SECTION 074113 - STANDING SEAM ROOF PANELS

This specification is applicable for IMETCO Series 300 structural standing seam panel system with separate mechanically seamed batten cap.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY.

Modify as necessary

A. Work described in this section includes pre-formed metal roofing system complete with clips, perimeter and penetration flashing, closures, gutters, and downspouts.

B. Related work specified elsewhere:

1. Structural steel.
2. Steel joists.
3. Metal roof decks.
4. Wood roof decks.
5. Metal fabrications.
6. Rough carpentry.
7. Flashing and sheet metal. (Not roof panel related).
8. Air barrier and vapor retarder.
9. Thermal insulation.
10. Sealants.

1.3 DEFINITIONS

A. American Architectural Manufacturer Association (AAMA):

1. AAMA 501.1-05: Standard Test Method for Water Penetration of Windows, Curtain Walls and Doors Using Dynamic Pressure.
2. AAMA 621-96: Voluntary/Standard Specifications for High Performance Organic Coatings on Coil Coated Architectural Hot Dipped Galvanized (HDG) & Zinc-Aluminum Coated Steel Substrates

B. American Iron and Steel Institute (AISI):

1. S100-07: 2007 Edition of the North American Specification for the Design of Cold-Formed Steel Structural Members.

C. American Society of Civil Engineers (ASCE):

1. ASCE 7-05: Minimum Design Loads for Buildings and Other Structures.

D. American Society for Testing and Materials (ASTM):

1. A653-03: Specification for Steel Sheet, Zinc-coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
2. A755–03: Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
3. A792-03: Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
4. B209-02a: Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
5. D1056-00: Specification for Flexible Cellular Materials - Sponge or Expanded Rubber.
6. D3575-00e1: Standard Test Methods for Flexible Cellular Materials made from Olefin Polymers.
7. E1514-98(2003) Standard Specification for Structural Standing Seam Steel Roof Panels.
8. E1592-01: Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference.
9. E1637-98(2003) Standard Specifications for Structural Standing Seam Aluminum Roof Panel Systems.
10. E1646-95(2003): Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference.
11. E1680-95(2003): Standard Test Method for Rate of Air Leakage Through Exterior Metal Roof Panel Systems.
12. E1886-02: Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Storm Shutters Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials.
13. E1996-09 Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes.
14. E2140-01: Standard Test Method for Water Penetration of Metal Roof Panels Systems by Static Water Pressure Head.

Factory Mutual approvals are only valid for certain material, gauge, and panel width configurations. Also, Factory Mutual assembly requirements may significantly affect structural roof elements beyond the metal roofing system. Please contact IMETCO for guidance if considering specifying Factory Mutual requirements.

E. Factory Mutual Approvals (FM):

1. FM 4471, August 1995: Approval Standard for Class I Panel Roofs.

The following test protocols are specific to Florida state building code requirements. They are similar to requirements of national standard tests referenced elsewhere in this specification. Please delete if this project is not subject to Florida Building Code requirements

F. Florida Building Code (FBC):

1. TAS 114-95.1: Test Procedure for Roof Assemblies in High Velocity Hurricane Jurisdiction.
2. TAS 100-95: Test Procedure for Wind and Wind Driven Rain Resistance of Discontinuous Roof.
3. TAS 201-95.1: Impact Test Procedures.
4. TAS 203-95.1: Criteria for Testing Products Subject to Cyclic Wind Pressure Loading.

G. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):

1. Architectural Sheet Metal Manual, 6th edition.

H. Underwriters Laboratory (UL):

1. UL 580, 4th Ed.: Standard for Tests for Uplift Resistance of Roof Assemblies.
2. UL 790, 7th Ed.: Standard for Tests for Fire Resistance of Roof Covering Materials.

I. National Association of Architectural Metal Manufacturers (NAAMM)

1. Metal Finishes Manual for Architectural and Metal Products

1.4 DESIGN AND PERFORMANCE CRITERIA.

A. Thermal Expansion and Contraction.

1. Completed metal roofing and flashing system shall be capable of withstanding expansion and contraction of components caused by changes in temperature without buckling, or reducing performance ability.
2. The design temperature differential shall be not less than 220 degrees Fahrenheit.
3. Interface between panel and clip shall provide for unlimited thermal movement in each direction along the longitudinal direction.

B. Uniform Wind Uplift Load Capacity.

1. Installed roof system shall withstand negative wind uplift pressures complying with the following criteria.
   a. Design Code: ASCE 7, Method 2 for Components and Cladding.
   b. Safety Factor: As determined in accordance with AISI S100 section D6.2.1, but in no instance shall the safety factor be taken to be less than 1.67 for any roof or wall zone. The provisions of Section D6.2.1a of Appendix A shall NOT be applicable for this project.

Select the wind uplift pressure design factors that are applicable to this project. Please contact IMETCO for guidance in selecting appropriate factors and pressures for this specific project.

c. Category [I] [II] [III] [IV] Building with an Importance Factor of [0.77] [1.00] [1.15].

d. Wind Speed: mph.

e. Exposure Category: [B] [C] [D]..

f. Mean Roof Height: _____ feet.

g. Minimum Building Width: _____ feet.

h. Roof Pitch: _____ inches per foot.

Roof Area Negative Uplift Pressure:

Zone 1 - Field of roof _____ psf.

Ridges and hips are only included in zone 2 for roof pitches exceeding 2:12. Delete ridges and hips from the following line, if appropriate.

Zone 2 – Eaves [, ridges, hips,] and rakes _____ psf.

Zone 3 – Corners _____ psf.

The "a" dimension used to determine the width of roof zones 2 and 3 shall be _____ feet.

2. The ultimate capacity of the panel system shall be determined based on performance testing in accordance with ASTM E1592. The allowable load carrying capacity shall be calculated in accordance with AISI S100 section D6.2.1, except the provisions of Section D6.2.1a of Appendix A shall NOT be applicable for this project.

C. Uniform Positive Load Capacity.

1. Uniform positive load capacity shall be determined in accordance with AISI S100.

2. The installed roof system shall be capable of resisting each of the following positive uniform roof loads: Roof Live Load of 20 psf; Roof Snow Load of _____ psf.

3. Installed roof system shall carry positive uniform design loads with a maximum system deflection of L/180 as measured at the rib (web) of the panel.

D. Wind Uplift Classification: The panel system shall be listed as a Class 90 windstorm rated system, as determined by UL 580.

E. Fire Resistance Classification: The panel system shall be listed as a Class A Roof Covering, as determined by UL 790.

F. Air infiltration: The panel system shall be tested in accordance with ASTM E1680, and meet or exceed the following performance requirements:

Pressure	Area Leakage Rate
1.57 PSF	0.0030 cfm/sq.ft.
6.24 PSF	0.0045 cfm/sq.ft.
20.0 PSF	0.0060 cfm/sq.ft.

G. Static air pressure water infiltration: The panel system shall be tested in accordance with ASTM E1646, and meet or exceed the following performance requirements:

Pressure	Result
6.2 Gal/Hr per S.F. and Static Air Pressure of 20.0 psf for 15 minutes	No Leakage

In the next 3 sections, delete reference to FBC test protocols if this project is NOT subject to the requirements of the Florida Building Code.

H. Static water pressure head water infiltration.

1. The panel system shall be tested in accordance with ASTM E2140, and pass with no leakage. The test specimen must include a panel end lap condition and successfully withstand being submerged under 6” of water for 6 hours.
2. The panel system shall be tested in accordance with the FBC TAS 114 Appendix G, and pass with no leakage. The test specimen must successfully withstand being submerged under 6” of water for 168 hours.

I. Dynamic pressure water penetration.

1. The panel system shall be tested in accordance with AAMA 501.1, and pass with no water penetration, other than condensation, when exposed to 8” per hour of dynamic rain and 70 mph wind velocities for not less than five (5) minutes duration.
2. The panel system shall be tested in accordance with FBC TAS 100, and pass with no water penetration, other than condensation, when exposed to 8.8” per hour of dynamic rain and 110 mph wind velocities for not less than five (5) minutes duration.

J. Missile Impact Test and Cyclic Wind Pressure Test.

1. The panel system shall be tested in accordance with ASTM E1886. The tested system shall be of identical profile and material type as the specified panel for this project; thicker gauge and/or narrow width panels than those tested will be acceptable. The anchor clip spacing for this project shall be based on E1592 requirements, but shall not exceed that of the E1886 test report.
2. The panel system shall be tested in accordance with FBC Test Protocols TAS 201 and TAS 203. The tested system shall be of identical profile and material type as the specified panel for this project; thicker gauge and/or narrow width panels than those tested will be acceptable. The anchor clip spacing for this project shall be based on E1592 requirements, but shall not exceed that of the TAS 201 test reports.

Factory Mutual approvals are only valid for certain material, gauge, and panel width configurations. Also, Factory Mutual assembly requirements may significantly affect structural roof elements beyond the metal roofing system. Please contact IMETCO if considering specifying Factory Mutual requirements.

K. Class I Panel Rating: The specified panel system shall be listed as a Class I Panel Roof, in accordance with FM 4471. The tested system shall be identical to the specified panel for this project with regard to profile, gauge, width, and material. The anchor clip spacing for this project name shall be based on E1592 requirements, but the clip spacing for roof zone 1 shall not exceed that of the FM 4471 test reports.

1.5 SUBMITTALS.

A. Shop drawings: Show roof panel system with flashings and accessories in plan view; sections and details. Include metal thicknesses and finishes, panel lengths, joining details, anchorage details, flashings and special fabrication provisions for termination and penetrations. Indicate relationships with adjacent and interfacing work. Shop drawings to be prepared by metal roof panel manufacturer and sealed by a professional engineer registered in the state of the project location.

B. Financial Certification: Provide the building owner with a signed and notarized (sealed) affidavit by an officer of the panel system manufacturer which confirms a current minimum corporate asset-to-liability ratio of not less than 3:1 for the panel manufacturer, or its parent corporation. Financial support information and affidavit must be dated within 30 days prior to the product submittal.

C. Design Test Reports.

1. Submit copies of design test reports for each of the performance testing standards listed in specification article 1.4.

2. Test reports shall be performed by independent, accredited testing laboratories, and shall bear the seal of a registered professional engineer.

D. Warranty: Provide unexecuted specimen warranty documents for each warranty as required in specification article 1.10.

E. Samples.

1. Submit sample of panel section, at least 6" x 6" showing seam profile and also a sample of color selected.

2. Submit sample of panel clip, gable clip, batten seam cap with sealant, and preformed metal and foam closures.

1.6 QUALITY CRITERIA/INSTALLER QUALIFICATIONS.

A. Engage an experienced metal roofing contractor (erector) to install standing seam system who has a minimum of three (3) years experience specializing in the installation of structural standing seam metal roof systems.

B. Contractor must be certified by manufacturer specified as a supplier of standing seam system and obtain written certification from manufacturer that installer is approved for installation of the specified system.

C. Successful contractor must obtain all components of roof system from a single manufacturer. Any secondary products that are required which cannot be supplied by the specified manufacturer must be recommended and approved in writing by primary manufacturer prior to bidding.

D. Fabricator/Installer shall submit work experience and evidence of adequate financial responsibility. Architect reserves the right to inspect fabrication facilities in determining qualifications.

1.7 DELIVERY, STORAGE, AND HANDLING.

A. Inspect materials upon delivery.

B. Handle materials to prevent damage.

C. Store materials off ground providing for drainage; under cover providing for air circulation; and protected from any debris.

1.8 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit metal roof panel work to be performed according to manufacturer's written instructions and warranty requirements.

B. Field Measurements: Verify actual dimensions of construction contiguous with metal roof panels by field measurements before fabrication.

1.9 COORDINATION

A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

Modify the following paragraph to indicate the scope of this project.

B. Coordinate metal roof panels with rain drainage work, flashing, trim, and construction of [decks, purlins, rafters, parapets, walls,] and other adjoining work to provide a leak proof, secure, and noncorrosive installation.

1.10 WARRANTIES

A. Endorse and forward to owner the following warranties:

1. Manufacturer’s standard 20 year roof system weathertightness warranty, jointly signed by the installer and manufacturer. The warranty shall not place any limitations on wind speed, up to a maximum design wind speed as given in Article 1.4 of this specification.

2. Manufacturer's standard 20 year finish warranty covering checking, crazing, peeling, chalking, fading, and adhesion of the prepainted sheet metal materials.

3. Installer's 3 year warranty covering roof panel system installation and watertightness.

B. Warranties shall commence on date of substantial completion.

PART 2 - PRODUCTS

2.1 PANEL MATERIALS

A. Painted, 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 A755/A755M.

1. Recycled Content: Provide steel sheet with average recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content is at least 70 percent.

2. [24] [22] [20] gauge, Zinc-Coated (Galvanized) Steel Sheet, as per ASTM A653: G90 (Z275) coating designation; structural quality, grade 40 ksi (275 MPa).

Stucco embossed material is generally NOT preferred for prefinished sheet steel materials. When specifying embossed material, there is always a risk of the process resulting in micro-fracture of the coating, which can lead to premature failure of the coating and corrosion of the substrate.

3. Texture: [Smooth] [Stucco Embossed] surface.

4. Exposed Coil-Coated Finish:

a. 2-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Manufacturers' approved applicator to prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

b. Coating system shall provide nominal 1.0 mil (0.025 mm) dry film thickness, consisting of primer and color coat.

Select one of the following 4 color choices:

c. Color shall be IMETCO's _____.

d. Color shall be selected from IMETCO's Standard Colors.

e. Color: Custom color selected by architect.

f. Color shall be: _____.

5. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored 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. Clear acrylic coated, 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 A755/A755M.

1. Recycled Content: Provide steel sheet with average recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content is at least 70 percent.

2. [24] [22] gauge, 55% Aluminum-Zinc alloy coated Steel Sheet, as per ASTM A792: AZ55 (AZ165) coating designation; with a nominal .04 mil (0.010 mm) dry film thickness of a clear organic polymer top film; structural quality, grade 50 ksi (340 MPa).

Stucco embossed material is generally NOT preferred for coated sheet steel materials. When specifying embossed material, there is always a risk of the process resulting in micro-fracture of the coating, which can lead to premature failure of the coating and corrosion of the substrate.

3. Texture: [Smooth] [Stucco Embossed] surface.

C. [Painted] [Mill Finish] Aluminum Sheet.

1. Recycle Content: Provide steel sheet with average recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content is at least 45 percent.

2. [0.032”] [0.040”] [0.050”] aluminum alloy 3003, 3004, 3005, or 3105 with H14 or H24 heat treatment, as per ASTM B209/209M.

Stucco embossed material is generally NOT preferred for prefinished aluminum sheet materials. When specifying embossed material, there is always a risk of the process resulting in micro-fracture of the coating, which can lead to premature failure of the coating and corrosion of the substrate.

3. Texture**:** [Smooth] [Stucco Embossed] surface.

If Specifying Prefinished Painted Materials, Delete the following Section.

4. Mill Finish Aluminum: The exposed and unexposed sheet surfaces shall be bare as furnished by the mill.

If Specifying Mill Finish Panels, Delete the following two Sections.

5. Exposed Coil-Coated Finish:

a. 2-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Manufacturers’ approved applicator to prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers’ written instructions.

b. Coating system shall provide nominal 1.0 mil (0.025 mm) dry film thickness, consisting of primer and color coat.

Select one of the following 4 color choices:

c. Color shall be IMETCO’s _____.

d. Color shall be selected from IMETCO’s Standard Colors

e. Color: Custom color selected by architect.

f. Color shall be: _____.

6. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).

D. Panel Sealants:

1. Seam Cap Sealant: Factory applied hot melt, high viscosity, pressure sensitive adhesive with high heat resistance.

2. Sealant Tape: Non-curing, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1-inch- (13-mm-) wide and 1/16-inch- (3-mm-) thick.

3. Exposed Sealant: ASTM C 920; elastomeric tripolymer, polyurethane, or other advanced polymer sealant; of type, grade, class, and use classifications required to seal joints in metal roof panels and remain weathertight; and as recommended in writing by metal roof panel manufacturer.

4. Concealed Sealant: ASTM C 1311: Butyl-Based, Solvent-Release, One-Part Sealant.

2.2 FIELD-INSTALLED THERMAL INSULATION

A. Refer to Division 07 Section "Thermal Insulation."

Retain first paragraph below if required.

B. Polyethylene Vapor Retarders: ASTM D 4397, 6-mils- (0.15-mm-) thick, with maximum permeance rating of 0.13 perm (7.5 ng/Pa x s x sq. m).

Board insulations in first four paragraphs below are typically used over metal deck and solid sheathing. Unfaced board insulation and insulation with foil or asphalt felt/glass-fiber mat facing require 16 gauge bearing plates or Z-shaped furring or channels for metal roof panel support; oriented-strand-board-faced board insulation does not.

Board insulation is recommended to be installed in two or more layers with joints staggered from layer to layer. The lower layers should be specified as unfaced, foil faced or glass-fiber faced boards. Foam board insulation may impact the fire and flame spread rating of a roof assembly; generally, less that 4" of total thickness of polyisocyanurate insulation is acceptable for most roof assemblies. Approved assemblies with thicker foam insulation can be achieved – please contact IMETCO for additional assistance.

C. Unfaced, Polyisocyanurate Board Insulation: ASTM C 591, Type II, compressive strength of 35 psi (240 kPa), with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, based on tests performed.

D. Faced, Polyisocyanurate Board Insulation: ASTM C 1289, [Type I, Class 1 aluminum foil] [Type II, Class 1 or 2 felt or glass-fiber mat, Grade 3] [Type V, oriented-strand-board facing], with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, based on tests performed on unfaced core.

Polystyrene insulation in first two paragraphs below may not be suitable for higher temperatures associated with metal roofing. Verify acceptability with metal roof panel manufacturer.

E. Extruded-Polystyrene Board Insulation: ASTM C 578, Type IV, 1.60-lb/cu. ft. (26-kg/cu. m) minimum density unless otherwise indicated; with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively.

F. Molded-Polystyrene Board Insulation: ASTM C 578, [Type I, 0.9 lb/cu. ft. (15 kg/cu. m)] [Type II, 1.35 lb/cu. ft. (22 kg/cu. m)], with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively.

G. Unfaced, Glass-Fiber Board Insulation: ASTM C 612, Type IA or Types IA and IB; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; and with a nominal density of 3 lb/cu. ft. (48 kg/cu. m).

Verify type of insulation required to obtain a fire-resistance rating if required.

Metal building insulation in paragraph below is commonly used with metal roof panels installed over purlins, especially if it is to be exposed on the interior. Type I insulation is unfaced; Type II is faced.

H. Metal Building Insulation: [ASTM C 991, Type I] [ASTM C 991, Type II], glass-fiber-blanket insulation; 0.5-lb/cu. ft. (8-kg/cu. m) density; 2-inch- (50-mm-) wide, continuous, vapor-tight edge tabs; and with a flame-spread index of 25 or less.

NAIMA recommends that metal building insulation have a vapor-retarder facing with a permeance not greater than 0.10 perm (5.75 ng/Pa x s x sq. m). Facing selection may also be affected by light reflectivity and cold-weather workability.

1. Vapor-Retarder Facing: ASTM C 1136, with permeance not greater than 0.02 perm (1.15 ng/Pa x s x sq. m) when tested according to ASTM E 96, Desiccant Method:

Retain one of five options in first subparagraph below or delete all and insert manufacturer's proprietary product. Fifth option has premium cost but offers very high puncture resistance.

a. Composition: [Polypropylene faced, scrim reinforced, and kraft-paper backing] [Foil faced, scrim reinforced, and kraft-paper backing with vapor-retarder coating] [Polypropylene faced, scrim reinforced, and foil backing] [Vinyl faced, scrim reinforced, and foil backing] [Vinyl faced, scrim reinforced, and polyester backing].

2. Insulation Retainer Strips: 0.019-inch- (0.48-mm-) thick, formed, galvanized-steel or PVC retainer clips colored to match insulation facing.

3. Thermal Spacer Blocks: Fabricated from extruded polystyrene, 1-inch- (25-mm-) thick.

2.3 SUBSTRATE BOARD

A. Glass-Mat Gypsum Sheathing Board: ASTM C 1177/C 1177M.

1. Type and Thickness: [Regular, 1/2 inch (13 mm)] [Type X, 5/8 inch (16 mm)].

Retain the following paragraph is specifying a self-adhesive underlayment.

2. The top surface of the substrate board shall be pre-primed to provide for adhesion of the self-adhering underlayment material.

3. Product: Subject to compliance with requirements, provide Dens-Dek Prime by Georgia-Pacific Corporation.

B. Substrate-Board Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FMG 4470, designed for fastening substrate board to substrate.

2.4 UNDERLAYMENT MATERIALS

A. Self-Adhering with reinforcing scrim, High-Temperature Sheet**:** [50-mils- (1.3-mm-)] [60-mils- (1.5-mm-)] thick minimum, consisting of slip-resisting top surface laminated to SBS-modified asphalt adhesive, with release-paper backing; cold applied.

1. Thermal Stability: Stable after testing at 250 deg F (121 deg C); ASTM D 1970.
2. Low-Temperature Flexibility: Passes after testing at minus 20 deg F (29 deg C); ASTM D 1970.
3. Seams shall be lapped in accordance with manufacturer's recommendations.
4. Underlayment shall be approved for 90 days (minimum) of exposure to UV and weather penetrations.
5. Products: Subject to compliance with requirements, provide one of the following:
   a. Aqua Block 50 by IMETCO of Norcross, GA.
   b. Aqua Block 60 by IMETCO of Norcross, GA
   c. Dry-Dek by IMETCO of Norcross, GA.

2.5 MISCELLANEOUS METAL FRAMING

AS REQUIRED

A. Miscellaneous Metal Framing, General: ASTM C645, cold-formed metallic-coated steel sheet, ASTM A653, G90 (Z275) hot-dip galvanized.

AS REQUIRED

B. Hat-Shaped, Rigid Furring Channels:

1. Nominal Thickness: As required to meet performance requirements
2. Depth: [As indicated] [7/8 inch (22 mm)] [1-1/2 inches (38 mm)].
3. Top flange: 1-1/8" (28 mm) minimum.

Retain first paragraph below for metal roof panels installed over unfaced board insulation.

C. Z-Shaped Furring: With slotted or nonslotted web, flanges of 1-5/8 inches (41 mm) minimum and depth as required to fit insulation thickness indicated.

1. Nominal Thickness: As required to meet performance requirements, but not less than 18 gauge (1.09 mm).

D. Fasteners for Miscellaneous Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten miscellaneous metal framing members to substrates.

2.6 MISCELLANEOUS MATERIALS

A. Concealed fasteners: Corrosion resistant steel screws, #10 minimum diameter x length appropriate for substrate, hex washer head or pancake head. Use self-drilling, self-tapping for metal substrate or A-point for plywood substrate.

B. Exposed fasteners: 3xx series stainless steel screws (cadmium or zinc coatings are not acceptable) with neoprene sealing washer, or 1/8-inch- (3-mm-) diameter stainless steel rivets.

2.7 STANDING-SEAM METAL ROOF PANELS

A. General: Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats and accessories required for weathertight installation.

1. Steel Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E 1514.

2. Aluminum Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E 1637.

B. Vertical-Rib, Standing-Seam Metal Roof Panels with separate mechanically field crimped batten seam cap: Formed with vertical ribs at panel edges, pencil beads and an intermediate stiffening rib symmetrically spaced between ribs; designed for 2-direction installation by mechanically attaching panels to supports using concealed clips located under one side of panels and engaging opposite edge of adjacent panels, attaching a separate batten seam cap and mechanically seaming panels together.

1. Basis-of-Design System: Panel shall be IMETCO Series 300 (S300) roof panel system as manufactured by Innovative Metals Company, Inc. (IMETCO), Norcross, Georgia, telephone 1-800-646-3826:

2. Alternate manufacturers are subject to full compliance with specification requirements, and shall be submitted for approval as follows:

a. Manufacturers not listed above must submit for approval, ten (10) days prior to bid date, each of the following: Manufacturer's literature; certification of testing in accordance with specification requirements and article 1.4; sample warranties in accordance with specification article 1.10; installer qualifications in accordance with specification article 1.6, and a list of five (5) similar projects in size and scope of work

b. No substitutions will be permitted after the bid date of this project.

Retain one of the following two paragraphs to specify the appropriate material type and sheet thickness for this project.

3. Material: Zinc-coated (galvanized) steel sheet, [0.023-inch (0.56-mm)] [0.029-inch (0.71-mm)] [0.034-inch (0.86-mm)] nominal thickness. See 2.1 for finishes and color selection.

4. Material: Aluminum sheet, [0.032 inch (0.81 mm)] [0.040 inch (1.02 mm)] [0.050 inch (1.27 mm)] thick. See 2.1 for finishes and color selection.

5. Characteristics:

a. The same panel profile from a single manufacturer shall be used for ALL standing seam roof areas.

b. Configuration: Standing seams incorporating mechanically interlocked, concealed anchor clips which allow unlimited thermal movement.

1) Profile of panel shall have two stiffening beads positioned 1-½" (38 mm) from the vertical seam and one raised stiffening rib centered in the panel.

2) Exposed fasteners, screws and/or roof mastic are unacceptable and will be rejected. System configuration only allows for exposed fasteners at panel overlap (if required and approved by architect) and trim details (as per manufacturer's guidelines).

3) Panels must be furnished in continuous lengths from ridge to eave with no overlaps unless approved by architect.

Delete the following section if curved panels are not applicable to this project. Mechanical curving of panels insures quality and can help to prevent excessive oil canning, clip binding, and panel buckling. Please contact an IMETCO sales representative for more information regarding curved panel applications.*

4) Curved panels shall be mechanically curved to the exact radius of each curved roof area. Panels may be mechanically curved in the factory or on site. Curving must be performed with the panel manufacturer's curving machine and operated by the manufacturer's full time trained and experienced technician. Flat panels conformed to the roof shape are not acceptable and will be rejected.

Delete the following section if tapered (wedge shape) panels are not applicable to this project.

5) Tapered Panels: Tapered panels shall be factory formed from a single piece of metal. Tapered panels formed from multiple pieces of joined metal are unacceptable.

c. Seam must be 2-3/8" (60 mm) minimum height for added strength for negative pressures and must have symmetrical design. Integral, asymmetrical seams are not acceptable.

Portable rollformers are light duty machines with fewer forming stations than manufacturers' factory equipment. IMETCO suggests avoiding the use of these machines in all circumstances. Portable rollformers can induce significant oil canning and other poor performance and aesthetic qualities in the panels. For jobs which require panel lengths in excess of shipping limitations (45 feet to 80 feet, depending on location), IMETCO recommends full length panels (no end laps or splices) formed on site by full size factory-type equipment, and operated by a full-time experienced technician. Choose one of the following two subparagraphs to prelude the use of site formed panels or to specify acceptable quality standards for site formed panels.

d. Site Formed Panels: Bidder will not be allowed to supply panels formed at the job-site on portable rollformers; metal panels must be factory pre-manufactured and engineered for this project.

e. Site Formed Panels: Panels in excess of shippable length shall be formed on-site. Site formed panels shall meet each of the following requirements:

   1) Panels shall be formed on heavy duty factory type rollformers with no fewer than 16 forming stations to improve quality and minimize oil canning.

   2) Panels shall be of identical profile and characteristics as factory formed panels and specimens used as the basis of performance tests.

   3) Sealant shall be factory applied in a separate factory formed snap on cap. Site/field applied seam sealant is unacceptable. Seam caps may be shipped in 45 feet (11.4 m) or less length and lap spliced over full length panels in accordance with manufacturer's system details.

   4) Site rollforming equipment shall be owned and maintained by the panel manufacturer and operated by the panel manufacturer's trained full time experienced technician. The installer must provide additional personnel to handle raw materials and finished product as necessary.

Select the type of Anchor Clip required for this project. Most steel panel systems will require galvanized steel clips; Use stainless steel clips for aluminum panel systems.

f. Concealed Standard Anchor Clips: Clips must be 16 gauge (1.4 mm) [galvanized steel] [stainless steel alloy 410] ONE (1) piece clip with projecting legs for additional panel alignment and provision for unlimited thermal movement in each direction along the longitudinal dimension.

   1) Two-piece clips are NOT acceptable.

   2) Clip design must isolate sealant in panel cap from clip to insure that no sealant damage occurs from the clip during expansion and contraction.

   3) Clip must maintain a clearance of a minimum of 3/8" (9.5 mm) between panel and substrate for proper ventilation to help prevent condensation on underside of panel and eliminate the contact of panel fastener head to panel.

g. Seam cap: Snap-on cap shall be a minimum of 1-inch- (25-mm-) wide "T" shaped of continuous length up to 45 feet (11.4 m) according to job conditions and field seamed by means of manufacturer's standard seaming machine.

1) Cap shall be designed to receive two (2) beads of hot applied, high viscosity, pressure sensitive adhesive with high heat resistance during manufacturing which will not come in contact with the anchor clip.

2) In all cases, seam caps shall be factory formed to insure quality and precision in the process of sealant application.

h. Standing Seam Panel Width: [12"] [16"] [18"] (nominal).

i. Stiffening ribs: Located in flat of panel to minimize oil canning and telegraphing of structural members.

j. Replaceability: Panels shall be of a symmetrical design with mechanically seamed cap configuration such that individual panels may be removable for replacement without removing adjacent panels and installation may proceed in both directions simultaneously.

k. Panel ends shall be folded up 90 degrees at ridge, headwall, and hip conditions, where applicable. No metal shall be cut or otherwise perforated at the folded end.

2.8 ACCESSORIES

A. Roof Panel Accessories: Provide components approved by roof panel manufacturer and as required for a complete metal roof panel assembly including trim, copings, fasciae, corner units, ridge closures, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels unless otherwise indicated.

1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal roof panels.

2. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible closure strips meeting ASTM D1056 and/or D3575; cut or premolded to match metal roof panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

3. Gable anchor clips: 16 gauge (1.4 mm) [galvanized steel] [stainless steel alloy 410].

B. Flashing and Trim: Formed from same material and gauge as roof panels, prepainted with coil coating. 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 metal roof panels.

C. Gutters: Formed from same material roof panels. Match profile of gable trim, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 10-foot- (3-m-) long sections, of size and metal thickness according to SMACNA's "Architectural Sheet Metal Manual." Furnish gutter supports spaced per SMACNA's recommendation based on gauge and stretch-out, fabricated from same metal as gutters. Provide wire ball strainers of compatible metal at outlets. Finish gutters to match [metal roof panels] [roof fascia and rake trim].

1. Gutter Hangers: External gutter supports shall be 2-inch- (50-mm-) wide x ¼-inch- (6-mm-) thick formed aluminum, and shall be spaced at no greater than 36" (0.9m) on center. External supports shall be post-painted with a matching full-strength 70 percent PVDF finish and warranted by the panel manufacturer for same term as specified for material finishes.

2. Gutter Straps: Internal gutter straps shall be 1-inch- (25-mm-) wide x 1/8-inch- (3-mm-) thick formed aluminum, and shall be spaced at no greater than 36" (0.9m) on center. Internal straps shall be post-painted with a matching full-strength 70 percent PVDF finish and warranted by the panel manufacturer for same term as specified for material finishes.

D. Downspouts: Formed from same material as roof panels. Fabricate in 10-foot- (3-m-) long sections, complete with formed elbows and offsets, of size and metal thickness according to SMACNA's "Architectural Sheet Metal Manual". Finish downspouts to match gutters.

1. Downspout Brackets: Where detailed, surface mounted downspout protection guards shall be fabricated from ¼-inch- (6-mm-) thick formed aluminum, and shall be post-painted with a matching full-strength 70 percent PVDF finish and warranted by the panel manufacturer for same term as specified for material finishes.

E. Roof Curbs: Fabricated from same material as roof panels, minimum and welded top box and integral full-length cricket. Fabricate curb subframing of minimum 0.0598-inch- (1.5-mm-) thick, angle-, C-, or Z-shaped steel sheet. Fabricate curb and subframing to withstand indicated loads, of size and height indicated. Finish roof curbs to match metal roof panels.

Retain article below if required.

2.9 SNOW GUARDS

A. Snow Guards: Prefabricated, noncorrosive units designed to be installed without penetrating metal roof panels, and complete with predrilled holes, clamps, or hooks for anchoring. Snow guards shall be illustrated with the panel manufacturer's installation drawings, and shall be designed to resist the sliding force of snow in accordance with the requirements of ASCE-7. Confirming calculations shall be provided by the panel manufacturer.

Retain one of the snow guard subparagraphs below. Coordinate with metal panel type and profile. Because each snow guard product is unique, insert manufacturer's proprietary requirements.

1. Surface-Mounted, Metal, Stop-Type Snow Guards: Extruded-aluminum stops designed for attachment to pan surface of metal roof panel using construction adhesive. Surface-mounted show guards shall be non-penetrating and shall be post-painted with a matching full-strength 70 percent PVDF finish and warranted by the panel manufacturer for same term as specified for material finishes.

   a. Products: Subject to compliance with requirements, provide IMETCO Extruded Aluminum Painted Snow Guard.

   b. Adhesive: Snow Guards shall be adhered to the metal panels with Sure Bond SB-120 construction adhesive. Apply in accordance with manufacturer's recommendations at a rate of 1.5 ounces (44 ml) minimum per snow guard.

2. Seam-Mounted, Bar-Type Snow Guards: Extruded Aluminum rods or bars held in place by aluminum clamps attached to vertical ribs of standing-seam metal roof panels.

   a. Aluminum Finish: Mill finish.

   b. Products: Subject to compliance with requirements, provide Metal Roof Innovations, Ltd.; S-5! ColorGard®

2.10 FABRICATION

A. Fabricate and finish metal roof panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes and as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.

B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

C. Fabricate metal roof batten seam cap with factory-installed hot melt, high viscosity, pressure sensitive adhesive with high heat resistance, in a manner that will seal weathertight.

D. Form flashing components from full single width sheet in minimum 10'-0" (3 m) sections. Provide mitered corners, joined using closed end pop rivets and butyl-based, solvent released one-part sealant.

E. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.

2. Sealed Joints: Form nonexpanding but movable joints in metal to accommodate butyl-based sealant to comply with SMACNA standards.

3. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.

4. Fabricate cleats and attachment devices of size and metal thickness recommended by SMACNA's "Architectural Sheet Metal Manual" or by metal roof panel manufacturer for application, but not less than thickness of metal being secured.

2.11 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. 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.

PART 3 - PREPERATION & EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal roof panel supports, and other conditions affecting performance of the Work.

Retain one or both of first two paragraphs below.

B. Examine primary and secondary roof framing to verify that rafters, purlins, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal roof panel manufacturer.

C. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal roof panel manufacturer.

D. Examine roughing-in for components and systems penetrating metal roof panels to verify actual locations of penetrations relative to seam locations of metal roof panels before metal roof panel installation.

Retain paragraph below if required.

E. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of substances harmful to insulation, including removing projections capable of interfering with insulation attachment.

Retain first paragraph below if required to separate foam-plastic insulation from interior.

B. Substrate Board: Install substrate boards over roof [deck] [sheathing] on entire roof surface. Attach with substrate-board fasteners.

1. Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.

2. Comply with [UL] [FMG] requirements for fire-rated construction.

C. Miscellaneous Framing: Install subpurlins, eave angles, furring, and other miscellaneous roof panel support members and anchorage according to metal roof panel manufacturer's written instructions.

Furring channels must be wire tied to supports in most fire-resistance-rated assemblies. Verify requirements of assemblies and revise subparagraph below to suit Project.

1. Soffit Framing: [Wire tie] [Clip] furring channels to supports[, as required to comply with requirements for assemblies indicated].

D. Establish straight, side and crosswise benchmarks

E. Use proper size and length fastener for strength requirements. Approximately 5/16 inch (8 mm) is allowable for maximum fastener head size beneath the panel.

F. Rectangular roofs shall be checked for square and straightness. Gable ends may not be straight; set a true line for the gable clips and flashing with string line.

G. Measure the roof lengthwise to confirm panel lengths, overhangs, coverage of flashings at eaves and ridges and verify clearances for thermal movement.

3.3 THERMAL INSULATION INSTALLATION

A. Polyethylene Vapor Retarder: Extend vapor retarder to extremities of areas to be protected from vapor transmission. Repair tears or punctures immediately before concealment by other work.

Retain first paragraph below for metal roof panels supported by roof deck or solid roof sheathing.

B. Board Insulation (reference 2.2.C-G): Extend insulation in thickness indicated to cover entire roof. Comply with installation requirements in Division 07 Section "Thermal Insulation."

1. Erect insulation and hold in place with Z-shaped furring members spaced 24 inches (610 mm) o.c. Securely attach narrow flanges of furring members to roof deck with screws spaced 24 inches (610 mm) o.c.

Retain paragraph below for metal roof panels supported by purlins.

C. Blanket Insulation: Install insulation concurrently with metal roof panel installation, in thickness indicated to cover entire roof, according to manufacturer's written instructions and as follows:

1. Set vapor-retarder-faced units with vapor retarder [to warm side] [in location indicated] of construction unless otherwise indicated. Do not obstruct ventilation spaces.

2. Tape joints and ruptures in vapor retarder and seal each continuous area of insulation to surrounding construction to ensure airtight installation.

3. Install blankets straight and true in one-piece lengths with both sets of facing tabs sealed. Comply with the following installation method:

Retain one of four installation subparagraphs below with last subparagraph above.

a. Over-Framing Installation: Extend insulation and vapor retarder over and perpendicular to top flange of secondary framing members. Hold in place by panels fastened to secondary framing.

Subparagraph immediately below accommodates thicker insulation with no compression at purlins; however, thermal bridging occurs through panels in direct contact with structure. Thermal spacer blocks can be added if required.

b. Between-Purlin Installation: Extend insulation and vapor retarder between purlins. Carry vapor-retarder facing tabs up and over purlin, overlapping adjoining facing of next insulation course maintaining continuity of retarder. Hold in place with bands and crossbands below insulation.

Subparagraph immediately below accommodates thicker insulation with compression occurring at structure. Thermal spacer blocks can be added to retard heat transfer at these locations.

c. Over-Purlin-with-Spacer-Block Installation: Extend insulation and vapor retarder over and perpendicular to top flange of secondary framing members. Install layer of filler insulation over first layer to fill space formed by roof panel standoffs. Hold in place by panels fastened to standoffs.

Subparagraph immediately below accommodates thicker insulation with no compression.

d. Two-Layers-between-Purlin-with-Spacer-Block Installation: Extend insulation and vapor retarder between purlins. Carry vapor-retarder facing tabs up and over purlins, overlapping adjoining facing of next insulation course maintaining continuity of retarder. Install layer of filler insulation over first layer to fill space between purlins formed by thermal spacer blocks. Hold in place with bands and crossbands below insulation.

4. Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with secondary framing to hold insulation in place.

3.4 UNDERLAYMENT INSTALLATION

Retain this article for metal roof panels applied over solid roof sheathing.

A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply [over entire roof surface] [at locations indicated below] [at locations indicated on Drawings], wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches (150 mm) staggered 24 inches (610 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm). [Extend underlayment into gutter trough.] Roll laps with roller. Cover underlayment within 90 days.

Revise list below to suit Project or delete if indicated on Drawings. If inserting dimensions, note that many self-adhering sheet underlayments are manufactured in 36-inch- (914-mm-) wide rolls.

1. Roof perimeter for a distance up from eaves of 36 inches (914 mm) beyond interior wall line.
2. Valleys, from lowest point to highest point, for a distance on each side of 30 inches (762 mm). Overlap ends of sheets not less than 6 inches (150 mm).
3. Rake edges for a distance of 36 inches (914 mm).
4. Hips and ridges for a distance on each side of 30 inches (762 mm). Roof to wall intersections for a distance from wall of 36 inches (914 mm) Around dormers, chimneys, skylights, and other penetrating elements for a distance from element of 30 inches (762 mm).

B. Felt Underlayment: Apply at locations indicated [below] [on Drawings]**,** in shingle fashion to shed water, and with lapped joints of not less than 2 inches (50 mm).

1. Apply on roof not covered by self-adhering sheet underlayment. Lap over edges of self-adhering sheet underlayment not less than 3 inches (75 mm), in shingle fashion to shed water.

C. Apply slip sheet over underlayment before installing metal roof panels.

D. Install flashings to cover underlayment to comply with requirements specified in Division 07 Section "Sheet Metal Flashing and Trim."

3.5 STANDING SEAM METAL ROOF PANEL INSTALLATION

A. All details will be shown on in accordance with approved shop drawings and manufacturer's product data, within specified erection tolerances.

The specifier should customize this section to illustrate the intended scope of work for this project.

For panel installation over board insulation, include the requirement for bearing plates. Otherwise delete.

B. Directly over the completed roof substrate, install one piece clips. [All anchor clips will be set on 16 gauge (1.5 mm) galvanized pre-punched bearing plates to distribute the loads on the board insulation.] All anchor clips will be fastened into the structural roof substrate based on the following spacing pattern:

Please contact IMETCO engineering for precise clip spacing pattern engineered for this project.

Clip spacing must be _____ on center for Zone 1 (field)

Ridges and hips are only included in zone 2 for roof pitches exceeding 2:12. Delete ridges and hips from the following line, if appropriate.

Clip spacing must be _____ on center for Zone 2 (eave [, ridge, hip,] and rake).

Clip spacing must be _____ on center for Zone 3 (corners)

*spacing for Zones 2 & 3 must extend _____ feet onto the roof area.

C. Installation of Roof Panels: Roof panels can be installed by starting from one end and working towards the opposite end. Due to the symmetrical design of the specified panel system, it is also acceptable to start from the middle of the roof and work toward each end.

1. A stainless steel rivet shall be secured through the anchor reveal of the panel leg and extend into the arms of the panel clip located at the ridge of the system. This is done at each arm of the clip along the ridge. The panel is then anchored at both sides of the clip.
    a. Be sure to capture all drilling debris during this operation with a rag or cloth placed on the panels at the drilling operation.
    b. Panels are not securely attached to the roof until fixed to the anchor clip. To avoid damage and injury, all panels shall be fixed to the anchor clip immediately as they are installed.
    c. The seam caps shall be shipped with two (2) beads of factory applied hot melt sealant located inside the caps. To install the caps, hook one side of the cap over the panel edge and rotate over the opposite panel leg. For ease of installation, start at one end of the panel and work toward the opposite end.
    d. A hand crimping tool is used to crimp the cap around the top of two adjacent panels.
    e. Caps shall then be permanently seamed with manufacturers mechanical seamer.

D. Isolate dissimilar metals and masonry or concrete from metals with bituminous coating. Use gasketed fasteners where required to prevent corrosive action between fastener, substrate, and panels.

E. Limit exposed fasteners to extent indicated on contract drawings.

F. Seal laps and joints in accordance with roofing system manufacturer's product data.

G. Coordinate flashing and sheet metal work to provide weathertight conditions at roof terminations. Fabricate and install in accordance with standards of SMACNA Manual.

H. Provide for temperature expansion/contraction movement of panels at roof penetrations and roof mounted equipment in accordance with system manufacturer's product data and design calculations.

I. Installed system shall be true to line and plane and free of dents, and physical defects. In light gauge panels with wide flat surfaces, some oil canning may be present. Oil canning does not affect the finish or structural integrity of the panel and is therefore not cause for rejection.

J. At joints in linear sheet metal items, set sheet metal items in two ¼-inch- (6-mm-) beads of butyl sealant. Extend sealant over all metal surfaces. Mate components for positive seal. Allow no sealant to migrate onto exposed surfaces.

K. Remove damaged work and replace with new, undamaged components.

L. Touch up exposed fasteners using paint furnished by roofing panel manufacturer and matching exposed panel surface finish.

M. Clean exposed surfaces of roofing and accessories after completion of installation. Leave in clean condition at date of substantial completion. Touch up minor abrasions and scratches in finish.

3.6 SNOW GUARD INSTALLATION

A. Stop-Type Snow Guards: Attach snow guards to metal roof panels with adhesive, sealant, or adhesive tape, as recommended by manufacturer. Do not use fasteners that will penetrate metal roof panels.

Delete last option in subparagraph below if retaining standing-seam-mounted, stop-type snow guards.

1. Provide _____ rows of snow guards, at locations indicated on Drawings, spaced _____ feet apart, beginning _____ feet up from gutter[, with each snow guard centered between panel ribs].

B. Bar-Type Snow Guards: Attach bar supports to vertical ribs of standing-seam metal roof panels with clamps or set screws. Do not use fasteners that will penetrate metal roof panels.

1. Provide _____ rows of snow guards, at locations indicated on Drawings, spaced _____ feet apart, beginning _____ feet up from gutter.

3.7 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align metal roof panel units 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.

3.8 FIELD QUALITY CONTROL

Retain first paragraph below for assemblies requiring weathertight warranty.

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect metal roof panel installation, including accessories. Report results in writing.

B. Remove and replace applications of metal roof panels where inspections indicate that they do not comply with specified requirements.

C. Additional inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.9 CLEANING

A. Remove temporary protective coverings and strippable films, if any, as metal roof panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of metal roof panel installation, clean finished surfaces as recommended by metal roof panel manufacturer. Maintain in a clean condition during construction.

B. Replace metal roof panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074113