

Insulated Metal Roof Panels NBC 2015 - Based

An insulated metal panel, or IMP, is a roof or wall cladding element consisting of two metal skins surrounding an insulating core. Individual units connect through tongue-and-groove joinery and when installed as a system, are designed to provide a weather-resistant, vapor retarding thermal barrier suitable for use in commercial construction.

IMPs, like all other building materials, must meet the provisions of the building code in effect for the project and site under consideration. However, certain basic parameters listed in this specification are generally required for use on most commercial buildings in Canada. This document is therefore being presented by the IMP Alliance of the Metal Construction Association (MCA) as an aid for designers to assist them in construction of project specifications, notes and other contract documents.

The scope of this document is a typical low-rise (i.e., 3 stories or less) commercial building of non-hazard occupancy as identified by the National Building Code of Canada, where IMPs with polyisocyanurate or polyurethane cores are used as either a standing seam or through-fastened roofing system.

SECTION 07 42 00

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Factory foamed-in-place or laminated insulated metal roof panels with standing seam side laps and related trim and accessories.

1.2 RELATED REQUIREMENTS

- A. Division 07 "Thermal Insulation" for insulation of roof assemblies
- B. Division 07 "Roofing and Siding Panels" for insulated metal panels
- C. Division 07 "Metal Roof and Wall Panels" for factory-formed metal roof panels
- D. Division 07 Section "Sheet Metal Flashing and Trim" for flashings and trim

1.3 REFERENCES

Specifier: Referenced Standard year of edition has been omitted for ease of maintenance. Generally, the edition of the referenced standards is that of Chapter 35 of the applicable version of IBC or IBC-based code, or latest version of the specification if not within one calendar year of release.

- A. American Society of Heating, Refrigeration, Air Conditioning and Refrigeration Engineers (ASHRAE)
 - 1. ANSI/ASHRAE/IES Standard 90.1 – Energy Standard for Buildings Except Low-Rise Residential Buildings (ASHRAE 90.1)
- B. American Society of Testing Materials (ASTM)
 - 1. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - 2. ASTM A 755/A 755M - 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. ASTM A 792/A 792M - Standard Specification for Steel Sheet, 55 % Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.

4. ASTM A 924/924M - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
 5. ASTM C 273/C 273M - Standard Test Method for Shear Properties of Sandwich Core Materials
 6. ASTM C 518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
 7. ASTM C 1363 - Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus
 8. ASTM D 1621 - Standard Test Method for Compressive Properties of Rigid Cellular Plastics
 9. ASTM D 1622/D 1622M - Standard Test Method for Apparent Density of Rigid Cellular Plastics
 10. ASTM D 1623 - Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics
 11. ASTM D 2126 - Standard Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging
 12. ASTM D 2244 - Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates
 13. ASTM D 4214 - Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films
 14. ASTM D 6226 - Standard Test Method for Open Cell Content of Rigid Cellular Plastics
 15. ASTM E 72 - Standard Test Methods of Conducting Strength Tests of Panels for Building Construction
 16. ASTM E 1592 - Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference
 17. ASTM E 1646 - Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference
 18. ASTM E 1680 - Standard Test Method for Rate of Air Leakage through Exterior Metal Roof Panel Systems
 19. ASTM E 2322 - Standard Test Method for Conducting Transverse and Concentrated Load Tests on Panels used in Floor and Roof Construction
 20. ASTM E 2357 - Standard Test Method for Determining Air Leakage Rate of Air Barrier Assemblies.
- C. FM Approvals (FM)
1. FM 4471 - Approval Standard for Class 1 Panel Roofs
- D. ICC Evaluation Service (ICC-ES)
1. ICC-ES AC04 - Acceptance Criteria for Sandwich Panels
- E. Underwriters Laboratories of Canada (ULC)
1. ULC-S102: Standard Method of Test for Surface Building Characteristics of Building Materials and Assemblies
 2. ULC S 107: Methods of Fire Tests of Roof Coverings
 3. ULC-S124: Test for the Evaluation of Protective Coverings for Foamed Plastic
 4. ULC-S138: Standard Method of Test for Fire Growth of Insulated Building Panels in Full-Scale Room Configuration

1.4 DESIGN REQUIREMENTS

- A. The insulated metal roof panels shall be metal faced foam core sandwich panels produced on a [continuous | discontinuous] process manufacturing line under strict quality control and must be independently audited by a recognized audit facility/testing lab. The roof panel system (panel thickness, gauge, spans, connections) shall be designed to resist specified wind loads, thermally induced movement, and exposure to weather without failure.

1.5 DELIVERY STORAGE AND HANDLING

- A. Protect products of metal panel system during delivery, storage, and handling to prevent staining, denting, deterioration of components or other damage. Product panels and trim bundles during shipping.
 - 1. Deliver insulated metal panels in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storage.
 - 2. Store in accordance with manufacturer's written instructions.
 - 3. Cover insulated metal panels with temporary shelter and from direct sunlight until all components are installed.

1.6 WARRANTY

- A. Manufacturer's Warranty: Submit manufacturer's written two (2) year limited warranty providing materials to be free from defects in material and workmanship from the date of production excluding coil coatings and paint finishes that are covered under a separate warranty.
- B. Paint Finish Warranty: Submit Manufacturer's limited warranty on the exterior paint finish for adhesion to the metal substrate and on the exterior paint finish for chalk, fade, and cracking.

Specifier: Choose applicable paint system specification.

- 1. Fluoropolymer (PVDF) Two-Coat System:
 - a. Chalk in excess of a numerical rating of eight (8) when measured in accordance with the standard procedures outlined in ASTM D 4214
 - b. Fade or change in color in excess of five (5) E units when calculated in accordance with ASTM D 2244. The color change is to be measured on exposed painted surface cleaned of surface soils and oxidation.
 - c. Failure of adhesion, peeling, checking, or cracking.
 - d. Warranty Period: Twenty (20) years from the date of Substantial Completion, or twenty (20) years and 3 months from the date of shipment from manufacturer's plant, whichever occurs first.
- 2. Silicone Modified Polyester (SMP) Two-Coat System:
 - a. Chalk in excess of a numerical rating of eight (8) when measured in accordance with the standard procedures outlined in ASTM D 4214
 - b. Fade or change in color in excess of five (5) E units when calculated in accordance with ASTM D 2244. The color change is to be measured on exposed painted surface cleaned of surface soils and oxidation.
 - c. Failure of adhesion, peeling, checking, or cracking.
 - d. Warranty Period: Twenty (20) years from the date of Substantial Completion, or twenty (20) years and 3 months from the date of shipment from manufacturer's plant, whichever occurs first.
- C. Unpainted Finish Warranty: Submit manufacturers limited warranty against rupture, structural failure, or perforation of exterior roof panels due to normal atmospheric corrosion within a period of 20 years from date of manufacture.
- D. Installer's Warranty: The installation contractor shall issue a separate warranty against defects in installed materials and workmanship, beginning from the date of substantial completion of the installation.

PART 2 - MATERIALS

2.1 APPROVED MANUFACTURERS

- A. All Weather Insulated Panels; 929 Aldridge Rd.; Vacaville, CA 95688; (888) 970-2947; sales@awipanel.com; www.awipanel.com

- B. ATAS International; 6612 Snowdrift Rd.; Allentown, PA 18106; (800) 468-1441; info@atas.com; www.atas.com
- C. CENTRIA; 1550 Coraopolis Heights Road Suite 500; Moon Township, PA 15108; (888) 254-7099; info@centria.com; www.centria.com
- D. Green Span Profiles; 21200 FM 362; Waller TX 77484; (844) 807-7400; info@gsplc.com; www.greenspanprofiles.com
- E. Kingspan Insulated Panels, Inc.; 726 Summerhill Dr.; DeLand, FL 32724; (877) 638-3266; info@kingspanpanels.us; www.kingspan.com
- F. Metl-Span; 1720 Lakepointe Dr. Suite 101; Lewisville TX 75057; (877) 585-9969; info@metlspan.com; www.metlspan.com
- G. Norbec Inc.; 97 Rue de Vaudreuil, Boucherville, QC J4B 1K7; (877) 667-2321; info@norbec.com; www.norbec.com
- H. TrueCore; 801 Hunter Industrial Park Road; Laurens SC 29360; (864) 300-4131; info@truecorepanels.com; www.truecorepanels.com

2.2 PERFORMANCE REQUIREMENTS

A. Structural performance

1. Resistance to loads applied normal to the plane of the roof panel shall be as determined by suitable pressure chamber test (positive or negative loading) such as ASTM E 72, ASTM E 2322, or ASTM E 1592 applied in accordance with common industry practice and published guidance from a recognized third-party evaluation criteria such as ICC-ES (AC04) or IAPMO (UES)
 - a. Dead, Roof Live, Snow and Wind Loads: As determined by applicable building code or referenced standard.
 - b. Roof Live and Snow Load Deflection Limit: [L/180 | L/240 | L/___]
 - c. Wind Load Deflection Limit (under service level loads): [L/180 | L/240 | L/___]

B. Fire Performance

Specifier: Choose required roof classification for external fire per NBC or local code requirements.

1. Insulated Metal Panels shall be approved for use in a Class [A | A or B | A, B or C] roofing assembly when tested in accordance with CAN/ULC S107
2. Foam plastic insulating core shall be tested to CAN/ULC S102 and shall have a Flame Spread Index less than or equal to 500.

Specifier: Choose paragraph 3 or 4 below on the basis of applicability of NBC 3.1.4 (combustible construction) or 3.1.5.6 (noncombustible construction) respectively.

3. Insulated Metal Panels shall be protected by a thermal barrier meeting the requirements of Classification B when tested to CAN/ULC-S124.
4. Insulated Metal Panels shall be tested to and meet the criteria of CAN/ULC-S138.

Specifier: Retain or delete the following paragraph on the basis of FM Global insurability requirements for the project.

5. Insulated Metal Panel assemblies shall have a FM Approvals Class 1 rating for metal panel roofs in accordance with FM 4471.

C. Thermal Performance:

Specifier: Choose U-factor or R-value requirements per NECCB or applicable building energy efficiency standard. Compliance via U-factor requires item 1, while compliance via R-value requires both items 2 and 3.

1. Assembly Heat Transfer Coefficient (U-factor) shall be determined by ASTM C 1363. Tested specimen must include at least two engaged side joints. Air film allowance shall be from ASHRAE 90.1 Section A9.4.1
2. Thermal Resistance (R-factor) of the foam core shall be determined by dividing the core nominal thickness by the k-factor for each product.

Specifier: The thermal conductivity of foam plastic changes with temperature. Many manufacturers test at 24°C mean for comparability with fiberglass insulation. However, other temperatures may be used based on the use, occupancy and location of the building. The options shown below, 4.4°C mean (3.a.), or 24°C mean (3.b.) are common temperatures used in the industry and are recommended in ASTM C1058. Generally, only one is chosen.

3. Thermal Conductivity (k-factor) shall be determined by ASTM C 518 at the following temperature:
 - a. 4.4°C (40°F) mean: Hot side ambient of 24±5°C (75±9°F), cold side ambient of -15±5°C (5±9°F)
 - b. 24°C (75°F) mean: Hot side ambient of 38±5°C (100±9°F), cold side ambient of 10±5°C (50±9°F)
- D. Air Infiltration: Assemblies of materials and components (sealants, tapes, etc.) shall have an average air leakage no more than 0.2 l/s·m² (0.04 cfm/ft²) under a pressure differential of 75 Pa (1.57 psf) when tested in accordance with ASTM E 1680 or ASTM E 2357.
- E. Weather Protection: Provide IMP system tested in accordance with ASTM E 1646 under a pressure differential of 960 Pa (20 psf) for a test duration of 120 minutes.

2.3 INSULATED METAL ROOF PANELS

Specifier: Retain or delete from the following paragraphs consistent with the roof panel configurations for the project. Paragraph A is for standing seam roof systems and Paragraph B is for exposed fastener roof systems.

- A. The insulated metal roof panel shall have a side joint with an offset tongue and groove on the interior side and a trapezoidal or vertical standing seam exterior design, permitting exterior side installation and fasteners completely concealed within side joint. [Factory Applied sealants shall be provided in the standing seam joint.] Fasteners shall be per manufacturer's fastening schedule and positively restrain the face sheet of the panel and adequately transfer loads to the structural supports.
- B. Insulated metal roof panels shall have a side joint with an offset tongue and groove on the interior side and a lapped rib exterior design with exposed fasteners permitting exterior side installation. Fasteners shall be per manufacturer's fastening schedule and positively restrain the face sheet of the panel and adequately transfer loads to the structural supports.

Specifier: Choose U-factor or R-value requirements per NECCB or applicable building energy efficiency standard. U-factor compliance requires item C, while R-value compliance requires item D.

- C. Provide Insulated Metal Panel assembly with a maximum Heat Transfer Coefficient (U-factor) of [____ W/m²·°C (____ Btu/hr·ft²·°F) | As shown on drawings].
- D. Provide Insulated Metal Panels with a minimum R-factor of [____ m²·°C/W (____ hr·ft²·°F/Btu) | As shown on drawings].

Specifier: Delete or retain the following two sections as necessary to accommodate painted and unpainted roof panels

- E. Painted exterior metal cover: G90 galvanized coated steel conforming to ASTM A 653M or AZM150 aluminum-zinc (Galvalume) alloy coated steel, conforming to ASTM A 792M, minimum Grade 230, pre-painted by the coil-coating process per ASTM A 755. General requirements as provided by ASTM A 924.
 - 1. The exterior profile shall be [one of the manufacturer's standard panel profiles | as shown on drawings]
 - 2. Nominal Uncoated Thickness: [0.48mm (0.019 inch) | 0.61mm (0.024 inch) | 0.74mm (0.029 inch)] minimum
 - 3. Finish: [Fluoropolymer (PVDF) Two-Coat System | Silicone Modified Polyester (SMP) Two-Coat System]
 - a. Thickness: 0.025 mm (1.0 mil) nominal dry film thickness
 - 4. Color: [As shown on drawings | As selected by Architect from manufacturer's standard colors | Match Architect's custom color]
- F. Unpainted exterior metal cover: AZM150 aluminum-zinc (Galvalume) alloy coated steel, conforming to ASTM A 792M, minimum Grade 230. General requirements as provided by ASTM A 924M.
 - 1. The exterior profile shall be [one of the manufacturer's standard panel profiles | as shown on drawings]
 - 2. Nominal Uncoated Thickness as follows:
 - a. Through-fastened profiles: [0.48mm (0.019 inch) | 0.61mm (0.024 inch) | 0.74mm (0.029 inch)] minimum
 - b. Standing seam profiles: [0.48mm (0.019 inch) | 0.61mm (0.024 inch) | 0.74mm (0.029 inch)] minimum
 - 3. Finish: Acrylic Coated
- G. Interior metal cover. G90 galvanized coated steel conforming to ASTM A 653M or AZM150 aluminum-zinc (Galvalume) alloy coated steel, conforming to ASTM A 792M, minimum Grade 230, pre-painted by the coil-coating process per ASTM A 755. General requirements as provided by ASTM A 924M.
 - 1. The interior profile shall be [one of the manufacturer's standard panel profiles | as shown on drawings]
 - 2. Nominal Uncoated Thickness: [0.48mm (0.019 inch) | 0.61mm (0.024 inch) | 0.74mm (0.029 inch)] minimum
 - 3. Finish: [Polyester Two-Coat System | Silicone Modified Polyester (SMP) Two-Coat System | Fluoropolymer (PVDF) Two-Coat System]
 - a. Thickness: 0.025mm (1.0 mil) nominal dry film thickness
 - 4. Color: [Manufacturer's Standard White | As Shown on drawings]
- H. The foam core shall meet or exceed the following physical properties:
 - 1. Compressive Strength (ASTM D 1621): 138 kPa (20 psi) minimum
 - 2. Density, in-place (ASTM D 1622): 32-42 kg/m³ (2.0-2.6 lb/ft³)
 - 3. Shear Strength (ASTM C 273): 193 kPa (28 psi) minimum
 - 4. Tensile Adhesion (ASTM D 1623): 207 kPa (30 psi) minimum
 - 5. Closed Cell Content (ASTM D 6226): 90% minimum
 - 6. Dimensional Stability (ASTM D 2126): 14 day aged <1% change at -30°C (-22°F), Dry Heat 70°C (158°F), Humid heat 70°C (158°F)

2.4 METAL ROOF PANEL ACCESSORIES

- A. Flashings: The insulated metal panel manufacturer shall furnish either the formed metal flashings or the flat stock in the same gauge, color, and paint finish system as the panel facings

- B. Panel Clips: Where shown on the panel shop/erection drawings, galvanized one-piece standing seam roof clips shall be provided by the panel manufacturer for use in the concealed panel joint and shall be identical to clips used in testing.
- C. Panel Fasteners: Self-drilling or self-tapping screws and other acceptable fasteners recommended by panel manufacturer. Where exposed fasteners cannot be avoided, supply corrosion-resistant fasteners with heads matching color of metal panels by factory-applied coating, with weather tight sealing washers.
- D. Sealant: Provide non-skinning butyl sealant, hot-melt gasket and/or butyl tape sealant in accordance with manufacturer's shop/erection drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine metal panel system substrate with Installer. Inspect for erection tolerances and other conditions that would adversely affect installation of metal panels.
 - 1. The contractor or installer shall examine the alignment of the steel supports before installing the metal wall panel system.
 - 2. Panel support tolerances:
 - a. Maximum deviation of steel alignment shall be limited to -0 to +9.5 mm (-0 to +3/16 inch) from the control with a 3.2 mm (1/8 inch) maximum change in deviation for any member of any 3 m (120 inch) run of panel.
 - 3. The erector shall not proceed with installation if panel support is not within the specified tolerances.
 - 4. The face of all structural members to which the panels are attached must be in the same roof plane, flat and free of obstructions, such as weld marks, bolts, or rivet heads. In no case shall roof panels be fastened directly to structural beams or rafters.

3.2 METAL PANEL INSTALLATION

- A. Manufacturer shall provide panel contractor with written instructions for recommended product storage and handling as well as standard installation procedures.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform tests and inspections and to prepare test reports.

3.4 PROTECTION AND CLEANING

- A. Remove temporary protective films in accordance with manufacturer's written instructions. Do not leave IMPs with protective films in direct sunlight for more than two days.
- B. Clean finished surfaces as recommended by metal panel manufacturer.
- C. Repair or replace any damaged or defective panels after determination of responsibility.