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SECTION 13 34 19

METAL BUILDING SYSTEMS



This guide specification is being provided to the building design community as a recommended starting point for architects, engineers and building specifiers that utilize metal building systems in their projects. It is based on the products provided by Robertson Building Systems, located at 1343 Sandhill Drive, Ancaster, ON, Canada (www.RobertsonBuildings.com). It is not intended that this specification cover all project conditions and as such a thorough review by a licensed construction professional should be conducted prior to utilizing this specification for actual projects. Note: Requirements related to USGBC LEED v4 are shown in green and may be removed as necessary for projects not requiring green building certification.

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PART 1 - GENERAL

1.1 SECTION INCLUDES:

- A. Metal building systems including:
 - 1. Metal framing components.
 - 2. Metal wall panels and trim.
 - 3. Metal roof panels and trim.
 - 4. Metal building accessories.

1.2 RELATED SECTIONS:

- A. Section 01 33 29 LEED™ Documentation.
- B. Section 07 92 00 - Joint Sealants.
- C. Section [03 30 00 - Cast-In-Place Concrete:] [____ - ____:] Concrete slabs and footings.
- D. Section [05 12 00 - Structural Metal Framing:] [____ - ____:] Metal wall and roof framing.
- E. Section [05 40 00 - Cold-Formed Metal Framing:] [09 22 00 - Metal Support Assemblies:] [____ - ____:] Metal partition wall framing.

1.3 REFERENCES

Specifier: The standards referenced below are in general chosen to match those required by the 2015 version of the International Building Code. Review and edit as necessary to reflect the applicable building code for the project.

- A. American Institute of Steel Construction (AISC):
 - 1. AISC 360 - Specification for Structural Steel Buildings, June 22, 2010.
 - 2. AISC 341 - AISC Seismic Provisions for Structural Steel Buildings, June 22nd, 2010.

3. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges, April 14th, 2010.
- B. American Iron and Steel Institute (AISI) :
1. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members, 2012 Edition.
- C. American Welding Society (AWS)
1. AWS D1.1/D1.1M - Structural Welding Code – Steel, 2010.
 2. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel, 2008
- D. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE):
1. ASHRAE 90.1-2013 - Energy Standard for Buildings Except Low-Rise Residential Buildings (I-P Edition).
- E. ASTM International (ASTM): Latest versions of:
1. ASTM A 36/A 36M - Standard Specification for Carbon Structural Steel.
 2. ASTM A 475 - Standard Specification for Zinc-Coated Steel Wire Strand.
 3. ASTM A 500/A 500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
 4. ASTM A 529/A 529M - Standard Specification for High-Strength Carbon-Manganese Steel of Structural Quality.
 5. ASTM A 563 - Standard Specification for Carbon and Alloy Steel Nuts.
 6. ASTM A 572/A 572M - Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
 7. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 8. ASTM A 792/A 792M - Standard Specification for Steel Sheet, 55 Percent Aluminum-Zinc Alloy-Coated by Hot-Dip Process.
 9. ASTM A 992/A 992M - Standard Specification for Structural Steel Shapes.
 10. ASTM A 1011/A 1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength, Low-Alloy and High-Strength Low-Alloy with Improved Formability and Ultra-High Strength
 11. ASTM A 1018/A 1018A - Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Hot-Rolled, Carbon, Commercial, Drawing, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
 12. ASTM C 518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
 13. ASTM C 1363 - Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus.
 14. ASTM D 635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position.
 15. ASTM D 1003 - Standard Test Method for Haze and Luminous Transmittance of Transparent Plastics.
 16. ASTM D 1494 - Standard Test Method for Diffuse Light Transmission Factor of Reinforced Plastics Panels.
 17. ASTM D 1929 - Standard Test Method for Determining Ignition Temperature of Plastics.
 18. ASTM D 2240 - Standard Test Method for Rubber Property—Durometer Hardness.
 19. ASTM D 2244 - Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates.

20. ASTM D 4214 - Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films.
 21. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
 22. ASTM E 72 - Standard Test Methods of Conducting Strength Tests of Panels for Building Construction.
 23. ASTM E 283 - Standard Test Method for Determining Rate of Air Leakage through Exterior Windows, Curtain Walls, and Doors under Specified Pressure Differences Across Specimen.
 24. ASTM E 331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
 25. ASTM E 1592 - Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference.
 26. ASTM E 1646 - Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference.
 27. ASTM E 1680 - Standard Test Method for Rate of Air Leakage Through Exterior Metal Roof Panel Systems.
 28. ASTM E 1980 - Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces.
 29. ASTM F 436 - Standard Specification for Hardened Steel Washers
 30. ASTM F 1941 - Standard Specification for Electrodeposited Coatings on Threaded Fasteners (Unified Inch Screw Threads (UN/UNR))
 31. ASTM F 3125 - Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions.
- F. Cool Roof Rating Council (CRRC):
1. ANSI/CRRC S100 - Standard Test Methods for Determining Radiative Properties of Materials, April 26th, 2016.
- G. Factory Mutual Approvals (FM Approvals):
1. FM 4471 - Approval Standard for Class 1 Panel Roofs.
 2. FM 4880 - Approval Standard for Class 1 Fire Rating of Insulated Wall or Wall and Roof/Ceiling Panels, Interior Finish Materials or Coatings and Exterior Wall Systems.
 3. FM 4881 - Approval Standard for Class 1 Exterior Wall Systems.
- H. FM Global:
1. FM 1-28 – Property Loss Prevention Data Sheet 1-28, Wind Design, October 2015.
- I. International Accreditation Service (IAS):
1. Accreditation Criteria 472 (AC472) - Accreditation Criteria for Inspection Programs for Manufacturers of Metal Building Systems, April 2017
- J. International Standards Organization (ISO)
1. ISO 14044 - Environmental management -- Life Cycle Assessment -- Requirements and Guidelines, 2006
 2. ISO 21930 - Sustainability in Building Construction -- Environmental Declaration of Building Products, 2007.
- K. Metal Building Manufacturers Association (MBMA):
1. Metal Building Systems Manual, 2012 Edition.

- L. National Fenestration Rating Council (NFRC):
 - 1. NFRC 100 - Procedure for Determining Fenestration Product U-factors, 2014
 - 2. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence, 2010.
- M. National Fire Protection Association (NFPA):
 - 1. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components, 2012 Edition.
- N. Research Council on Structural Connections (RCSC):
 - 1. Specification for Structural Joints Using High Strength Bolts, August 1, 2014.
- O. Underwriters Laboratories (UL):
 - 1. UL-580 - Tests for Uplift Resistance of Roof Assemblies.
 - 2. UL-790 - Standard Test Methods for Fire Tests of Roof Coverings.
 - 3. UL-2218 - Impact Resistance of Prepared Roof Covering Materials.
- P. United States Green Building Council (USGBC):
 - 1. LEED v4 - Leadership in Energy and Environmental Design for Building Design and Construction, January 27th, 2017.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Pre-installation Meeting: Prior to erection of framing, conduct pre-installation meeting at site attended by Owner, Architect, manufacturer's technical representative, inspection agency and related trade contractors.
- B. Coordinate work of Division 07 Sections "Roof Specialties" and "Roof Accessories" and openings and penetrations and manufacturer's accessories with installation of metal panels.

1.5 DEFINITIONS

- A. Traditional Metal Building System: Building system using either continuous or simple span "Z" purlins for support of roof covering material.
- B. Long Bay System (LBS): Building system using simple span, cold-formed, open web purlins to support roof covering material.
- C. Gable Symmetrical: Continuous frame building with ridge in center of building, consisting of tapered or straight columns and tapered or straight rafters. Sidewall girts may be continuous (by-passing columns) or simple span (flush in column line). Rafters may or may not have interior columns.
- D. Gable Unsymmetrical: Continuous frame building with an off-center ridge, consisting of tapered or straight columns and tapered or straight rafters. Eave height and roof slope may differ on each side of ridge. Sidewall girts may be continuous (by-passing columns) or simple span (flush in column line). Rafters may or may not have interior columns.
- E. Single Slope: Continuous frame building which does not contain ridge, but consists of one continuous slope from side to side. Building consists of straight or tapered columns and tapered or straight rafters. Sidewall girts may be continuous (by-passing columns) or simple span (flush in column line). Rafters may or may not have interior columns.

- F. Lean-to (LT): Building extension, which does not contain ridge, but consists of one continuous slope from side to side, usually with same roof slope and girt design as building to which attached.
- G. Roof Slope: Pitch expressed as inches of rise for each 12 inches (305 mm) of horizontal run.
- H. Acrylic-Coated Galvalume: Aluminum-Zinc coated steel with a thin clear acrylic finish coating eliminating the need for roll-forming oil and reducing incidence of field marking by handling or foot traffic.
- I. Building Eave Height: Nominal dimension measured from finished floor to top flange of eave strut.
- J. Building Width: Measured from outside to outside of side wall secondary structural member.
- K. Building Length: Measured from outside to outside of end wall secondary structural member.
- L. Auxiliary Loads: Dynamic loads induced by cranes, conveyors, or material handling systems.
- M. Collateral Loads: Weight of any non-moving equipment or material, such as ceilings, electrical or mechanical equipment, sprinkler systems, plumbing, or ceilings.
- N. Dead Load: Actual weight of building system as supplied by manufacturer supported by given member.
- O. Floor Live Loads: Loads induced on floor system by building occupants and possessions including but not limited to furniture and equipment.
- P. Roof Live Loads: Loads produced by maintenance activities, rain, erection activities, and or movable or moving loads but not including wind, snow, seismic, crane, or dead loads.
- Q. Roof Snow Loads: Gravity load induced by weight of snow or ice on roof, assumed to act on horizontal projection of roof.
- R. Seismic Loads: Loads acting in any direction on structural system due to action of an earthquake.
- S. Wind Loads: Loads on structure induced by forces of wind blowing from any horizontal direction.

1.6 DESIGN REQUIREMENTS

- A. Governing Design Code: Structural design for the metal building system shall be performed by the manufacturer of the metal building system in accordance with the building code provided in the contract documents.
- B. Design Basis:
 1. Use standards, specifications, recommendations, findings, and interpretations of professionally recognized groups as basis for establishing design, drafting, fabrication, and quality criteria, practices, and tolerances, including the AISC Code of Standard Practice for Steel Buildings and Bridges.
 2. Design structures in accordance with MBMA Practices and Manual including fabrication and erection tolerances.
 3. Design structural mill sections and welded plate sections in accordance with AISC 360, ASD Method.
 4. Design the lateral force resisting systems and related components for seismic loads in accordance with AISC 341.

5. Design cold-formed steel structural members and panels in accordance with AISI S-100.
6. Design all bolted joints in accordance with RCSC Specification.

C. Design Loads:

- 1.2. In accordance with Contract Documents and manufacturer's standard design practices.
2. Design loads include dead loads, roof live loads, wind loads, seismic loads, gq gn

d. MR Credit: Building Product Disclosure and Optimization - Sourcing of Raw Materials: Provide product data in accordance with Option 2, Leadership Extraction Practices, for the following:

- 1) Material costs for each product having recycled content.
- 2) Percentages by weight of post-consumer and pre-consumer recycled content for each item.
- 3) Total weight of products provided.

B. Samples:

1. Submit color chips showing manufacturer's full range of available colors and patterns for each finish product.
2. After color selection submit samples representing actual product, color, and patterns.

C. Quality Control Submittals:

1. IAS AC472 Certificate for each facility involved in the design and fabrication of the Metal Building System.
2. Certified Erector Certificate issued to the erector by the manufacturer.

Specifier: Retain this paragraph for when MTR submittal is required in the contract documents.

3. Material Test Reports (MTR) for all steel material used in the manufacture of primary and secondary framing members, panels and bolts specified in this section and when required by ASTM A 6/A 6M

1.8 QUALITY ASSURANCE

A. Manufacturer and Fabricator Qualifications: Primary products furnished by single IAS AC472 accredited manufacturer/fabricator with minimum [5] [] years of experience.

B. Erector Qualifications:

1. Single installer with minimum [5] [] years of experience in installing products of same or similar type and scope.
2. Installer must be certified by the metal building manufacturer.

1.9 DELIVERY, STORAGE AND HANDLING

- A. Store packaged products in original, unopened packaging until ready for installation.
- B. Store and dispose of solvent-based materials and materials used with solvent-based materials in accordance with requirements of the authority having jurisdiction.
- C. Protect steel products from weather as specified by manufacturer instructions.

1.10 PROJECT CONDITIONS

A. Do not install systems when temperature, humidity, or ventilation is outside of limits recommended by manufacturer.

1.11 WARRANTIES

A. Special Manufacturer's Warranty: On manufacturer's standard form, in which manufacturer agrees to repair or replace metal building system components that fail in materials and workmanship within one year from date of Substantial Completion.

- B. Special Weathertightness Warranty: On manufacturer's standard form, in which manufacturer agrees to repair or replace metal building system components that fail to remain weathertight, including leaks, [without monetary limitation] [up to cost limitation of seven dollars (\$7.00) per square foot of covered area] [up to cost limitation of fourteen dollars (\$14.00) per square foot of covered area] within [5] [10] [15] [20] years from date of Substantial Completion.
- C. Special Panel Finish Warranty: On Manufacturer's standard form, in which Manufacturer agrees to repair or replace metal panels that evidence deterioration of factory-applied finish within the specified number years from date of Substantial Completion, including:
 - 1. Acrylic Coated Galvalume (Galvalume® Plus): Product will not rupture, fail structurally, or perforate within period of 20 years due to normal atmospheric corrosion.
 - 2. Fluoropolymer Two-Coat System (PVDF):

Specifier: Confirm warranted performance values below for custom colors. Second options in subparagraphs below are for Robertson Building Systems Brite Red.

- a. Color fading in excess of [5] [10] Hunter units per ASTM D 2244 for [30] [25] years.
- b. Chalking in excess of No. [8] [6] rating per ASTM D 4214 for [30] [25] years.
- c. Failure of adhesion, peeling, checking, or cracking for 40 years.
- 3. Metallic Fluoropolymer Two-Coat System (Metallic PVDF):
 - a. Chalking in excess of No. 6 rating per ASTM D 4214 for 25 years.
 - b. Failure of adhesion, peeling, checking, or cracking for 25 years.
- 4. Modified Silicone-Polyester Two-Coat System (SMP):

Specifier: Confirm warranted performance values below for custom colors. Second options in subparagraphs below are for Robertson Building Systems Crimson Red. Robertson Building Systems Polar White Polyester does not carry a warranty against chalking.

- a. Color fading in excess of [5] [7] Hunter units per ASTM D 2244, for vertical applications for [30] [25] years.
- b. Color fading in excess of [7] [10] Hunter units per ASTM D 2244, for non-vertical applications for [30] [25] years.
- c. Chalking in excess of No. [8] [7] rating per ASTM D 4214, for vertical applications for [30] [25] years.
- d. Chalking in excess of No. [6] [5] rating per ASTM D 4214, for non-vertical applications for [30] [25] years.
- e. Failure of adhesion, peeling, checking, or cracking for 40 years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design Manufacturer: Robertson Building Systems (www.RobertsonBuildings.com). Other acceptable manufacturers include:
 - 1. A&S Building Systems, subsidiary of NCI Building Systems, Inc. (www.a-s.com)
 - 2. All-American Systems, subsidiary of NCI Building Systems, Inc. (www.allamericansys.com)
 - 3. Ceco Building Systems, subsidiary of NCI Building Systems, Inc. (www.cecobuildings.com)

4. Garco Building Systems, a subsidiary of NCI Building Systems, Inc. (www.garcobuildings.com)
5. Mesco Building Solutions, subsidiary of NCI Buildings, Inc. (www.mescobuildingsolutions.com)
6. Metallic Building Co., subsidiary of NCI Building Systems, Inc. (www.metallic.com)
7. Mid-West Steel Building Company, subsidiary of NCI Building Systems, Inc. (www.midweststeel.com)
8. Star Building Systems, subsidiary of NCI Building Systems, Inc. (www.starbuildings.com)

B. Substitutions: [Under provisions of Division 01] [Not permitted].

2.2 MATERIALS

Specifier: Retain and modify the following section when project has domestic content requirements, which would be all federal government work and most state government work. Also note that there was a significant change in how ferrous products apply made to the Buy American Act by the American Reinvestment and Recovery Act of 2009. Specifically, many of the cost limitations and exceptions provided to foreign materials processed in America in the original act were disallowed for ferrous products, requiring them to be 100% domestic steel.

A. Buy American Act/American Reinvestment and Recovery Act (ARRA) requirements: Provide materials in compliance with the following requirements:

1. Buy American Act of 1933 BAA-41 U.S.C §§ 10a – 10d for non-ferrous products.
2. Buy American provisions of Section 1605 of the American Recovery and Reinvestment Act of 2009 (ARRA), for ferrous products.

B. Primary Framing Steel:

Specifier: Recycled content is required for some sustainable building programs and standards. Retain as necessary here and elsewhere. Primary framing recycled content is based on the Steel Recycling Institute (SRI) data for Electric Arc Furnace (EAF) method. Secondary framing and panel recycled content is based on SRI data for Basic Oxygen Furnace (BOF) method.

1. Recycled Content: Post-consumer recycled content plus one-half of pre-consumer recycled content not less than 75 percent.
2. Hot-rolled shapes: ASTM A 36 or ASTM A 992, minimum yield of 36 ksi (248 MPa) or 50 ksi (345 MPa).
3. Built-up sections:
 - a. Webs:
 - 1) ASTM A 1011 or ASTM A1018, SS or HSLAS, Grade 55 (380) for webs 3/16 inch (4.76 mm) thick and thinner.
 - 2) ASTM A 572 Grade 50 (340) or ASTM A572 Grade 55 (380) or ASTM A 529 Grade 55 for webs thicker than 3/16 inch (4.76 mm).
 - b. Flanges: ASTM A 529 Grade 55 (380) or ASTM A 572 Grade 50 (340) or 55 (380).
4. Round tube: ASTM A 500, Grade B or C with minimum yield strength of 42 ksi (290 MPa).
5. Square and rectangular tube: ASTM A 500, Grade B or C, minimum yield strength of 42 ksi (290 MPa).
6. Cold-formed C sections: ASTM A 1011, Grade 55 (380), or ASTM A 653, Grade 55 (380).

7. X-bracing: ASTM A 529 or A 572 for rod bracing 36 ksi (248 MPa) or 50 ksi (345 MPa), ASTM A 36 for angle bracing or ASTM A 475 for cable bracing.

C. Secondary Framing Steel:

1. Purlins, girts, and eave struts: ASTM A 1011 Grade 55 (380), or ASTM A 653, Grade 55 (380).
2. Recycled Content: Post-consumer recycled content plus one-half of pre-consumer recycled content not less than 25 percent.

Specifier: Gauge is an insufficient way to specify thickness for cold-formed steel coil material due to outdated standards which have built-in tolerances greater than current coil steel manufacturing technology requires. However, much of the construction industry continues to specify thickness by gauge alone, which opens up possible gamesmanship in material thickness specification by allowing manufacturers to intentionally use tolerances to reduce supplied minimum thickness. In order to ensure the material provided meets the intended specification, it is recommended that the gauge designations be used only as descriptors that reference a minimum uncoated decimal thickness defined explicitly in a common area of the specification as shown below. Specifying material by gauge alone will default to outdated standards being used to provide a minimum or nominal thickness.

3. Thickness:
 - a. 16 gauge: 0.056 inch (1.421 mm) minimum uncoated thickness.
 - b. 14 gauge: 0.067 inch (1.689 mm) minimum uncoated thickness.
 - c. 13 gauge: 0.081 inch (2.051 mm) minimum uncoated thickness.
 - d. 12 gauge: 0.100 inch (2.534 mm) minimum uncoated thickness.
4. Finish: [G-90 Pre-galvanized] [Red Oxide] [Gray] Shop Coat. Shop coat only intended to provide temporary protection during transportation and erection.

D. Panels:

1. Materials: ASTM A 792.
2. Recycled Content: Post-consumer recycled content plus one-half of pre-consumer recycled content not less than 25 percent.
3. Thickness and yield strength:
 - a. 26 gauge: 0.0172 inch (0.437 mm) minimum uncoated thickness, 80 ksi (550 MPa) yield strength.
 - b. 24 gauge: 0.0212 inch (0.538 mm) minimum uncoated thickness, 50 ksi (340 MPa) yield strength.
 - c. 22 gauge: 0.0272 inch (0.690 mm) minimum uncoated thickness, 50 ksi (380 MPa) yield strength.
4. Finishes:

Specifier: Delete brand names here and replace them with references to this section going forward if required.

- a. Galvalume: Aluminum-Zinc Alloy Coating, 55% Aluminum, 50% Zinc coated steel per ASTM A 792 AZ55.
- b. Galvalume® Plus: Acrylic-Coated Aluminum-Zinc Alloy Coating, 55% Aluminum, 50% Zinc coated steel per ASTM A 792 AZ55 with acrylic finish with no added lubricant.
- c. Exterior Paint:

Specifier: Retain one or more of the following three finish paragraphs as applicable to the project.
Coordinate with Warranty article in Part 1.

- 1) Modified Silicone-Polyester Two-Coat System (SMP): 0.20 – 0.25 mil primer with 0.7 – 0.8 mil color coat. Basis of Design: Signature 200.

Specifier: Fluoropolymer coatings are based on Arkema, Inc. Kynar 500 and Solvay Solexis Hylar 500 PVF2 resins.

- 2) Fluoropolymer Two-Coat System (PVDF): 0.2 – 0.3 mil primer with 0.7 - 0.8 mil 70 percent PVDF fluoropolymer color coat. Basis of Design: Signature 300.
 - 3) Fluoropolymer Two-Coat Metallic System (PVDF Metallic): 0.2 – 0.3 mil primer with 0.7 - 0.8 mil 70 percent PVDF metallic fluoropolymer color coat. Basis of Design: Signature 300 Metallic.
- d. Interior Paint: 0.5 mil total dry film thickness consisting of primer coat and wash coat of manufacturer's standard light-colored acrylic or polyester backer finish.
5. Fasteners:
- a. Through-fastened panels: Self-drilling with sealing washer.
 - b. Standing seam panels: Long life self-drilling with sealing washer.
 - c. Ridge: Long-life self-drilling with sealing washer.
 - d. Clips to purlin or bar joists: Long-life self-drilling with hex washer head and washer.
6. Clips:
- a. Low or high fixed clips: Use where moderate thermal expansion and contraction in roof panel is expected.
 - b. Low or high sliding clips: Provide 2 to 4 inches of travel for panel thermal expansion and contraction.
7. Sealants and closures:
- a. Side-laps: Factory applied, hot melt, foamable mastic.
 - b. End-laps, eave, ridge assembly, gable flashings: Field-applied non-skinning sealant as specified in Section 07 92 00.
 - c. Standing Seam Roof Closures:
 - 1) Outside closures: 24 gauge steel sheet.
 - 2) Inside closures: 18 gauge Galvalume or G-40 galvanized coated steel complying with ASTM A 653/A 653M.
 - d. Through-Fastened Roof Closures: Provide closed-cell polyethylene inside [and outside] foam closures.
 - 1) Bulk Density: 2 pounds per cubic foot.
 - 2) Service Temperature: -100 to 180 degrees Fahrenheit.
 - 3) Shore Hardness: 7 on AA scale or 51 on 00 scale when tested to ASTM D 2240.

2.3 PRIMARY FRAMING

- A. Frame Design: [As indicated on Drawings] [Gable Symmetrical] [Single Slope] [Lean-to].
- B. Sidewall Column Profile: [Tapered or Prismatic] [Prismatic] [As indicated on Drawings].

- C. Frame Span: [Modular or Clear Span as indicated on Drawings] [Modular Span as indicated on Drawings] [Clear Span].
- D. Modular Frame Interior Column Profile: H Shape, Round Pipe, or Tube] [H Shape] [Round Pipe] [Tube Sections] [As indicated on Drawings].
- E. Bracing: [Standard X-Bracing or Portal Frames as allowed by accessories] [X-Bracing] [Portal Frames] [Shear Walls by others].

2.4 SECONDARY FRAMING

- A. Roof Zee Purlins:
 1. Horizontal structural members which support roof coverings.
 2. Depth: As required by design, [8] [10] [12] inches ([203] [216] [254] [305] mm) minimum.
 3. Thickness: As required by design, 16 gauge minimum.
 4. Finish: [Red Oxide] [Gray] shop coat. Shop coat only intended to provide temporary protection during transportation and erection.
- B. Long Bay Purlins:
 1. Horizontal structural members that support roof systems, with virtual square shaped top and bottom chords and web members.
 2. Open Web Purlins for Long Bay applications.
 3. Finish: Gray shop coat. Shop coat only intended to provide temporary protection during transportation and erection.
- C. Wall Zee Girts:
 1. Horizontal structural members that support vertical panels.
 2. Depth: As required by design, [8] [10] [12] inches ([203] [216] [254] [305] mm) minimum.
 3. Gauge: As required by design, 16 gauge (0.056 inch (1.424 mm) minimum uncoated thickness).
 4. Finish: [Red Oxide] [Gray] shop coat. Shop coat only intended to provide temporary protection during transportation and erection.
- D. Spandrel Beams: ASTM A 36/A 36M or ASTM A 992/A 992M wide flange shapes, minimum yield 50 ksi for support of wall systems provided by others, as required by design.

2.5 BOLTS

- A. Rigid Frame Connections: Provide High Strength Bolts, Nuts and Washers:
 1. Bolts: ASTM F 3125 Grade A325 Heavy Hex Structural Type I.
 2. Washers: [ASTM F 436 Type 1 Hardened Steel] [Not Required].
 3. Nuts: ASTM A 563 Grade C Heavy Hex. Nuts shall be wax coated by emulsion such that the torque required to complete a Rotational Capacity (RC) test shall be reduced by 40% from the un-waxed state.
 4. Coating: [ASTM F 1941 Electrodeposited Yellow Zinc] [Hot-Dipped Galvanized].
- B. Other Connections: Provide High Strength or Machine Bolts as required by manufacturer design:
 1. High Strength Bolts and Nuts:
 - a. Bolts: ASTM F 3125 Grade A325 Heavy Hex Structural Type I.

- b. Nuts: ASTM A 563 Grade C Heavy Hex.
- c. Coating: ASTM F 1941 Electrodeposited Yellow Zinc.

2. Machine Bolts:

- a. Bolts: ASTM A 307 Grade Carbon Steel.
- b. Nuts: ASTM A 563 Grade A Hex Nut.
- c. Coating: ASTM F 1941 Electrodeposited Clear Zinc.

2.6 ROOF SYSTEMS

- A. Assembly Performance Requirements: Provide roof products and assemblies meeting the following requirements:

Specifier: Coordinate these requirements with applicable national codes and standards. Roof radiative properties are particular to climate and standards and may not be required. UL and/or FM Global requirements may be needed for insurance purposes.

- 1. Class 90 rated and listed in accordance with UL-580 for Wind Uplift.
- 2. Class A rated and listed in accordance with UL-790 for External Fire.
- 3. Class 4 rated and listed in accordance with UL-2218 for Impact Resistance.

Specifier: Review and retain the following item for LEED projects pursuing credit SS 7.2 - Heat Island Effect. SRI may also be an energy code requirement.

- 4. Third-party listed and rated in a nationally recognized program in accordance with ANSI/CRRC S100 with an [Initial] [3-year Aged] Solar Reflectance and [Initial] [3-year Aged] Thermal Emittance such that a minimum [Initial] [3-year Aged] Solar Reflectance Index (SRI) of ___ per ASTM E 1980 assuming medium wind conditions is provided.

B. Through-Fastened Panels:

- 1. Type: Single skin ribbed panels with exposed fasteners.
- 2. Strength: Determine and certify allowable panel strengths in accordance with AISI S100.
- 3. Panel profile(s): PBR; 1-1/4 inch (32 mm) ribs at 12 inch (305 mm) centers, 1/2:12 minimum roof slope.
 - a. Thickness: [26 gauge] [24 gauge] [22 gauge]
 - b. Finish:[Galvalume® Plus] [SMP] [PVDF] [PVDF Metallic]

Specifier: Delete color for unpainted finishes such as Galvalume® and Galvalume® Plus.

- c. Color: [Selected from manufacturer standard colors] [As shown on drawings].
- d. Air Infiltration: Maximum air infiltration of 0.04 cubic feet per minute per square foot of specimen area when tested to ASTM E 1680 at a pressure differential of +/- 1.57 psf (75 Pa).
- e. Water Infiltration: No uncontrollable water leakage when tested to ASTM E 1646 at a 20 psf (955 Pa) pressure differential when sprayed with 5 gallons of water per hour per square foot (203 liters per square meter) of specimen area.

Specifier: Retain FM Approvals' listing requirement for FM Global-insured projects or where FM Global requirements are used as minimum design standard. Select required windstorm classification based upon calculation method in FM Global Loss Prevention Sheet 1-28; note that FM Approvals' windstorm classification does not correlate directly to design wind speed.

- f. FM Approvals Rating: Provide FM 4471 Approved assemblies on the basis of the following ratings. Identify materials with FM Approvals markings:
 - 1) External Fire: Class A.
 - 2) Internal Fire: Class 1.
 - 3) Hail: Severe.
 - 4) Wind: [1-60] [1-75] [1-90] [1-120] [As determined by FM 1-28]
- 4. Panel Profile(s): [PBU; 3/4 inch (19 mm) ribs at 6 inch (152 mm) centers, 1:12 minimum roof slope.] [7.2; (1-1/2 inch (39 mm) ribs at 7.2 inch centers, 1/2:12 minimum roof slope.)]
 - a. Thickness: [26 gauge] [24 gauge] [22 gauge]
 - b. Finish:[Galvalume® Plus] [SMP] [PVDF] [PVDF Metallic]

Specifier: Delete color for unpainted finishes such as Galvalume® and Galvalume® Plus.

- c. Color: [Selected from manufacturer standard colors] [As shown on drawings].
 - 5. Panel fasteners: [Long-life finish.] [410 Series stainless steel] [300 Series stainless steel].
 - 6. Sidelap mastic: [1 inch x 3/32 inch (25 mm x 2.4 mm)] [1/2 inch x 3/32 inch (13 mm x 2.4 mm)].
- C. Standing Seam Panels:
- 1. Type: Single skin panels with concealed clips.
 - 2. Panel Strength: Determine and certify panel strength as follows:
 - a. Positive Loading (Toward Panel Supports): Determine in accordance with AISI S100.
 - b. Negative Loading (Away from Panel Supports): Determine in accordance with ASTM E 1592.
 - 3. Panel profile: Double-Lok:
 - a. Panel Type: Trapezoidal machine seamed, 1/4:12 minimum roof slope.
 - b. Panel width: [24 inches wide x 3 inches high (610 mm wide x 76 mm high)] [24 inches wide x 3 inches high (610 mm wide x 76 mm high)] [18 inches wide x 3 inches high (457 mm wide x 76 mm high)] [12 inches wide x 3 inches high (305 mm wide x 76 mm high)].
 - c. Thickness: [24 gauge] [22 gauge].
 - d. Finish: [Galvalume® Plus] [PVDF] [SMP] [PVDF Metallic].

Specifier: Delete color for unpainted finishes such as Galvalume® and Galvalume® Plus.

- e. Color: [Selected from manufacturer standard colors] [As shown on drawings].
- f. Air Infiltration: Maximum air infiltration of 0.04 cubic feet per minute per square foot of specimen area when tested to ASTM E 1680 at a pressure differential of +/- 1.57 psf (75 Pa).
- g. Water Infiltration: No uncontrollable water leakage when tested to ASTM E 1646 at a 20 psf (955 Pa) pressure differential when sprayed with 5 gallons of water per hour per square foot (203 liters per square meter) of specimen area.

Specifier: Retain FM Approvals' listing requirement for FM Global-insured projects or where FM Global requirements are used as minimum design standard. Select required windstorm classification based upon calculation method in FM Global Loss Prevention Sheet 1-28; note that FM Approvals' windstorm classification does not correlate directly to design wind speed.

h. FM Approvals Rating: Provide FM 4471 Approved assemblies on the basis of the following ratings. Identify materials with FM Approvals markings:

- 1) External Fire: Class A.
- 2) Internal Fire: Class 1.
- 3) Hail: Severe.
- 4) Wind: [1-60] [1-75] [1-90] [1-120] [As determined by FM 1-28]

4. Panel profile: Ultra-Dek:

- a. Panel Type: Trapezoidal snap lock, 1/4:12 minimum roof slope.
- b. Panel width: [24 inches wide x 3 inches high (610 mm wide x 76 mm high)] [24 inches wide x 3 inches high (610 mm wide x 76 mm high)] [18 inches wide x 3 inches high (457 mm wide x 76 mm high)] [12 inches wide x 3 inches high (305 mm wide x 76 mm high)].
- c. Thickness: [24 gauge] [22 gauge].
- d. Finish: [Galvalume® Plus] [PVDF] [SMP] [PVDF Metallic].

Specifier: Delete color for unpainted finishes such as Galvalume® and Galvalume® Plus.

e. Color: [Selected from manufacturer standard colors] [As shown on drawings].

5. Panel profile: SuperLok; vertical leg architectural SSR machine seamed, 1/2:12 minimum roof slope.

- a. Panel width: [16 inches wide x 2 inches high (406 mm wide x 51 mm high)] [12 inches wide x 2 inches high (305 mm wide x 51 mm high)].
- b. Seaming Type: Machine seamed.
- c. Thickness: [24 gauge] [22 gauge].
- d. Finish: [Galvalume® Plus] [PVDF] [SMP] [PVDF Metallic].

Specifier: Delete color for unpainted finishes such as Galvalume® and Galvalume® Plus.

- e. Color: [Selected from manufacturer standard colors] [As shown on drawings].
- f. Air Infiltration: Maximum air infiltration of 0.04 cubic feet per minute per square foot of specimen area when tested to ASTM E 1680 at a pressure differential of +/- 1.57 psf (75 Pa).
- g. Water Infiltration: No uncontrollable water leakage when tested to ASTM E 1646 at a 12 psf (574 Pa) pressure differential when sprayed with 5 gallons of water per hour per square foot (203 liters per square meter) of specimen area.

Specifier: Retain FM Approvals' listing requirement for FM Global-insured projects or where FM Global requirements are used as minimum design standard. Select required windstorm classification based upon calculation method in FM Global Loss Prevention Sheet 1-28; note that FM Approvals' windstorm classification does not correlate directly to design wind speed.

h. FM Approvals Rating: Provide FM 4471 Approved assemblies on the basis of the following ratings. Identify materials with FM Approvals markings:

- 1) External Fire: Class A.
- 2) Internal Fire: Class 1.
- 3) Hail: Severe.
- 4) Wind: [1-60] [1-75] [1-90] [1-120] [As determined by FM 1-28].

6. Panel profile: BattenLok HS; vertical leg architectural SSR machine seamed, 1/2:12 minimum roof slope.

- a. Panel width: [16 inches wide x 2 inches high (406 mm wide x 51 mm high)] [12 inches wide x 2 inches high (305 mm wide x 51 mm high)].
- b. Seaming Type: Machine seamed.
- c. Thickness: [24 gauge] [22 gauge].
- d. Finish: [Galvalume® Plus] [PVDF] [SMP] [PVDF Metallic].

Specifier: Delete color for unpainted finishes such as Galvalume® and Galvalume® Plus.

- e. Color: [Selected from manufacturer standard colors] [As shown on drawings].
 - f. Air Infiltration: Maximum air infiltration of 0.04 cubic feet per minute per square foot of specimen area when tested to ASTM E 1680 at a pressure differential of +/- 1.57 psf (75 Pa).
 - g. Water Infiltration: No uncontrollable water leakage when tested to ASTM E 1646 at a 12 psf (574 Pa) pressure differential when sprayed with 5 gallons of water per hour per square foot (203 liters per square meter) of specimen area.
- 7. Panel clips: [As required by design and insulation requirements] [High Floating Clips] [Low Floating Clips] [High Sliding Clips] [Low Sliding Clips].
 - 8. Thermal spacers: As Required for insulation system and panel clip.

D. Foam Insulated Metal Panels

- 1. Basis of Design Manufacturer: Metl-Span. Other approved manufacturers include:
 - a. CENTRIA, subsidiary of NCI Building Systems, Inc. (www.centria.com)

Specifier: Although FM Approvals requirements are not required for the majority of projects, the International Building Code does reference FM Approval Standard 4880 in Chapter 26 to qualify foam plastics for the thermal barrier exemption and requires them to be labeled when that exemption is exercised.

- 2. Labeling: Labeled through [a nationally recognized program] [FM Global], identifying the manufacturer, product name and model and product listings required in this section.
- 3. Panel Core: Foamed in-place, Zero Ozone Depletion Potential polyurethane or polyisocyanurate.
- 4. Fire Resistance:
 - a. FM 4880 Class 1 Approval with no height restrictions.
 - b. Flame Spread and Smoke Developed Index: The Flame Spread Index shall not exceed 25 and the Smoke Developed Index shall not exceed 450 when tested to ASTM E 84.
- 5. Panel Strength: Determine and certify panel allowable strengths as follows:
 - a. Positive Loading (Toward Panel Supports): Determine in accordance with ASTM E 72.
 - b. Negative Loading (Away from Panel Supports): Determine in accordance with ASTM E 1592.
- 6. U-Factor Determination: ASTM C 1363 conducted in accordance with ASHRAE 90.1 Section A9.3.2 or by Finite Element Modeling per ASHRAE 90.1 Section A9.4 and using core insulation thermal conductivity (k-factor) determined using ASTM C 518 conducted at 75 degree F mean temperature in the calculation.
- 7. Through-fastened Insulated Panels:
 - a. Panel profile: LS-36.

- b. Panel Thickness: [1-1/2] [2] [2-1/2] [3] [4] [5] [6] inches ([39] [51] [64] [76] [102] [127] [154] mm).
- c. Panel Width: 36 inches (91 mm)
- d. Exterior Face:
 - 1) Profile: [Stucco Embossed] 1-1/4 inch (32 mm) high ribs at 12 inch (305 mm) centers.
 - 2) Thickness: [26 gauge] [24 gauge] [22 gauge].
 - 3) Finish: [Galvalume®] [PVDF] [SMP] [PVDF Metallic].

Specifier: Delete color for unpainted finishes such as Galvalume® and Galvalume® Plus.

- 4) Color: [Selected from manufacturer standard colors] [As shown on drawings].
- e. Interior Face:
 - 1) Profile: Stucco Embossed [1/8 inch (3.2 mm) Mesa] [1/16 inch (1.6 mm) Mesa] symmetrical ribs nominally 4 inches (10 mm) on centers.
 - 2) Thickness: [26 gauge] [24 gauge] [22 gauge]
 - 3) Finish: [Polyester] [SMP] [PVDF].
 - 4) Color: [Igloo White] [Selected from manufacturer standard colors] [As shown on drawings].

Specifier: When specifying insulated panels, it is generally advisable to specify a maximum U-factor on the basis of the prescriptive requirements of the applicable energy code and have the contractor coordinate with other disciplines once the supplier is selected and thickness is determined. Alternatively, thickness can be specified below and then have the contractor verify code compliance via a trade-off calculation using acceptable compliance software such as ComCheck (<http://www.energycodes.gov/comcheck>) once the supplier is selected as the U-factor will not match ASHRAE requirements exactly in this case. **It is not recommended to specify insulation R-value since there is no nationally recognized standard for determining the R-value of IMPs** and not all manufacturers report equivalent R-values due to different handling of the effects of joints, air films, temperature differentials, etc. Determination of U-factor of generic assemblies is addressed in Appendix A of ASHRAE 90.1 and this generally leads to comparable numbers between manufacturers. Retain item d or e below as appropriate here and similarly below.

- f. Maximum U-factor: _____ BTU/hour-square foot-degree F.
- g. Air Infiltration: Maximum air infiltration of 0.04 cubic feet per minute per square foot of specimen area when tested to ASTM E 1680 at a pressure differential of +/- 1.57 psf (75 Pa).
- h. Water Infiltration: No uncontrollable water leakage when tested to ASTM E 1646 at a 20 psf (955 Pa) pressure differential when sprayed with 5 gallons of water per hour per square foot (203 liters per square meter) of specimen area.

Specifier: Retain FM Approvals' listing requirement for FM Global-insured projects or where FM Global requirements are used as minimum design standard. Select required windstorm classification based upon calculation method in FM Global Loss Prevention Sheet 1-28; note that FM Approvals' windstorm classification does not correlate directly to design wind speed.

- i. FM Approvals Rating: Provide FM 4471 Approved assemblies on the basis of the following ratings. Identify materials with FM Approvals markings:
 - 1) External Fire: Class A.
 - 2) Internal Fire: Class 1.
 - 3) Hail: Severe.
 - 4) Wind: [1-60] [1-75] [1-90] [1-120] [As determined by FM 1-28].

8. Standing Seam Insulated Roof Panels:

- a. Panel profile: CFR
- b. Panel thickness: [2] [2-1/2] [3] [4] [5] [6] inches ([51] [64] [76] [102] [127] [152] mm).
- c. Panel Width: [42] [36] [30] inches ([1067] [914] [762] mm).
- d. Exterior Face:
 - 1) Profile: Stucco embossed 1/8" (3.2mm) Mesa symmetrical ribs nominally 4 inches (10mm) on centers with 2" vertical leg standing seam side laps.
 - 2) Sheet Thickness: [26 gauge] [24 gauge] [22 gauge]
 - 3) Finish: [Galvalume®] [PVDF] [SMP] [PVDF Metallic].

Specifier: Delete color for unpainted finishes such as Galvalume® and Galvalume® Plus.

- 4) Color: [Selected from manufacturer standard colors] [As shown on drawings].
- e. Interior Face:
 - 1) Profile: Stucco embossed [1/8" (3.2mm) Mesa] [1/16" (1.6 mm) Mesa] symmetrical ribs nominally 4 inches (10mm) on centers.
 - 2) Sheet Thickness: [26 gauge] [24 gauge] [22 gauge]
 - 3) Finish: [Polyester] [SMP] [PVDF]
 - 4) Color: [Igloo White] [Selected from manufacturer standard colors] [As shown on drawings].
- f. Maximum U-factor: _____ BTU/hour-square foot-degree F.
- g. Air Infiltration: Maximum air infiltration of 0.04 cubic feet per minute per square foot of specimen area when tested to ASTM E 1680 at a pressure differential of +/- 1.57 psf (75 Pa).
- h. Water Infiltration: No uncontrollable water leakage when tested to ASTM E 1646 at a 20 psf (955 Pa) pressure differential when sprayed with 5 gallons of water per hour per square foot (203 liters per square meter) of specimen area.

Specifier: Retain FM Approvals' listing requirement for FM Global-insured projects or where FM Global requirements are used as minimum design standard. Select required windstorm classification based upon calculation method in FM Global Loss Prevention Sheet 1-28; note that FM Approvals' windstorm classification does not correlate directly to design wind speed.

- i. FM Approvals Rating: Provide FM 4471 Approved assemblies on the basis of the following ratings. Identify materials with FM Approvals markings:
 - 1) External Fire: Class A.
 - 2) Internal Fire: Class 1.
 - 3) Hail: Severe.
 - 4) Wind: [1-60] [1-75] [1-90] [1-120] [As determined by FM 1-28]

E. Roof Light Transmitting Panels:

- 1. Material: Provide UV-resistant, Woven Roving fiber-reinforced acrylic Light Transmitting Panels (LTP) meeting the following requirements:
 - a. Self-Ignition Temperature: 650 degrees Fahrenheit (343 degrees Celsius) when tested in accordance with ASTM D 1929.
 - b. Diffuse Light Transmission: Not less than 50% when tested to ASTM D 1494.
 - c. Burn Rate: Less than 2.5 inches per minute when tested in accordance with ASTM D 635.

- d. Smoke Developed Index: Not greater than 450 when tested in accordance with ASTM E 84.
- e. Haze Value: Not less than 90% when tested in accordance with ASTM D 1003.

Specifier: LTPs are not generally recognized by ASHRAE 90.1 and as such, don't have explicit U-factor or SHGC requirements or accepted methods other than testing to determine their performance levels. Therefore, it is recommended that the supplier be asked to provide the values in their submittals so that they can be used in code compliance calculations, rather than set them specifically.

- f. Thermal Transmission: Provide U-Factor determined by ASTM C 1363 conducted in accordance with ASHRAE 90.1 Section A9.3.2, NFRC 100 or by Finite Element Modeling per ASHRAE 90.1 Section A9.4.
 - g. Solar Heat Gain Coefficient: Provide SHGC determined by NFRC 200.
- 2. Through-Fastened Roof LTP: Provide [single] [double] layer LTP that match the profile of the roof panel.
 - 3. Standing Seam Roof LTP: Provide [single] [double] layer [field-located] [factory-assembled] LTP.

F. Accessories

- 1. Pipe flashing: [_____].
- 2. Roof curbs: [_____].
- 3. Roof Vents:
 - a. Source: [By metal building system manufacturer] [_____].
 - b. Type: [12 inches x 10 feet (305 mm x 3.05 m) ridge gravity] [20 inch (508 mm) round gravity] [24 inch (610 mm) round gravity] [Include operable dampers].
 - c. Finish: [Unpainted Galvalume®] [Prefinished white] [Field paint over white] [_____].
- 4. Eave trim condition: [Standard gutters and downspouts] [Low profile snow gutters and downspouts] [Simple eave] [Sculptured eave].
- 5. Valley gutters: [_____].
- 6. Parapet gutters: [_____].

2.7 WALL, LINER, SOFFIT, AND FASCIA PANEL SYSTEMS

- A. Assembly Performance Requirements: Provide assemblies that function as exterior walls that meet the following requirements:
 - 1. Air Infiltration: Maximum air infiltration of 0.04 cubic feet per minute per square foot of specimen area when tested to ASTM E 283 at a pressure differential of +/- 1.57 psf (75 Pa).
 - 2. Water Infiltration: No uncontrollable water leakage when tested to ASTM E 331 at a 6.24 psf pressure differential when sprayed with 5 gallons of water per hour per square foot of specimen area.
- B. Through-Fastened Panels:
 - 1. Panel type: Single skin ribbed panels with exposed fasteners.
 - 2. Panel Strength: Determine in accordance with AISI S100.
 - 3. Panel profiles:
 - a. PBR: 12 inch x 1 inch (305 mm x 25 mm) Rib. 1-1/4 inch (32 mm) ribs x 12 inch (305 mm) centers.
 - b. Reverse Rolled PBR: 1-1/4 inch (32 mm) inverted ribs x 12 inch centers.
 - c. AVP: 1-1/8 inch (28.5 mm) inverted ribs x 12 inch (305 mm) centers.

- d. PBU: 3/4 inch (19 mm) ribs x 6 inch (152 mm) centers.
 - e. Reverse Rolled PBU: 3/4 inch (19 mm) ribs x 6 inch (152 mm) centers.
 - f. 7.2: 1-1/2 inch (39 mm) ribs x 7.2 inch (183 mm) centers.
 - g. PBC: 7/8 inch (22 mm) corrugated x 2.67 inch (68 mm) centers.
 - h. PBD: 5/8 inch (16 mm) ribs x 2.67 inch (68 mm) centers.
- 4. Thickness: [26 gauge] [24 gauge].
 - 5. Finish: [Galvalume® Plus] [PVDF] [SMP] [PVDF Metallic].

Specifier: Delete color for unpainted finishes such as Galvalume® and Galvalume® Plus.

- 6. Color: [Selected from manufacturer standard colors] [As shown on drawings].
- 7. Panel fasteners: [Long-life finish] [Stainless steel].

C. Concealed Fastener Panels:

- 1. Panel type: Single skin panels with concealed fasteners.
- 2. Panel Strength: Determine and certify panel strength as follows:
 - a. Positive Loading (Toward Panel Supports): Determine in accordance with AISI S100.
 - b. Negative Loading (Away from Panel Supports): Determine in accordance with ASTM E 1592.
- 3. Panel Profiles:
 - a. ShadowRib: 16 inches x 3 inches (mm x 76 mm).
 - b. NuWall: 12 inches x 2-1/2 inches (305 mm x 63.5 mm).
 - c. Designer Series: 12 inches x 1-3/4 inch (305 mm x 44.5 mm) flat.
 - d. Designer Series: 16 inches x 1-3/4 inches (406 mm x 44.5 mm) fluted.
 - e. Artisan Panel: 12 inches x 1 inch (305 mm x 25 mm); soffits or interior liner only.
- 4. Thickness: [26 gauge] [24 gauge] [22 gauge].
- 5. Finish: [Galvalume® Plus] [PVDF] [SMP] [PVDF Metallic].

Specifier: Delete color for unpainted finishes such as Galvalume® and Galvalume® Plus.

- 6. Color: [Selected from manufacturer standard colors] [As shown on drawings].
- 7. Panel fasteners: [Long-life finish] [Stainless steel].

D. Foam Insulated Metal Panels

- 1. Basis of Design Manufacturer: Metl-Span. Other approved manufacturers include:
 - a. CENTRIA, subsidiary of NCI Building Systems (www.centria.com)

Specifier: Although FM Approvals requirements are not required for the majority of projects, the International Building Code does reference FM Approval Standard 4880 in Chapter 26 to qualify foam plastics for the thermal barrier exemption and requires them to be labeled when that exemption is exercised.

- 2. Labeling: Labeled through [a nationally recognized program] [FM Global], identifying the manufacturer, product name and model and product listings required in this section.
- 3. Panel Core: Foamed in-place, Zero Ozone Depletion Potential polyurethane or polyisocyanurate.

Specifier: IBC exempts IMPs from having to be NFPA 285 approved assemblies when they are used as exterior walls one-story buildings equipped with an automatic sprinkler. IBC also exempts IMPs from having to be used with an interior thermal barrier when tested and listed under FM 4880 Class 1 Approval. Retain or edit the following section as necessary.

4. Fire Resistance:
 - a. Third-party listed assembly tested to and meeting the requirements of NFPA 285.
 - b. FM 4880 Class 1 Approval with no height restrictions.
 - c. Flame Spread and Smoke Developed Index: The Flame Spread Index shall not exceed 25 and the Smoke Developed Index shall not exceed 450 when tested to ASTM E84.
5. Panel Strength: Determine and certify panel strength as follows:
 - a. Positive Loading (Toward Panel Supports): Determine in accordance with ASTM E 72.
 - b. Negative Loading (Away from Panel Supports): Determine in accordance with ASTM E 1592.

Specifier: See note regarding specification of U-factor and thickness for IMPs in roof section above.

6. U-Factor Determination: ASTM C 1363 conducted in accordance with ASHRAE 90.1 Section A9.3.2 or by Finite Element Modeling per ASHRAE 90.1 Section A9.4 and using core insulation thermal conductivity (k-factor) determined using ASTM C 518 conducted at 75 degree F mean temperature in the calculation.

Specifier: Retain FM Approvals' listing requirement for FM Global-insured projects or where FM Approval requirements are used as minimum design standard. Select required windstorm classification based upon calculation method in FM Global Loss Prevention Sheet 1-28; note that FM Approvals' windstorm classification does not correlate directly to design wind speed.

7. FM Approvals Rating: Provide FM 4881 Approved panels on the basis of the following ratings. Identify materials with FM Approvals markings:
 - a. Hail: Severe.
 - b. Wind: Class +____/-____, Zone H.
8. Through-Fastened Insulated Wall Panels:
 - a. Panel Profile: LS-36.
 - b. Panel Thickness: [1-1/2] [2] [2-1/2] [3] [4] [5] [6] inches ([39] [51] [63.5] [76] [102] [127] [152] mm).
 - c. Panel Width: 36 inches (91 mm)
 - d. Exterior Face:
 - 1) Profile: Stucco embossed 1-1/4 inch (32 mm) high ribs at 12 inch (305 mm) centers.
 - 2) Sheet Thickness: [26 gauge] [24 gauge] [22 gauge].
 - 3) Finish: [PVDF] [SMP] [PVDF Metallic].
 - 4) Color: [Selected from manufacturer standard colors] [As shown on drawings].
 - e. Interior Face:
 - 1) Profile: Stucco embossed [1/8" (3.2mm) Mesa] [1/16" (1.6 mm) Mesa] symmetrical ribs nominally 4 inches (10mm) on centers.

- 2) Sheet Thickness: [26 gauge] [24 gauge] [22 gauge].
 - 3) Finish: [Polyester] [SMP] [PVDF]
 - 4) Color: [Igloo White] [Selected from manufacturer standard colors] [As shown on drawings].
- f. Maximum U-factor: _____ BTU/hour-square foot-degree F.
- g. Panel fasteners: Stainless steel.
9. Concealed Fastener Insulated Panels:
- a. Panel profile: CF Vertical.
 - 1) Panel thickness: [2] [2-1/2] [3] [4] inches ([51] [63.5] [76] [102] mm).
 - 2) Panel width: [36] [30] [24] inches ([914] [762] [610] mm).
 - 3) Exterior Face:
 - a) Profile: Flat stucco embossed
 - b) Sheet Thickness: 22 gauge.
 - c) Finish: [SMP] [PVDF] [PVDF Metallic]
 - d) Color: [Selected from manufacturer standard colors] [As shown on drawings].
 - 4) Interior Face
 - a) Profile: Stucco embossed [1/8" (3.2mm) Mesa] [1/16" (1.6 mm) Mesa] symmetrical ribs nominally 4 inches (10mm) on centers.
 - b) Sheet thickness: 22 gauge.
 - c) Finish: [Polyester] [SMP] [PVDF].
 - d) Color: [Igloo White] [Selected from manufacturer standard colors] [As shown on drawings].
 - 5) Maximum U-factor: _____ BTU/hour-square foot-degree F.
 - b. Panel profile: CF Mesa.
 - 1) Panel thickness: [2] [2-1/2] [3] [4] [5] [6] inches ([51] [63.5] [76] [102] [127] [152] mm).
 - 2) Panel width: [36] [42] inches ([914] [1067] mm).
 - 3) Exterior Face
 - a) Profile: Stucco Embossed [1/8" (3.2mm) Mesa] [1/16" (1.6 mm) Mesa] symmetrical ribs nominally 4 inches (10mm) on centers.
 - b) Sheet thickness: [26 gauge] [24 gauge] [22 gauge].
 - c) Finish: [SMP] [PVDF] [PVDF Metallic].
 - d) Color: [Selected from manufacturer standard colors] [As shown on drawings].
 - 4) Interior Face
 - a) Profile: Stucco embossed [1/8" (3.2mm) Mesa] [1/16" (1.6 mm) Mesa].
 - b) Sheet Thickness: [26 gauge] [24 gauge] [22 gauge].
 - c) Finish: [Polyester] [SMP] [PVDF]
 - d) Color: [Igloo White] [Selected from manufacturer standard colors] [As shown on drawings].
 - 5) Maximum U-factor: _____ BTU/hour-square foot-degree F.

- c. Panel profile: CF Fluted
- 1) Panel Thickness: [2] [2-1/2] [3] [4] [5] [6] inches ([51] [63.5] [76] [102] [127] [152] mm).
 - 2) Panel Width: 42 inches (1067 mm).
 - 3) Exterior Face
 - a) Profile: Stucco Embossed, flutes 1" wide and nominal 3/8" deep, 8-1/2 inch (21.6 mm) on centers.
 - b) Sheet thickness: 26 gauge.
 - c) Finish: [SMP] [PVDF] [PVDF Metallic]
 - d) Color: [Selected from manufacturer standard colors] [As shown on drawings].
 - 4) Interior Face
 - a) Profile: Stucco Embossed [1/8 inch (3.2mm) Mesa] [1/16 inch (1.6 mm) Mesa] symmetrical ribs nominally 4 inches (10mm) on centers.
 - b) Sheet thickness: 26 gauge.
 - c) Finish: [Polyester] [SMP] [PVDF].
 - d) Color: [Igloo White] [Selected from manufacturer standard colors] [As shown on drawings].
 - 5) Maximum U-factor: _____ BTU/hour-square foot-degree F.
- d. Panel profile: Santa Fe
- 1) Panel thickness: [2] [2-1/2] [3] [4] inches ([51] [63.5] [76] [102] mm).
 - 2) Panel width: [42] [36] inches ([1067] [914] mm).
 - 3) Exterior Face:
 - a) Profile: Flat Aztec (heavy stucco) embossed.
 - b) Sheet Thickness: [24 gauge] [22 gauge].
 - c) Finish: [SMP] [PVDF] [PVDF Metallic].
 - d) Color: [Selected from manufacturer standard colors] [As shown on drawings].
 - 4) Interior Face
 - a) Profile: Stucco Embossed [1/8" (3.2mm) Mesa] [1/16" (1.6 mm) Mesa] symmetrical ribs nominally 4 inches (10mm) on centers.
 - b) Sheet thickness: [26 gauge] [24 gauge] [22 gauge].
 - c) Finish: [Polyester] [SMP] [PVDF].
 - d) Color: [Igloo White] [Selected from manufacturer standard colors] [As shown on drawings].
 - 5) Maximum U-factor: _____ BTU/hour-square foot-degree F.
- e. Panel profile: CF Striated
- 1) Panel thickness: [2] [2-1/2] [3] inches ([51] [63.5] [76] mm).
 - 2) Panel width: [30] [36] [42] inches ([762] [914] [1067] mm).
 - 3) Exterior Face:
 - a) Profile: Stucco Embossed longitudinal striations 1" (25mm) wide and nominal 1/32 inches (0.8mm) deep.
 - b) Sheet thickness: [24 gauge] [22 gauge].

- c) Finish: [SMP] [PVDF] [PVDF Metallic].
- d) Color: [Selected from manufacturer standard colors] [As shown on drawings].

4) Interior face:

- a) Profile: Stucco embossed [1/8 inch (3.2mm) Mesa] [1/16 inch (1.6 mm) Mesa] symmetrical ribs nominally 4 inches (10mm) on centers.
- b) Sheet thickness: [26 gauge] [24 gauge] [22 gauge].
- c) Finish: [Polyester] [SMP] [PVDF].
- d) Color: [Igloo White] [Selected from manufacturer standard colors] [As shown on drawings].

5) Maximum U-factor: _____ BTU/hour-square foot-degree F.

f. Panel Profile: 7.2 InsulRib

1) Panel thickness: [2-1/2] [3] [4] [5] [6] inches ([63.5] [76] [102] [127] [152] mm).

2) Panel width: 36 inches (762 mm).

3) Exterior Face:

- a) Profile: Stucco Embossed longitudinal trapezoidal ribs 1 ½ inches (3.8mm) deep and 7.2 inches (18.3mm) on center.
- b) Sheet Thickness: [26 gauge] [24 gauge] [22 gauge].
- c) Finish: [SMP] [PVDF] [PVDF Metallic]
- d) Color: [Selected from manufacturer standard colors] [As shown on drawings].

4) Interior Face:

- a) Profile: Stucco embossed [1/8 inch (3.2mm) Mesa] [1/16 inch (1.6mm) Mesa] symmetrical ribs nominally 4 inches (10mm) on centers.
- b) Sheet thickness: [26 gauge] [24 gauge] [22 gauge].
- c) Finish: [Polyester] [SMP] [PVDF].
- d) Color: [Igloo White] [Selected from manufacturer standard colors] [As shown on drawings].

5) Maximum U-factor: _____ BTU/hour-square foot-degree F.

E. Accessories:

1. Base condition:

- a. Formed base: Pre-finished bronze, self-flashing, for through-fastened panels.
- b. Base member: [Angle] [Channel] [Girt].
- c. Base member flashing: [Drip] [Masonry] [As indicated on Drawings].

2. Framed openings:

- a. Finish: [Match girt finish] [Pre-Galvanized].
- b. Framed opening trim: [Standard jamb, head, sill trim package] [Standard trim plus full cover trim on exposed jambs and headers].

3. Trim profiles: [Manufacturer's standard profiles] [As indicated on Drawings].

F. Wall Light Transmitting Panels (LTP):

1. Material: Provide UV-resistant, [Chopped Glass] [Woven Roving] fiber-reinforced acrylic LTP meeting the following requirements:
 - a. Self-Ignition Temperature: 650 degrees Fahrenheit (343 degrees Celsius) when tested in accordance with ASTM D 1929.
 - b. Diffuse Light Transmission: Not less than 50% when tested to ASTM D 1494.
 - c. Burn Rate: Less than 2.5 inches per minute when tested in accordance with ASTM D 635.
 - d. Smoke Developed Index: Not greater than 450 when tested in accordance with ASTM E 84.
 - e. Haze Value: Not less than 90% when tested in accordance with ASTM D 1003.

Specifier: LTPs are not generally recognized by ASHRAE 90.1 and as such, don't have explicit U-factor or SHGC requirements or accepted methods other than testing or modeling to determine their performance levels. Therefore, it is recommended that the supplier be asked to provide the values in their submittal so that they can be used in code compliance calculations, rather than set them specifically.

- f. Thermal Transmission: Provide U-Factor determined by ASTM C 1363 conducted in accordance with ASHRAE 90.1 Section A9.3.2 or by Finite Element Modeling per ASHRAE 90.1 Section A9.4
 - g. Solar Heat Gain Coefficient: Provide SHGC determined by NFRC 200.
 2. Through-Fastened wall LTP: Provide [single] [double] layer LTP that match the profile of the wall panel.

G. Walk Doors:

1. Source: [Specified in other sections] [By metal building system manufacturer].
2. Size: [3 x 7 feet] [4 x 7 feet] [6 x 7 feet] [As indicated on Drawings].
3. Elevation: [Solid] [Narrow lite] [Half glass] [As indicated on Drawings].
4. Type: [Insulated] [Non-insulated].
5. Hardware:
 - a. [Cylindrical] [Mortise] lockset.
 - b. Exit device.
 - c. Weather stripping and threshold.
 - d. Closers.
 - e. Kick plate.
 - f. Latch guard.
 - g. Chain stops.
6. Frame type: [Self framing] [Framed openings].
7. Door assembly: [Knocked down for field assembly and glazing] [Pre-assembled with glazing included].
8. Glazing: [Laminated] [Tempered].
9. Finish: [White primer] [Bronze primer].

H. Windows:

1. See Section
2. Source: [Specified in other sections] [By metal building system manufacturer].

I. Louvers:

1. Source: [Specified in other sections.] [By metal building manufacturer].

2. Size: [To be selected from available sizes] [[2 x 2] [3 x 2] [3 x 3] [4 x 3] [3 x 4] [5 x 4] [__ x __] feet].
3. Type: [Fixed] [Adjustable].
4. Frame type: [Self framing] [Framed openings].
5. Finish: [Match adjacent wall color] [_____].

2.8 FABRICATION

A. General:

1. Shop-fabricate framing members for field bolted assembly.
2. Surfaces of bolted connections: Smooth and free from burrs and distortions.
3. Shop connections to conform to manufacturer's standard design practices.
4. Mark framing members with identifying mark.
5. Welding to conform to AWS D1.1 and AWS D1.3 as applicable.

B. Primary Framing:

1. Plates, stiffeners, and related members: Factory welded base plates, splice plates, cap plates, and stiffeners into place on structural members.
2. Bolt holes and related machining: Shop fabricate base plates, splices and flanges to include bolt connection holes. Shop-fabricate webs to include bracing holes.
3. Secondary structural connections (purlins and girts): Ordinary (not pretensioned) bolted connections with welded clips.
4. Welding inspection: Per IAS AC472 Part A.

C. Long Bay Purlins:

1. Fabricate purlins from cold-formed open web long bay system assemblies with stiffened chords.
2. Install connection bolts through purlin seats.
3. Pre-punch assemblies to allow for attachment of frame flange brace angles, compression strut extensions, and diagonal X-bridging at centerline.
4. Furnish bridging as light-gauge cold-formed angles secured using self-drilling fasteners.
5. Manufacture sections in IAS AC472 Part A and B Accredited facility.
6. Top and bottom chords: Nominal 4 inch (102 mm) width formed so that top surface is continuous and flat to facilitate easy assembly of roof system.
7. Fabricate all elements of minimum 16 gauge steel.
8. Subject finished assemblies to periodic testing to loads equal to 110 percent of design loads.

D. Zee Purlins:

1. Fabricate purlins from cold-formed Z-shaped sections with stiffened flanges.
2. Size flange stiffeners to comply with requirements of AISI S100.
3. Purlin flanges unequal in width for easier nesting during erection.
4. Purlins pre-punched at factory to provide for field bolting to rigid frame clips.

E. Eave Struts:

1. Fabricate eave struts from cold-formed unsymmetrical C-shaped sections with stiffened flanges.
2. Size flange stiffeners to comply with requirements of AISI S100.
3. No welded splices permitted.
4. Eave Struts pre-punched at factory to provide for field bolting to rigid frame clips.

- F. Girts: Simple or continuous span as required by design. Connection bolts will install through webs not flanges.
- G. Bracing:
1. Diagonal Bracing:
 - a. Diagonal bracing in roof and sidewalls may be used to resist longitudinal loads in structure when panel diaphragm cannot be used.
 - b. Furnish to length and equipped with hillside washers and nuts at each end.
 - c. Bracing may consist of rods threaded at each end or galvanized cable with suitable threaded end anchors.
 - d. If load requirements dictate, bracing may be of structural angle or pipe, bolted in place.
 2. Special Bracing:
 - a. When diagonal bracing is not permitted in sidewall use rigid frame type portal or fixed base column.
 - b. Shear walls may be used where adequate to resist applied wind or seismic forces.
 3. Flange Braces: Brace compression flange of primary framing laterally with angles connecting to purlin or girt webs so that flange compressive stress is within allowable limits for any combination of loading.
 4. Bridging:
 - a. Laterally brace top chord of long bay purlins with horizontal bridging if roof system being used will not supply adequate lateral support to top chord.
 5. Horizontally bridge bottom chord for lateral bracing. One row of bolted diagonal bridging required for long span purlins 40 feet (12 192 mm) long and longer.
- H. Standing Seam Panels:
1. Provide factory fabricated and finished metal panels and accessories meeting performance requirements, indicated profiles and structural requirements.
 2. Fabricate metal joints configured to accept applied sealant providing weathertight seal and preventing metal to metal contact and minimizing noise resulting from thermal movement.
 3. Fabricate panels in continuous lengths for full length of detailed runs, except where otherwise indicated on drawings.
 4. Sheet Metal Flashing and Trim: Fabricate or install flashing and trim to comply with manufacturer's written instructions and construction drawings.
 5. Configure Ultra-Dek and Double-Lok panels with interlocking edges with factory applied hot-melt mastic inside female seam. Female side snaps over male side (Ultra-Dek) and when seamed (Double-Lok) creates continuous lock, forming 360 degree Pittsburgh seam.
 6. Notch Ultra-Dek and Double-Lok panels at factory at both ends so that field installation can commence or terminate from either end of building.
 7. Maximum panel length: 45 feet (13 716 mm) unless otherwise indicated.
- I. End Laps:
1. Fabricate with 16 gauge backup plates and eight end lap joint fasteners installed in six pre-punched holes in flat and in dimples in trapezoidal legs.

2. Apply mastic between panels and secure with self-drilling fasteners through panels and backup plate.
3. Through roof fasteners may be used only at end laps and eaves.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean surfaces prior to installation.
- B. Prepare surfaces using methods recommended by manufacturer for best result for substrate.

3.2 INSTALLATION

- A. Install system in accordance with manufacturer's instructions and approved Shop Drawings.
- B. Fit members square against abutting components.
- C. Position members plumb, square, and level.
- D. Temporarily brace members until permanently fastened.
- E. Do not splice load bearing members.
- F. Align and adjust various members forming parts of a complete frame or structure after assembly but before fastening.
- G. Welding to conform to AWS D1.1.
- H. Fasten panels to supports.
- I. Install trim to maintain visual continuity of system.
- J. Install joint sealant and gaskets to prevent water penetration.
- K. Flash penetrations through roofing with metal trim to match panels

3.3 PROTECTION

- A. Protect installed products until completion of project.

3.4 ADJUSTMENT

- A. Touch up, repair, or replace damaged products before Substantial Completion.

END OF SECTION