Preload Test-Pressure Difference: 50 percent of design wind-uplift-pressure difference.
- D. Water Penetration: No water penetration when tested according to ASTM E 1646 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 2.86 lbf/sq. ft. (137 Pa) .
 - 2. Test-Pressure Difference: 20 percent of positive design wind pressure, but not less than 6.24 lbf/sq. ft. (300 Pa) and not more than 12.0 lbf/sq. ft. (575 Pa).
 - 3. Positive Preload Test-Pressure Difference: Greater than or equal to 15.0 lbf/sq. ft. (720 Pa) and the greater of 75 percent of building live load or 50 percent of building design positive wind-pressure difference.
 - 4. Negative Preload Test-Pressure Difference: 50 percent of design wind-uplift-pressure difference .
- E. Hydrostatic-Head Resistance: No water penetration when tested according to ASTM E 2140.

- F. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with the requirements of the International Building Code, 2006 edition and UL 580 for wind-uplift-resistance class indicated.
 - 1. Uplift Rating: UL 90.
- G. Structural Performance: Provide metal roof panel assemblies capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 1592:
 - 1. Wind Loads: 130 mph wind load, as determined according to the International Building Code, 2006 edition.
 - 2. Deflection Limits: Metal roof panel assemblies shall withstand wind and snow loads with vertical deflections no greater than 1/240 of the span.
- H. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- I. Thermal Performance: Provide insulated metal roof panel assemblies with thermal-resistance value (R-value) indicated when tested according to ASTM C 518.

1.3 SUBMITTALS

- A. Product Data: Submit Manufacturer's Specifications, design data and installation instructions for each type of underlayment product and metal roof system indicated.
- B. Shop Drawings: Show fabrication and installation layouts of metal roof panels; details of edge conditions, side-seam and endlap joints, panel profiles, corners, anchorages, trim, flashings, closures, and accessories; and special details. Distinguish between factory- and field-assembled work.
 - 1. Accessories: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches (1:10):
 - a. Flashing and trim.
 - b. Roof curbs.
- C. Samples: For each type of exposed finish required, prepared on Samples of size indicated below:
 - 1. Metal Roof Panels: 12 inches (300 mm) long by actual panel width. Include fasteners, clips, closures, and other metal roof panel accessories.
 - 2. Trim and Closures: 12 inches (300 mm) long. Include fasteners and other exposed accessories.
- D. Delegated-Design Submittal: For metal roof panel assembly indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

- E. Coordination Drawings: Roof plans, drawn to scale, on which the following are shown and coordinated with each other, based on input from installers of the items involved:
 - 1. Roof panels and attachments.
 - 2. Purlins and rafters.
 - 3. Roof-mounted items including roof hatches, equipment supports, pipe supports and penetrations, lighting fixtures, snow guards, and items mounted on roof curbs.
- F. Manufacturer Certificates: Signed by manufacturer certifying that roof panels comply with energy performance requirements specified in "Performance Requirements" Article.
 - 1. Submit evidence of meeting performance requirements.
- G. Qualification Data: For qualified Installer, professional engineer, and testing agency.
- H. Material Certificates: For thermal insulation and vapor retarders, from manufacturer.
- I. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.
- J. Field quality-control reports.
- K. Maintenance Data: For metal roof panels to include in maintenance manuals.
- L. Warranties: Samples of special warranties.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of sheet metal roofing.
- B. Roll-Formed Sheet Metal Roofing Fabricator Qualifications: An authorized representative of roll-formed sheet metal roofing manufacturer for fabrication and installation of units.
- C. Sheet Metal Roofing Standard: Comply with SMACNA's "Architectural Sheet Metal Manual."
- D. Preinstallation Conference: Conduct conference at Project site. Review methods and procedures related to sheet metal roofing including, but not limited to, the following:
 - 1. Meet with Owner, Owner's Project Representative, Architect, Owner's insurer if applicable, sheet metal roofing Installer, metal deck Installer, and installers whose work interfaces with or affects sheet metal roofing including installers of roof accessories and roof-mounted equipment.
 - 2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 3. Review methods and procedures related to sheet metal roofing installation.

4. Examine metal deck conditions for compliance with requirements, including flatness and attachment to structural members.
5. Review structural loading limitations of metal deck during and after roofing.
6. Review flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect sheet metal roofing.
7. Review governing regulations and requirements for insurance, certificates, and testing and inspecting if applicable.
8. Review temporary protection requirements for sheet metal roofing during and after installation.
9. Review roof observation and repair procedures after sheet metal roofing installation.
10. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.5 WARRANTY

- A. **Manufacturer's Warranty:** Provide manufacturers warranty that the roofing system, including roof panels, flashing and related items used to fasten the roof panels and flashings, will not allow intrusion of water from the exterior of the roofing manufacturer's Roof System into the building envelope, when exposed to the ordinary weather conditions and ordinary wear and usage.
 1. **Warranty Period:** 20 years from date of Substantial Completion.
- B. **Warranty on Finishes:** Manufacturer's standard form in which manufacturer agrees to repair finish or replace sheet metal roofing that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 1. **Fluoropolymer Finish Warranty Period:** 20 years from date of Substantial Completion.
- C. **Installer's Warranty:** Roofing Installer's warranty, on manufacturer's standard form, signed by Roofing Installer, in which Roofing Installer agrees to repair or replace components of custom-fabricated sheet metal roofing that fail in materials or workmanship within specified warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Structural failures.
 - b. Loose parts.
 - c. Wrinkling or buckling.
 - d. Failure to remain weathertight, including uncontrolled water leakage.
 - e. Deterioration of metals, metal finishes, and other materials beyond normal weathering, including nonuniformity of color or finish.
 - f. Galvanic action between sheet metal roofing and dissimilar materials.
 2. **Warranty Period:** 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 ROOFING SHEET METALS

- A. Prefinished Metal:
 - 1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653, G90 coating designation; structural quality.
 - 2. Thickness: Minimum of 24 gage, unless otherwise indicated.
 - 3. Exposed Finishes:
 - a. High-Performance Organic Finish: 2 or 3-coat thermocured system containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with physical properties and coating performance requirements of AAMA 2604: Provide clear top coat (3rd coat) as recommended by manufacturer.
 - 1) Primer: Type as recommended by the Fluoropolymer manufacturer, 0.20 mil minimum coating thickness.
 - 2) Color coat: fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 605, 1.0 mil dry film thickness.
 - 3) Clear coat: As recommended by the Fluoropolymer manufacturer if required for color selected.
 - b. Color: As selected by Architect.
 - c. Factory Prime Coating: White or light-colored, factory-applied, baked-on epoxy primer coat.
- B. Strippable film: Liquid applied to top side of painted coil to protect finish during fabrication, shipping and field handling.

2.2 UNDERLAYMENT

- A. Felts: ASTM D 226, Type II (No. 30), asphalt-saturated organic felts.

2.3 ACCESSORIES

- A. Sheet Metal Roofing Accessories: Provide components required for a complete sheet metal roofing assembly including trim, copings, fasciae, corner units, ridge closures, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of sheet metal roofing, unless otherwise indicated.
 - 1. Clips: Manufacturer's standard panel clips designed to withstand negative-load requirements.
 - 2. Cleats: Manufacturer's standard mechanically seamed cleats.

- B. Flashing and Trim: Formed from 24 gauge, metallic-coated steel sheet. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent sheet metal roofing.
- C. Fasteners: Self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads. Use fasteners of sizes that will not penetrate a minimum of 1/4 inch, but not completely through substrate.
 - 1. Exposed Fasteners: Heads matching color of sheet metal roofing by means of plastic caps or factory-applied coating.
 - 2. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws with hex washer head.
 - 3. Blind Fasteners: High-strength aluminum or stainless-steel rivets.
 - 4. Fastener materials:
 - a. Steel Roofing: Use stainless-steel fasteners.
- D. Clips:
 - 1. Provide UL listed clip designed to allow panels to thermally expand and contract.
 - 2. Clip shall be designed to meet positive and negative pressures as calculated per local building code.
- E. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.
- F. Elastomeric Joint Sealant: ASTM C 920, of base polymer, type, grade, class, and use classifications required to produce joints in sheet metal roofing that will remain weathertight.
- G. Expansion-Joint Sealant: For hooked-type expansion joints, which must be free to move, provide nonsetting, nonhardening, nonmigrating, heavy-bodied polyisobutylene sealant.
- H. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat.

2.4 FABRICATION

- A. General:
 - 1. Fabricate roll-formed sheet metal according to equipment manufacturer's written instructions and to comply with details recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions (pan width and seam height), geometry, metal thickness, and other characteristics of installation indicated.

2. Fabricate roll-formed sheet metal roofing panels with UL-certified, portable roll-forming equipment capable of producing roofing panels for sheet metal roofing assemblies that comply with UL 580 for wind-uplift resistance classification specified in "Quality Assurance" Article.
 3. When required, panel assembly to bear Underwriter's Laboratories Label UL90, pursuant to Construction Number 403 and/or Fire Ratings.
 4. Certification shall be submitted, based on independent testing laboratory, indicating no measurable water penetration or air leakage through the system when tested in accordance with ASTM E-1646 and E-1680.
- B. Configuration: As selected by Architect.
- C. Fabrication Tolerances: Fabricate sheet metal roofing that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.
- D. Fabricate sheet metal roofing to allow for expansion in running work sufficient to prevent leakage, damage, and deterioration of the Work. Form exposed sheet metal work to fit substrates without excessive oil canning, buckling, and tool marks, true to line and levels indicated, and with exposed edges folded back to form hems.
1. Form and fabricate sheets, seams, strips, cleats, valleys, ridges, edge treatments, integral flashings, and other components of metal roofing to profiles, patterns, and drainage arrangements shown and as required for leakproof construction.
- E. Expansion Provisions: Fabricate sheet metal roofing to allow for expansion in running work sufficient to prevent leakage, damage, and deterioration of the Work. 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.
- F. Metal Protection: Where dissimilar metals will contact each other, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by manufacturers of dissimilar metals or by fabricator.
- G. Sheet Metal Accessories: Custom fabricate flashings and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated. Obtain field measurements for accurate fit before shop fabrication.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Examine subsurfaces to receive Work and report detrimental conditions in writing to Architect. Commencement of Work will be construed as acceptance of subsurfaces.
 - 1. Examine metal deck to ensure proper attachment to framing.
 - 2. Inspect roof deck to verify deck is clean and smooth, free of depressions, waves or projections, properly sloped to valleys and eaves.
 - 3. Verify roof openings, curbs, pipes, sleeves, ducts or vents through roof are solidly set, cant strips and reglets in place, and nailing strips located.
 - 4. Verify deck is dry and free of snow or ice. Flutes in steel deck to be clean and dry and joints in wood deck to be solidly supported and nailed.
 - 5. Ensure that all nail heads are totally flush with the substrate.
- B. Coordination: Coordinate with other Work which affects, connects with, or will be concealed by this Work.

3.2 PREPARATION

- A. Install flashings and other sheet metal to comply with requirements specified in Section 07 62 00 -Sheet Metal Flashing and Trim.

3.3 UNDERLAYMENT INSTALLATION

- A. Felt Underlayment: Install felt underlayment and building-paper slip sheet on roof sheathing under sheet metal roofing. Use adhesive for temporary anchorage. Apply at locations indicated on Drawings, in shingle fashion to shed water, with lapped joints of not less than 2 inches.

3.4 INSTALLATION – METAL ROOF

- A. Comply with Manufacturers standard instructions and conform to SMACNA Architectural Sheet Metal Manual to achieve a watertight installation.
- B. General: Install sheet metal roofing perpendicular to purlins or supports. Anchor sheet metal roofing and other components of the Work securely in place, with provisions for thermal and structural movement. Install fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for a complete roofing system and as recommended by fabricator for sheet metal roofing.
 - 1. Field cutting of sheet metal roofing by torch is not permitted.
 - 2. Provide metal closures as required.
 - 3. Flash and seal sheet metal roofing with weather closures at eaves, rakes, and at perimeter of all openings. Fasten with self-tapping screws.

- C. Attach panels using Manufacturer's standard clips and fasteners, spaced in accordance with approved Shop Drawings.
- D. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by fabricator of sheet metal roofing or manufacturers of dissimilar metals.
- E. Conceal fasteners and expansion provisions in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
 - 1. Exposed fasteners shall be approved by Architect.
- F. Fabricate and install work with lines and corners of exposed units true and accurate. Form exposed faces flat and free of buckles, excessive waves, and avoidable tool marks, considering temper and reflectivity of metal. Provide uniform, neat seams with minimum exposure of sealant. Fold back sheet metal to form a hem on concealed side of exposed edges, unless otherwise indicated.

3.5 ACCESSORY INSTALLATION

- A. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.
 - 1. Install components required for a complete sheet metal roofing assembly including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
 - 2. Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

3.6 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as sheet metal roofing is installed. On completion of sheet metal roofing installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.

END OF SECTION

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