a. **LEED v3.0**: Minimum 78 for roof slopes of 2:12 or less and 29 for roof slopes greater than 2:12 under medium wind conditions, per ASTM E 1980.

b. **LEED v4.0**: Minimum SRI requirements per Sustainable Sites Credit, Heat Island Reduction, Table 1:
   i.) Minimum 82 **initial** SRI for roof slopes of 2:12 or less and 39 **initial** SRI for roof slopes greater than 2:12.
   ii.) Minimum 64 **aged** SRI for roof slopes of 2:12 or less and 32 **aged** SRI for roof slopes greater than 2:12.

2. **Energy Star Qualified**: Listed on USDOE ENERGY STAR Roof Products Qualified Product List.
3. **Cool Roof Rating Council**: Listed in CRRC Rated Product Directory, with minimum properties as required by applicable Energy efficiency or High-Performance Green Building standard.

C. Structural Performance: Provide metal panel assemblies capable of withstanding the effects of indicated loads and stresses within limits and under conditions indicated, as determined by ASTM E 72 or ASTM E 1592 applied in accordance with ICC AC 04, Section 4, Panel Load Test Option or Section 5, Panel Analysis Option:

Specifier: Consult structural engineer and edit below as required by local codes. Insert structural data below if not indicated on drawings. Select applicable deflection limit.

1. Wind Loads: Determine loads based on uniform pressure, importance factor, exposure category, and basic wind speed indicated on drawings.
   a. Roof Panel Wind Uplift Testing: Certify capacity of metal panels by testing of proposed assembly per ASTM E 72 or ASTM E 1592.
2. Roof Panel Snow Loads: [25 lbf/sq. ft. (1197 Pa)].
3. Deflection Limits: Withstand inward and outward wind-load design pressures in accordance with applicable building code with maximum deflection of 1/180 of the span with no evidence of failure.

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. Consult Ceco representative for details.

D. **Roof Panels FM Approvals Listing**: Comply with FM Approvals 4471 as part of a panel roofing system, and that are listed in FM Approvals' "RoofNav" for Class 1 construction.

1. Fire/Windstorm Classification: [Class 1A-60] [Class 1A-75] [Class 1A-90] [Class 1A-105] [Class 1A-120] [Class 1A-135].
2. Hail Resistance Rating: SH.

E. Fire Performance Characteristics: Provide metal panel systems with the following fire-test characteristics determined by indicated test standard as applied by UL or other testing and inspection agency acceptable to authorities having jurisdiction.

1. Surface-Burning Characteristics: Provide metal panel systems with the following characteristics when tested per ASTM E 84. The core shall have:
   a. Flame spread index: 25 or less.
   b. Smoke developed index: 450 or less.
2. Fire Performance of Insulated Roof: Class 1 roof and wall panel per ANSI/FM 4880.

F. Roof Panel Air Infiltration, ASTM E 1680: Maximum 0.023 cfm/sq. ft. (0.115 L/s per sq. m) at static-air-pressure difference of 12 lbf/sq. ft. (575 Pa).

G. Roof Panel Water Penetration Static Pressure, ASTM E 1646: No uncontrolled water penetration at a static pressure of 20 lbf/sq. ft. (958 Pa).

H. Test procedure for susceptibility to leakage of discontinuous roof systems protocol TAS 114: Water applied to a depth of 6" above the lowest section of roof profile. No water infiltration observed during the seven day test period.

I. Thermal Movements: Allow for thermal movements from variations in both ambient and internal temperatures. Accommodate movement of support structure caused by thermal expansion and contraction. Allow for deflection and design for thermal stresses caused by temperature differences from one side of the panel to the other.

Specifier: The specific configuration of thermal performance testing has a significant impact on the published results. The thermal performance testing performed by Ceco and described below conforms to industry standard testing and ASHRAE 90.1 requirements.

J. Thermal Performance: When tested in accordance with ASTM C 518, Measurement of Steady State thermal Transmission, the panels shall provide a k factor of 0.14 btu/sf/hr/deg F at a 75° F (24° C) mean temperature, as required by code, or 0.126 btu/sf/hr/deg F at a 40° F (4° C) mean temperature.

2.3 INSULATED METAL ROOF PANELS

A. Standing Seam, Foamed-Insulation-Core Metal Roof Panels: Structural metal panels consisting of an exterior standing seam with an interior tongue and groove joint, coupled with a vapor seal in the standing seam, and provides superior resistance to air and moisture intrusion. Attached with concealed fasteners to the structure.

1. Basis of Design: Ceco**, CFR Insulated Metal Panel**.

Specifier: Second paragraph below describes Galvalume Plus with clear acrylic coating for use as exposed metallic finish.

2. **G-90 Galvanized Coated Steel:** ASTM A 653 **or Aluminum-Zinc Alloy-Coated Steel**: ASTM A 792/A 792M, structural quality, Grade 50, Coating Class AZ50 (Grade 340, Coating Class AZM150), prepainted by the coil-coating process per ASTM A 755/A 755M.

3. **Aluminum-Zinc Alloy-Coated Steel Sheet**: ASTM A 792/A 792M, structural quality, Grade 50, Coating Class AZ55 (Grade 340, Coating Class AZM165) unpainted Galvalume Plus coating.

Specifier: Prior to selecting metal thickness and panel thickness below, consult manufacturer's span tables and review selection against panel thickness requirements and span condition. Select appropriate panel configuration to meet requirements of design wind pressure. **Important: Consult this document when specifying gauge with the intent that it meet a prescriptive decimal thickness requirement in addition to strength performance requirements. (Click Here To View)**

4. Exterior Face Sheet: [24 gauge] [22 gauge] coated thickness, with stucco embossed] surface.

1) Finish: [Modified silicone-polyester two-coat system] [Fluoropolymer two-coat system] [Fluoropolymer two-coat metallic color system] [Exposed Galvalume Plus coating].
2) Color: [As indicated] [As selected by Architect from manufacturer's standard colors] [Match Architect's custom color].

5. Interior Face Sheet: [26 gauge] [24 gauge] [22 gauge] coated thickness, with stucco embossed surface and planked profile.
   1) Finish: [Polyester two-coat system] [Modified silicone-polyester two-coat system] [Fluoropolymer two-coat system] [Vinyl plastisol two-coat system] [304 Stainless Steel] [316 Stainless Steel].
   2) Color: [As indicated] [As selected by Architect from manufacturer's standard colors] [Match Architect's custom color].

6. Endlaps: Provide panels with factory endlaps, notching, swedging and backer plates; where panel lengths permit.

7. Low Eave Treatment: Provide cutback for trim/gutter installation; where panel lengths permit.

8. Panel Width: [30 inches (762 mm)] [36 inches (914 mm)] [42 inches (1067 mm)] [as shown on drawings].

6. Panel Thickness: [2 inch (51 mm)] [2.5 inch (64 mm)] [3 inch (76 mm)] [4 inch (102 mm)] [5 inch (127 mm)] [6 inch (152 mm)] [As required to meet performance requirements] [as shown on drawings].

7. Insulating Core: Polyurethane with zero ozone depletion potential blowing agent
   a. Closed Cell Content: 90% or more as determined by ASTM D 6226
   b. Compressive Strength: As required to meet structural performance requirements and with a minimum of 15 psi as determined by ASTM D 1621
   c. Minimum Density: 2.0 pcf (32 kg/m3) as determined by ASTM D 1622

PART 2 - Specifier: Insert corresponding panel thickness R-value below if using IMP as continuous insulation or U-factor if treating as an assembly for code compliance purposes. Refer to Ceco literature and Paragraph 2.2 K above. Coordinate with information on drawings. Consult Ceco representative for details.

   d. **Thermal Resistance (R-Value)**: [insert corresponding value deg. F * hr * sq. ft./Btu (K * sq. m/W)] as determined by ASTM C 518 at 75 degrees Fahrenheit mean temperature.

8. Heat Transfer Coefficient (U-factor)**:** [insert corresponding value Btu/hr * sq. ft. * deg. F insert corresponding value (W/K * sq. m)] as determined by ASTM C 1363 at 75 degrees Fahrenheit mean temperature. Tested specimen must include at least two engaged side joints.

2.4 METAL ROOF PANEL ACCESSORIES

A. General: Provide complete metal panel assemblies incorporating trim, copings, fasciae, gutters and downspouts, and miscellaneous flashings. Provide required fasteners, closure strips, and sealants as indicated in manufacturer's written instructions.

B. Flashing and Trim: Match material, thickness, and finish of metal panel face sheet.

C. Panel Fasteners: Self-tapping screws and other acceptable fasteners recommended by metal panel manufacturer. Provide corrosion-resistant fasteners with heads matching color of metal panels by means of factory-applied coating, with weathertight resilient washers.

D. Joint Sealers: Provide Tape Mastic Sealants and Concealed Joint Sealants per Section 07 92 00, “Joint Sealants”.

E. **Roof Accessories**: Approved by metal panel manufacturer. Refer to Section 07 72 00 "Roof Accessories" for requirements for curbs, equipment supports, roof hatches, heat and smoke vents, ventilators, and preformed flashing sleeves.

F. **Snow Guards**: Compatible with standing seam roof and approved by metal panel manufacturer. Refer to Section 07 72 53 "Snow Guards" for requirements for snow guards attached to metal roof panels.

G. **Roof Curbs**: Compatible with standing seam roof and approved by metal panel manufacture. Refer to Section 07 72 10 “Roof Curbs” for requirements for roof curbs attached to metal roof panels.

2.5 FABRICATION

A. General: Provide factory fabricated and finished metal panels, trim, and accessories meeting performance requirements, indicated profiles, and structural requirements.

B. Fabricate metal panel joints configured to accept sealant tape providing weathertight seal and preventing metal-to-metal contact and minimizing noise resulting from thermal movement.

C. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's written instructions, approved shop drawings, and project drawings.

2.6 FINISHES

A. Finishes, General: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

B. Exterior Face Sheet Coil-Coated Finish System

1. Silicone-Polyester Two-Coat System: 0.20 – 0.25 mil primer with 0.7 – 0.8 mil color coat, [meeting solar reflectance index requirements].
   a. Basis of Design: Ceco, Silicone Polyester.

Specifier: Ceco's fluoropolymer coatings are based on Arkema, Inc. Kynar 500 and Solvay Solexis Hylar 500 PVF2 resins.

2. Fluoropolymer Two-Coat System: 0.2 – 0.3 mil primer with 0.7 - 0.8 mil 70 percent PVDF fluoropolymer color coat, AAMA 621, [meeting solar reflectance index requirements].
   a. Basis of Design: Ceco, Fluoropolymer.

Specifier: Select interior face sheet finish from three options below; Igloo White color is standard unless otherwise indicated. Verify with Ceco; not all finishes are available on all products.

C. Interior Face Sheet Coil-Coated Finish System:
1. Polyester Two-Coat System: 0.20 – 0.25 mil primer with 0.7 – 0.8 mil color coat
   a. Basis of Design: Ceco, Igloo White
2. Silicone-Polyester Two-Coat System: 0.20 – 0.25 mil primer with 0.7 – 0.8 mil color coat
   a. Basis of Design: Ceco, Silicone Polyester
3. Fluoropolymer Two-Coat System: 0.2-mil primer with 0.7 - 0.8 mil 70 percent PVDF fluoropolymer color coat
   a. Basis of Design: Ceco, Fluoropolymer
4. Vinyl Plastisol Two-Coat System: 0.2 mil primer with 4 mil high solids plastisol finished with PVC technology.

a. Basis of Design: Ceco, Vinyl

5. 304 and 316 Stainless Steel: 2B 304 or 2B 316 Stainless Steel.
   a. Basis of Design: Ceco, Stainless Steel

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine metal panel system substrate with Installer present. Inspect for erection tolerances and other conditions that would adversely affect installation of metal panels.

1. Inspect framing that will support insulated metal panels to determine if support components are installed as indicated on approved shop drawings and are within tolerances acceptable to metal panel manufacturer and installer. Confirm presence of acceptable framing members at recommended spacing to match installation requirements of metal panels.

2. Panel Support Tolerances: Confirm that metal panel supports are within tolerances acceptable to metal panel manufacturer but not greater than the following:

   a. 1/4 inch (6 mm) in 20 foot (6100 mm) in any direction.
   b. 3/8 inch (9 mm) over any single roof plane.
   c. At Purlin Spacing 7 feet (2133 mm) or less: 1/8 inches (3 mm), out only.

B. Correct out-of-tolerance work and other deficient conditions prior to proceeding with insulated metal panel installation.

3.2 METAL PANEL INSTALLATION

A. Standing Seamed, Concealed-Fastener Insulated Metal Panels: Install metal panel system in accordance with manufacturer's written instructions, approved shop drawings, and project drawings. Install metal panels in orientation, sizes, and locations indicated. Anchor panels and other components securely in place. Provide for thermal and structural movement.

B. Attach panels to metal framing using clips, fasteners, and sealants recommended for application by metal panel manufacturer.

1. Fasten metal panels to supports with fasteners at each location indicated on approved shop drawings, at spacing and with fasteners recommended by manufacturer.
2. Cut panels in field where required using manufacturer's recommended methods.
3. Provide weatherproof jacks for pipe and conduit penetrating metal panels.
4. Dissimilar Materials: Where elements of metal panel system will come into contact with dissimilar materials, treat faces and edges in contact with dissimilar materials as recommended by metal panel manufacturer.

C. Attach panel flashing trim pieces to supports using recommended fasteners and joint sealers.

D. Joint Sealers: Install tape sealers and liquid sealants where indicated and where required for weatherproof performance of metal panel assemblies.

1. Seal panel side and perimeter joints using joint sealers indicated in manufacturer's instructions.

Specifier: Retain optional panel vapor seal bead below when recommended based upon architect's water vapor transmission analysis.

2. Seal roof panel joints utilizing tape sealer and vapor seal bead of non-curing butyl.

3. Prepare joints and apply sealants per requirements of Division 07 Section "Joint Sealants."

3.3 ACCESSORY INSTALLATION

A. General: Install metal panel accessories with positive anchorage to building and weathertight mounting; provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal panel assembly, including trim, copings, flashings, sealants, closure strips, and similar items.
2. Comply with details of assemblies utilized to establish compliance with performance requirements and manufacturer's written installation instructions.
3. Set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently weather resistant.

3.4 FIELD QUALITY CONTROL

Specifier: Retain one or both paragraphs below and edit options when scope and complexity of metal roof panel installation justifies independent inspection and testing provisions.

A. Testing Agency: **[**Owner will engage**]** **[**Engage**]** an independent testing and inspecting agency acceptable to Architect to perform field tests and inspections and to prepare test reports.

3.5 CLEANING AND PROTECTION

A. Remove temporary protective films immediately in accordance with metal panel manufacturer's instructions. Clean finished surfaces as recommended by metal panel manufacturer.

B. Replace damaged panels and accessories that cannot be repaired to the satisfaction of the Architect.

END OF SECTION