RoofStar Guarantee Standards for
ASM Systems

How to use the Guarantee Standards section

This section contains the Standards, Guiding Principles, Recommendations and reference materials necessary for the design and installation of a roof qualifying for a RoofStar Guarantee.

All relevant Standards for the selection and application of materials necessary to qualify for a ***RoofStar Guarantee*** are found in this section. Readers are advised to review relevant materials that can be accessed through the links available in the body of text or embedded in section titles; these are shown in **blue font**. Subsection titles shown in blue indicate links to more relevant material that the reader is advised to consult.

Content in this section is colour-coded according to four classes:

Guarantee Standards

Guiding Principles

Recommendations

Reference materials

To hide or reveal classes of text, use the buttons at the bottom of the page. ***Guarantee Standards*** always remain visible

For definitions of these terms of reference, click **here**.

Editor's note

The following materials are divided into fourteen (14) sections, and most of the content was significantly revised and supplemented in November 2018. Therefore, the reader should consider all of the content in this Section to be new since that date. Highlighted text indicates revisions made subsequent to the publishing of these revised Standards.

1 GENERAL

1. Architectural Metal Roofing Systems that are accepted for use in the RoofStar Guarantee Program are roll formed, non-structural (not designed to carry normal live loads), hydrokinetic (water-shedding) systems that must be installed over solid roof decks or rigid insulation panels. Although some metal panels may also be designed for use as structural (spanning member) systems, only their use as an architectural metal panel system (over solid deck) is accepted in the RoofStar Guarantee Program.
2. Metal roofing panels are roll formed in full rafter length pans that are fastened to decks with metal clips and screws, or that are manufactured with perforations or slots to facilitate concealed fastening. Galvanized steel and wood are the most common deck materials used with architectural metal roofing. (Refer to **3 Securing the Roof Assembly**).

1.1 References

In this **Manual**, all references

1. to the British Columbia Building Code or other standards presume the current edition that is in force.
2. to materials are assumed to be Accepted by the RGC, unless stated otherwise.

1.2 Definitions

In this **Manual**,

Architectural Sheet Metal and ASM are used interchangeably.

Design Authority means the individual or firm responsible for the issuance of *Project* specifications and details to which the *Project* will be bid and constructed. When a Contractor designs a *Project*, the Contractor is deemed to be the *Design Authority*.

Contractor ("contractor") means the installer of a roof assembly or system. For the purpose of issuing a ***RoofStar Guarantee***, *Contractor* shall be read to mean a Member of the RCABC.

Project means the designed or constructed ASM roof assembly or system.

1.3 Design Considerations

1. Compliance with ***RoofStar Guarantee Standards*** is mandatory for issuance of the ***RoofStar Guarantee*** certificate. The reader is urged to review all the sections of this **Manual** for ***RoofStar Guarantee Standards*** applicable to all aspects of the design.
2. The ***RoofStar Guarantee Program*** covers only architectural metal roof systems applied over solid decking. Structural metal roof systems requiring metal panels to span framing members unsupported by solid decking are not covered under the ***RoofStar Guarantee Program***.
3. Repairs or renovations to an existing roof system that is not covered by a ***RoofStar Guarantee*** do not qualify for a ***RoofStar Guarantee***. Renovations are defined as the partial removal and replacement of a metal roof system. To qualify for a ***RoofStar Guarantee***, the roof system must incorporate new materials, unless provided otherwise by a written Variance issued by the RoofStar Guarantee Department prior to tendering. Modifications or additions to a guaranteed roof are permissible, subject to various conditions, but must be made by a Contractor qualified to perform work under the ***RoofStar Guarantee Program***.

1.3.1 Engineered Designs: Structural

1. To qualify for a RoofStar Guarantee, all Architectural Sheet Metal roofs must be professionally engineered and documented on a Schedule S form (Specialty engineering; see BCBC, current edition). Roofs must be engineer-designed to
    1. withstand all anticipated live and dead loads, including but not limited to wind and other environmental loads (i.e. rain, snow) expected for the building's size and location (see **1.3.3 High Snow Loads**, below)
    2. accommodate thermal expansion and contraction of the roof system components
2. Engineered designs to resist wind uplift may refer to the British Columbia Building Code, Div. B, Appendix C, Table C-2 which lists various types of loads, including wind loads, for specific reference locations throughout the province. See also **Application Guides and Notes (Wind Resistance)** for a simplified calculation procedure. Regardless of the resources indicated here, the *Design Authority* is responsible to perform accurate wind load calculations and specify securement requirements.

    Each engineered designs must include, without limitation, the following:
    1. Metal panel profile and gauge
    2. Type of clips
    3. Bearing plates

4. Drag load components
5. Fasteners (type, size and spacing)
6. Roof assembly components (i.e. underlayment, insulation)
7. Deck Substrate

1.3.2 Detail Review

1. Shop drawings for each *Project* detail, which may be drawn by the roofing contractor, must be reviewed by the Accepted field reviewer and returned to the RCABC for conformity to the ***RoofStar Guarantee Standards*** prior to the start of construction.
2. Each construction detail must be reviewed during a field review and documented in the RGC field review report, to verify conformity to the ***RoofStar Guarantee Standards***.

1.3.3 High Snow Loads

1. In this **Manual**, a *high snow load area* is considered a regional area with a Specified Snow Load higher than 3.5 kPa.
2. To determine whether or not a building is located in a high snow load area, the *Design Authority* must calculate the anticipated snow loads for the roof, using the building code having jurisdiction. The following references are extracted from the British Columbia Building Code:
    1. **Div. B, 4.1.6.2 Specified Snow Load** (see the formula for calculating snow loads).
    2. Div. B, Appendix C, Table C-2 which lists various types of loads, including snow loads, for specific reference locations throughout the province.
3. Consideration should be given to
    1. slope.
    2. entrances/exits.
    3. penetrations.
    4. valley construction.
4. Roofs subject to high snow loads require
    1. full support for metal panels.
    2. a minimum slope of 1:1.5 (8"/12").
    3. a self-adhered modified bituminous membranes as eave protection and underlay.
    4. placement of penetrations near the ridge line.

1.4 Contractor Qualifications

1. Supervision, manufacturing and installation of a ***RoofStar-guaranteed*** metal roof system may be conducted only by established employees of Contractors who possess at least one of the following valid qualifications:

    1. Architectural Sheet Metal Journeyperson Certificate of Qualification.
    2. Sheet Metal trade ticket, together with at least five (5) years of documented experience installing and supervising the installation of ASM roofing.
    3. Roofing, Damp & Waterproofing trade ticket, together with at least five (5) years of documented experience installing and supervising the installation of ASM roofing.

    Refer to RCABC Policy A-248 and RCABC Policy A-107 Subcontracting.

1.5 Replacement Roofing and Additions

1. Where a new roof is tied-in to an existing roof, the two areas must be isolated and separated by a properly constructed curb joint that is

    1. at least 125 mm (5”) in height.
    2. securely attached to the structure.

3. sealed and flashed in keeping with the requirements for curbs (see **11.3.1 Curbs**).

If job conditions or aesthetic considerations do not allow for a curb joint, written permission must be obtained from the ***RoofStar Guarantee Program*** department to eliminate curb joints; a positive water cut-off must be installed to the deck to isolate the existing roof from the new roof.

1.6 Workmanship

While integrity and functionality of a new roof or waterproofed deck is the foundation of a ***RoofStar Guarantee***, it is no less important to ensure that the end product exhibits excellent workmanship.

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2 SUPPORTING STRUCTURES: Decks and Walls

2.1 Roof Slope

1. A minimum slope of 1:6 (2" in 12") is required. Where the designed slope is less than 1:4 (3/12), the engineered shop drawing package must be accompanied by manufacturer's literature confirming that this application is acceptable.
2. Roofs with designed slopes less than the stated minimum (such as curved applications) will be considered for a ***RoofStar Guarantee*** provided
    1. the design and installation details are submitted in writing to the Guarantee Program Administrator prior to the tendering of documents.
    2. a written Variance is issued by the ***RoofStar Guarantee Program*** prior to close of tender.

    See also **9 PANELS**.

3. If proprietary systems are specified, the manufacturer's suggested minimum slope and application procedures must be followed in addition to ***RoofStar Guarantee*** requirements.

2.2 Supporting Deck Types

2.2.1 Wood Decks

1. All wood decks
    1. must be affixed to the supporting framing or structure with corrosion-resistant
        1. wood screws.
        2. spiral nails.
        3. ring shank nails.
    2. with knots or cracks must
        1. have metal affixed over them before the deck can be accepted for roofing (this work should be done by others)
        2. be overlaid with a layer of knot-free 12.5 mm (1/2") plywood
2. The structural suitability of the fastener is the responsibility of the *Design Authority*.
3. Plywood with a minimum thickness of 15.9 mm (5/8") is the only acceptable sheathing to be used for wood roof decking, unless applied over a solid lumber decks (including, without limitation, laminated timber and wood board decks). Tongue and groove plywood sheathing with a minimum thickness of 15.9 mm (5/8") is required for decking on all copper and zinc non-ferrous (i.e. copper, zinc) metal panel roof systems.
4. OSB (sheathing) is **not** an acceptable wood deck.

2.2.2 Steel Decks

1. Steel decks must conform to one of the following specifications:
    1. ASTM Standard Specification A653 / A653M, Sheet Steel, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality, minimum Grade 33, with a design thickness of 22 gauge (0.759 mm) or greater and a minimum zinc coating designation Z275.
    2. ASTM Standard Specification A792 / A792M, Steel Sheet, Aluminium-Zinc Alloy-Coated by the Hot-Dip Process, General Requirements, minimum Grade 33, with a design thickness of 22 gauge (0.759 mm) or greater and a minimum aluminium-zinc alloy coating designation AZ150.

2.2.3 Concrete

1. Direct contact between metal roofing and concrete, light concrete, stone and mortar **must be avoided**. The selection of a suitable underlay, insulation, and method of attachment to a concrete deck or wall is the responsibility of the *Design Authority*.

2.3 Walls

1. Wood or steel-stud walls must be sheathed with a material suitable for securing metal flashings.
2. For concrete walls, refer to **2.2.3 Concrete** above.

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3 SECURING the ROOF ASSEMBLY

3.1 General

3.1.1 Design and Testing

The *Design Authority* is responsible to design the securement of the roof assembly, as required under **1.2.1 Engineered Designs: Structural**. The following information is a reference tool for designers, to be used at their own discretion.

The ***RoofStar Guarantee Program*** (RCABC Guarantee Corp., or RGC) initiated an investigation to establish the wind uplift resistance of architectural concealed fastener metal roof systems for use in British Columbia. The wind uplift tests were carried out at the Dynamic Roofing Facility at National Research Council, Institute For Research In Construction (NRC / IRC).

NRC / IRC report No.B1040 –3 (see **ASM Special Applications**) provides a simplified procedure for wind uplift design for roof assemblies with architectural metal roof coverings. In addition, NRC / IRC reports No. B1040-1 and B1040-2 provided the wind resistance test results for RoofStar-accepted metal panel systems and assisted the ***RoofStar Guarantee Program*** in developing guarantee standards and acceptance criteria for the Architectural Concealed Fastener Metal Roof Systems that are accepted for used in the ***RoofStar Guarantee Program***.

3.2 Materials

3.2.1 Fasteners, Clips and Cleats

1. For specific requirements, see below under Sections 9, 10 and 11.

3.3 Application

1. Concealed fasteners should provide clearance for the underside of the metal panel and must be of a material compatible with the metal clip.

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4 MATERIALS

NOTE: Click **here** to view all the Materials accepted for use in the ***RoofStar Guarantee Program***.

4.1 General

1. All roofing components installed by the contractor must be
    1. new
    2. accepted by the ***RoofStar Guarantee Program***
    3. manufactured, or listed as acceptable by, the panel manufacturer

    A listing is published in this **Manual** (see link above).
2. All materials must be protected from weather, properly stacked and secured above ground or the roof surface and covered by wrappers approved or recommended by the manufacturer.
3. All installed roofing materials that are susceptible to moisture damage must be made watertight by the end of each work day.
4. A Primary Material is a roofing, waterproofing or water-shedding material which is directly exposed to the weather and which is primarily responsible for protecting secondary materials, and the building interior, from water and weather generally. Membranes, metal panels or shingles form the core of this material type.
5. A Secondary Material is one which forms part of the roof or waterproofing assembly and which may affect the wind resistance characteristics of the entire assembly, but is not necessarily exposed to the weather.
6. Metals and fasteners must be compatible with each other, to avoid galvanic corrosion which can occur when dissimilar metals come in contact with each other. The size of fasteners shall be determined by the *Design Authority.*

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5 DECK and WALL OVERLAYS

5.1 General

1. A roof deck overlay is installed as part of the Roof Assembly, on the top surface of the roof deck but beneath the roofing materials. These products are most commonly affixed to steel decks to provide a level surface for the roof membrane or air/vapour barrier, or to serve as a thermal barrier between the roof deck and combustible insulation. Roof deck overlay materials may also be applied to other types of supporting deck structures, depending on the roof design criteria.

5.2 Materials

1. Deck and wall overlays must be suitable for, and compatible with, any membrane or panel application. Plywood, measuring at least 12.5 mm (1/2") in thickness, is acceptable as a deck or wall overlay.
2. When the Building Code having jurisdiction requires a thermal barrier, an accepted deck overlay must be specified and installed.
3. Walls that require resurfacing for membrane application must be covered with an accepted wall overlay. See **Accepted Wall Overlays**.
4. See also **Accepted Deck Overlays**.

5.3 Application

5.3.1 General

1. Deck overlays must be
    1. fully or intermittently supported along all edges by the deck.
    2. installed in a staggered pattern (offset) at least 300 mm (12") from adjacent board rows. A minus offset tolerance of 50 mm (2") maximum will be permitted to compensate for variance in the manufacturer's tolerance of differing board widths and lengths.
    3. affixed to the deck with either
        1. mechanical fasteners, and/or
        2. proprietary polyurethane foam adhesives acceptable to the primary roof system manufacturer.

        to meet or exceed the requirements set out in **3 SECURING the ROOF ASSEMBLY**.
    4. independently fastened to the deck
        1. with at least four (4) fasteners (with plates) per 1200 x 2400 (4'x8') sheet, or
        2. as specified by the *Design Authority*.
2. Wall overlays
    1. must be applied to existing sheathing where sheathing is not an acceptable substrate
    2. may be mechanically fastened or adhered.

5.3.2 Steel Decks

1. Deck overlays used as a thermal barrier to achieve a specific fire rating must conform to the applicable code and insurance requirements for the roof assembly.
2. When the roof assembly is uninsulated, the deck must be overlaid to provide a continuous layer of support. The deck overlay must be at least one layer of 12.7 mm (1/2")
    1. moisture resistant gypsum core board deck overlay board, or with
    2. plywood.

5.3.3 Wood Decks

1. A mechanically-fastened overlay board is required for any deck structure that does not meet the deck fastening criteria set out in **2.2.1 Wood Decks**.

5.3.4 Concrete Decks

1. While metal panels must be separated from a concrete deck to prevent corrosion, a deck overlay board is not mandatory and separation may be made with an underlayment.

5.3.5 Walls

1. Where the wall surface is unsuitable to receive a membrane, it must be covered with an accepted overlay material.
2. Wall overlays must be
    1. mechanically fastened with screw fasteners placed
        1. at the perimeters.
        2. at the corners.
        3. in the field, spaced no less than 300 mm (12”) O.C. vertically and horizontally, or in alignment with structural supports of the overlay panels.
    2. adhered with a polyurethane adhesive, applied with a continuous z-patterned ribbon spaced no less than 300 mm (12”) apart, in alignment with structural supports.

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6 AIR & VAPOUR CONTROLS

6.1 General

6.1.1 Intent

Air and vapour control layers, along with thermal barriers, water resistive barriers and water-shedding surfaces, serve to separate the outside environment from the interior environments of a structure. Continuous air control layers are perhaps the most critical. Building Codes in force in each jurisdiction, and the National Energy Code (2011), require the selection and proper installation of "a continuous air barrier system comprised of air-barrier assemblies to control air leakage into and out of the conditioned space" (NEC 2011).

Continuity of the air and vapour control layers from the wall systems and roof systems is essential to the satisfactory performance of either or both. Therefore, proper connection between air and vapour control systems is essential, and the responsibility of both the *Design Authority* and trades constructing walls and roofs.

Air control layers control "flow of air through the building enclosure, either inward or outward" (*Guide for Designing Energy Efficient Building Enclosures*, **Homeowner Protection Office**). Controlling air flow into and out of conditioned spaces affects the performance of "thermally efficient enclosure assemblies" (ibid), impacts the potential for condensation in between materials, and directly influences rain water penetration of the building envelope. Some air control layers are considered permeable, others air-impermeable or 'airtight'. The suitability of one over the other, in the application of a roofing system, is left to the discernment of the *Design Authority*. Consequently, the ***RoofStar Guarantee Program*** strongly recommends that designers and builders of roof systems intended to qualify for a ***RoofStar Guarantee*** carefully consider the regulatory design and installation requirements for effective, continuous air control systems.

Vapour control layers regulate or prohibit the movement of water vapour from one space to another by means of diffusion. Consequently, these control layers are referred to as either vapour-permeable or impermeable. Diffusion is a slow process, in contrast to air movement, and its regulation is not always mandatory or even desirable. Consequently, because continuous vapour control layers "are not needed within all climate zones and assemblies", they are considered non-critical and may be left to the discretion of the *Design Authority*. Nevertheless, where continuous vapour control layers are required and specified by provincial or municipal building codes (current and in force), the ***RoofStar Guarantee Program*** requires that a suitable vapour control system be selected by the *Design Authority* and properly installed by the roofing contractor in conformity with the vapour control layer manufacturer's published instructions, and with the *Design Authority*'s specified details.

Any references in this **Manual** to installation methodologies, and any construction details that show air and vapour control layers, are merely illustrative and not prescriptive. Installers of continuous air and vapour control layer systems are urged to understand and comply with best practices for their application.

6.1.2 Limitations and Exclusions

1. Air and vapour control layer performance is not part of the ***RoofStar Guarantee***, and air and vapour control materials are not listed in the Accepted Materials section of this **Manual**. Therefore, the decision to specify air and vapour control layers, the placement of continuous air and vapour control layers in relation to a roof assembly and its components, and the selection of suitable materials for that application, is the sole responsibility of the *Design Authority*. The *Design Authority* is urged to review and consider the performance characteristics of materials available for such applications.

2. Neither the ***RoofStar Guarantee Program*** nor the roofing contractor will accept any responsibility for damage to, or failure of, the roof system caused by the use or absence of air or vapour control layers.
3. In some roof assembly designs, the required underlayment may serve as an air control layer, vapour control layer, or both; this is dependent upon the properties of the material to be used, and will be subject to the designer's modelling of the assembly. Consult the Technical Data Sheets for suitable materials.

6.1.3 Vapour Retarder Design for High-Humidity Building Interiors

1. Careful consideration should be given to the performance characteristics of air and vapour control layers when specifying such a membrane for roof assemblies constructed over high-humidity building interiors. These types of building interiors include (but are not limited to)
    1. swimming pools.
    2. commercial laundry facilities.
    3. large aquariums.
    4. paper mills.

    Roof systems for facilities such as these, with high-humidity environments, may be susceptible to the accumulation of moisture within the roof assembly unless effective air and vapour controls are installed.

6.2 Materials

1. The material selected for air and vapour control layers must be compatible with any other materials in the roof or wall assembly to which the control layer may come in contact. This includes, without limitation, contact with primers and adhesives, substrates, solvents and cleaners.
2. Fully supported air and vapour control layers should possess a minimum published static puncture resistance rating of 150 N (34 lbf) (ref. CGSB-37.56-M for both test method and standard limits) and be either self-adhering or torch-applied; a high puncture resistance is necessary for the membrane to withstand accidental damage during construction. For unsupported air and vapour control layers, see **6.2(3)** below. Therefore, while responsibility for the selection of suitable air and vapour control layers rests with the *Design Authority*, a roof designed and built to qualify for a ***RoofStar Guarantee*** shall not include either polyethylene sheet plastic or bitumen-impregnated kraft paper.
3. Notwithstanding any of the foregoing, the ***RoofStar Guarantee Program*** strongly recommends that any air and~~/or~~ vapour control systems be installed over a smooth, continuous plane (for example, concrete or plywood). Consequently, a deck overlay board installed on corrugated steel roof decks in highly recommended. Where no deck overlay board is installed and the air and vapour control layers are partially unsupported (for example, on a steel deck), the control layers each must have a published static puncture resistance of at least 400 N (90 lbf). Furthermore, both the side laps and end laps must be fully supported.
4. Should the air or vapour control layers be used as a temporary roof during *Project* construction by either the roofing contractor or by other trades, a minimum 2mm thick bituminous membrane is recommended.
5. Because curing concrete releases considerable moisture that can compromise the performance of a roof system, a vapour control layer installed on new concrete decks (28 days or older) must be selected to prevent condensation inside the roof system. A membrane with a permeability of 0.01 perms (Class I) is recommended. Nevertheless, the selection of the vapour control material is the responsibility of the *Design Authority*.

6.3 Application

1. Proper installation and continuity of air and vapour control layers within the roof assembly is the responsibility of the roofing contractor. Therefore, air and vapour control layers in the roof assembly must
    1. extend beyond the end of the roof assembly at least 100 mm (4"), in new construction, to provide sufficient room for the installation of matching control layers to so that they provide a positive (water-shedding) lap seal union between courses of material.

2. be sealed to matching control layers in the wall assembly, for roof replacement *Project*s.

2. Installation must conform to the manufacturer's published requirements and the *Design Authority*'s design details.

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7 INSULATION

7.1 General

7.1.1 Definitions

Heat-sensitive insulation means insulation that may be physically or chemically altered when exposed to heat greater than 70°C (158°F) - for example, heat from a torch or from liquefied bitumen. Heat-sensitive insulation includes EPS, XPS and Polyurethane.

Heat-resistant insulation means insulation that resists heat and will not physically or chemically change when exposed to heat greater than 70°C (158°F), including liquefied bitumen. Insulation boards of this type include fibreboard, polyisocyanurate and mineral wool. Note that heat-resistant does not mean or even infer 'fire-proof'. While some heat-resistant insulation materials will resist burning for a period of time, only mineral wool insulation will not burn.

See the **Glossary** for other terms used in this Section.

7.1.2 Design

1. The use of thermal barrier between the roof deck and the insulation is the responsibility of the *Design Authority* and may be required by the Building and Fire Code having jurisdiction. See also **5 DECK and WALL OVERLAYS**.
2. Consult the Building Code having jurisdiction for the minimum required thermal resistance of the roof assembly.
3. Insulation compressive strength must be taken into consideration by the structural engineer.
4. Insulation materials rely on various standards for the determination of thermal resistance, which means that not all data can be easily compared. Furthermore, not all insulation products perform with consistent thermal resistance as temperature changes, and some insulation performance declines with age. The *Design Authority* is therefore urged to consider the Long Term Thermal Resistance (LTTR) for each product, in relation to its placement within the roof assembly and the anticipated outside and interior climates of the building.
5. In warm seasons, the roof surface may reach temperatures higher than 85°C (185°F), affecting the performance and stability of some insulation. Combining insulation types in a roof assembly may help mitigate these temperature swings and consequential distortion of the assembly. The *Design Authority* therefore must consider these variables when specifying materials and their installation.
6. Only heat-resistant insulation may be used directly beneath metal panels or flashings.
7. When heat-sensitive insulations are used in a roof assembly, they must be covered with a heat-resistant insulation at least 50 mm (2”) thick.
8. Insulation assemblies with a cumulative thermal resistance greater than RSI-2.64 (R-15) (based on published values measured at 24°C) must be installed in multiple layers that are offset and staggered (see **7.3 Application**). Within that multi-layered assembly, any single layer of insulation may have a thermal resistance greater than RSI-2.64 (R-15) provided no one layer exceeds 60% of the cumulative thermal resistance of the combined assembly of insulation and insulation overlay boards.

7.2 Materials

1. The type of insulation is to be specified by the *Design Authority*. A list of acceptable insulation materials may be found in **Roof Deck Insulation**.
2. Material dimensions:
    1. The maximum width and length of any adhered insulation panel shall be 1200 mm (4’)
    2. The maximum width and length of insulation boards installed with mechanical fasteners is limited only by the manufacturer

3. Insulation installed directly over a fluted steel deck must be thick enough to span the flutes under live loads (minimum live load equal to or greater than 115 Kg (253 lbs); see also **9.1.1 Design**), without risk of cracking or breakage.

7.3 Application

7.3.1 Layering

1. See **7.1.2(8)** above.
2. Insulation joints must be offset or staggered at least 300 mm (12") from adjacent layers and rows.
3. Only thermally non-conductive clips or bars passing through the insulation assembly, or mechanically fastened bearing plates, may be used to secure and support insulation panels, or provide support for panel clips.

7.3.2 Alignment, Sizing and Support

1. On steel roof decks, insulation boards must be firmly supported.
2. Insulation boards must be square and make firm, full contact with adjacent panels. Gaps greater than 10 mm (3/8”) between boards must be filled with expanding spray foam or chinked with fibreglass wool.
3. Insulation board joints must be offset at least 300 mm (12"), both for adjacent layers and for adjacent rows.

7.3.3 Securement

Refer to **3 SECURING the ROOF ASSEMBLY**.

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8 EAVE PROTECTION, UNDERLAYMENTS and DRAINAGE

8.1 General

8.1.1 Definitions

Eave Protection means a self-adhering membrane applied in parallel courses along the eaves, up the roof slope to a point measured vertically from the inside of the exterior wall, and intended to block the ingress of water that may leak behind shingles or metal roof panels as the result of snow or ice buildup on the roof surface.

Underlayment means a roll material that is either self-adhering or mechanically fastened (typically with large head nails), and which is installed to

1. provide a secondary water-shedding surface between the shingles or metal panels and the building interior.
2. keep shingles or metal panels from adhering to the underlying substrate.

Slip Sheet means a roll material installed directly below metal roof panels to inhibit bonding of the metal panels with underlying materials, such as bitumen-based underlayments or eave protection membranes. A slip sheet by itself does not function as a drainage layer.

Panel Drainage Layer means a layer of roll material, usually comprised of stiff, synthetic entangled mesh, installed directly beneath the metal panels in place of, or in addition to, a slip sheet, and intended to

1. inhibit bonding of metal roof panels with underlying materials.
2. facilitate the drainage of condensation that collects on the bottom surface of metal roof panels.

See the **Glossary** for other terms used in this Section.

8.1.2 Design

1. Eave protection, while always located on the supporting deck or deck overlay, may also serve as an air barrier, vapour barrier, or both when installed in combination with the underlayment. It is incumbent upon the *Design Authority* to determine the appropriate location of air and vapour control layers, and to select the suitable material. See also **6.1.2** above.
2. Eave protection is required for all ***RoofStar-guaranteed*** metal roofing systems. Eave protection must be a RoofStar-accepted self-adhered modified bituminous membrane.
3. The location of the membrane is the responsibility of the *Design Authority*.
4. Since condensation on the underside of metal panels is probable, a vapour-permeable slip sheet may be specified over underlying materials for additional moisture protection. The *Design Authority* is responsible to evaluate the necessity of a second membrane.
5. Where the slope is less than 1:3 (4” in 12”), the design must incorporate
    1. a vapour-permeable membrane between the insulation assembly and metal panels (for additional moisture protection).
    2. a minimum air space of 10 mm (3/8”) above the vapour-permeable membrane.

8.2 Materials

Accepted materials for this purpose are listed in the **Eave Protection & Underlayment (Architectural Metal Roofing)** section of this **Manual**.

1. All membranes must provide proprietary sealants, mastics, tapes and/or primers suitable for the application of the underlayment and must be applied in accordance with the manufacturer’s written instructions.

8.2.1 Eave and Valley Protection

1. Only self-adhered membranes with a minimum thickness of 1 mm are permissible for use as eave or valley protection.

8.2.2 Underlayment

1. For slopes from 1:6 (2" in 12") and up to but not including 1:3 (4" in 12"), a continuous self-adhesive membrane underlay **must be installed prior to the application of the sheet metal roofing**. Direct torch application to wood surfaces is not permitted.
2. Synthetic underlayments are permissible for slopes 1:3 (4” in 12”) and greater.
3. For slopes less than 1:6 (2” in 12”), underlayments must be a continuous self-adhesive or thermally fused membrane with a minimum thickness of 3.0 mm, but this is subject to approval of the design by the ***RoofStar Guarantee Program***. Contact the ***RoofStar Guarantee Program*** for a *Project* review.
4. Modified bituminous underlayments utilized directly beneath metal roof panels and flashings, or otherwise protected by insulating materials, must be made of bitumen with a high softening point and a minimum flow temperature of 87.7°C (190°F) ASTM D5147 high temperature stability.

8.2.3 Separation Layer

1. A separation layer or entangled mesh is required over any bituminous-type underlayment that does not have a tri-laminate facer, and which may come in direct contact with metal panels.
2. A vapour-permeable separation layer over insulation
    1. must be used when the roof slope is less than 1:3 (4” in 12”).
    2. in combination with a drainage layer is recommended when the roof slope exceeds 1:3 (4” in 12”).

8.2.4 Drainage Layer

Drainage layer materials, such as entangled mesh, are ancillary materials and, as such, are not listed in the **Accepted Materials** section of the RPM.

1. A drainage layer of entangled mesh no less than 10 mm (3/8”) in thickness, or clips incorporating tabs 3/8” above the top surface of clip base,
    1. must be used when the roof slope is less than 1:3 (4” in 12”).
    2. is recommended on uninsulated assemblies when the roof slope exceeds 1:3 (4” in 12”).

8.3 Application

8.3.1 Eave and Valley Protection

1. Eave protection must be carried a minimum of 600 mm (24") inside interior walls, or 900 mm (36") in heavy snow load conditions (For ***RoofStar Guarantee*** purposes, high snow load is considered regional areas with snow loading higher than 3.5 kPa as referenced in the National Building Code Appendix C “Climatic Information for Building Design in Canada”. See also **1.3.3 High Snow Loads**).
2. Valley protection membrane must be at least 1000 mm (39") wide and centred on the valley. The membrane must be the same materials as that used for eave protection.

8.3.2 Underlayment – Field, Penetrations and Vertical Transitions

1. All roof assembly components installed above the structural deck must be installed by the Contractor.
2. An underlayment is required for all slopes. See **8.2.2** for material requirements.
3. Horizontal runs of underlayment must be positively lapped at least 50 mm (2"), and end laps (vertical joints) must be at least 150 mm (6").
4. Where negative (backward) laps are unavoidable, only a self-adhering underlayment may be used. Negative laps must be at least 150 mm (6"), and seams must be roller-pressed and sealed with a compatible mastic along the seam edge.
5. Underlayment must be installed horizontally on slopes up to 2:3 (8” in 12”).
6. Underlayment may be installed perpendicular to the eaves provided the laps are self-sealing or sealed with a suitable lap cement provided by the underlay manufacturer. On slopes steeper than 2:3 (8” in 12”) underlayment installed vertically (perpendicular to the eaves) must
    1. be self-adhering.

2. extend beyond the furthermost edge of the flashing at least 100 mm (4").
3. positively lap beneath other vertical membranes.

7. Back pan membrane protection must
    1. extend 900 mm (36") up the slope from the curb transition.
    2. extend onto the field, past the curb at least 150 mm (6”).
8. Membrane protection for back pans and any penetration, regardless of its geometry, must
    1. extend
        1. at least 100 mm (4”) up the face of the penetration (on insulated assemblies).
        2. no higher than the top of a flexible boot penetration.
        3. to the top inside edge of curbs.
        4. onto field membranes by at least 150 mm (6”).
    2. be a high-temperature rated membrane.

8.3.3 Slip Sheets and Drainage Layer

1. A slip-sheet is required when metal panels or flashings come in direct contact with any bituminous underlayments that do not have a tri-laminate facer, or if soldering is to be done.
2. Horizontal runs of slip sheets must be positively lapped at least 50 mm (2") and end laps (vertical joints) must be at least 150 mm (6").
3. For roofs designed with a slope less than 1:3 (4” in 12”), drainage beneath the metal panel must be facilitated with either of the following:
    1. a continuous layer of entangled mesh no less than 10 mm (3/8”) in thickness.
    2. clips incorporating tabs 3/8” above the top surface of clip base.

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9 PANELS

This section covers metal panels that are site-formed by contractors or manufactured by a supplier. Both options are listed under the **Accepted Architectural Sheet Metal Roofing** section of this **Manual**.

9.1 General

9.1.1 Design

1. See also **1.2.1.** for engineered design requirements applicable to, without limitation,
    1. drag load fastening.
    2. snow loads.
    3. wind loads.
    4. panel expansion and contraction.
2. Some limitations and conditions apply for slopes less than 1:6 (2" in 12"). See **2.1.2** for ***RoofStar Guarantee Standards***.
3. As roof slope diminishes, the height of the seam between panels musts increase, to accommodate the increased potential for water ingress. Therefore, the following requirements apply:

Slope (see also **2.1 Roof Slope**)	Seam Height minimums	Permissible Seam Types
1:3 (4" in 12") or greater	25 mm (1")	All
1:6 (2" in 12") to 1:3 (4" in 12")	38 mm (1 ½")	Mechanical Lock only (single or double)
	42 mm (1 5/8")	Snap Lock (male seam)
Less than 1:6 (2" in 12") (reviewed by RGC prior to tender)	50 mm (2") + butyl sealant in seam	Mechanical Lock only (single or double)
	50 mm (2")	Mechanical Lock only (double)

4. The *Design Authority* must calculate the maximum panel length based on
    1. the material type.
    2. the direction of expansion and contraction that is determined by the location of drag load fasteners.
    3. the amount of expansion and contraction provided by
        1. the fastener slot on the fastening flange.
        2. the concealed expansion clip slot.
5. Metal panels **must** be pinned to the structure with fasteners to prevent slippage down the roof due to gravity loads or drag loads.

    By design, most architectural standing seam metal panel systems are intended to float to provide freedom for thermal expansion and contraction. Proprietary attachment clip designs permit metal panels to slide back and forth on the clip as the panel expands and contracts during the thermal cycle. Live snow loads can create considerable drag on panels displacing them from their intended location. The most common place to install drag load fasteners (point of fixity) is at the roof ridge, which allows fasteners to be concealed by cap flashing.
6. When metal roof panels are not fully supported, and are instead supported intermittently, the metal panels must be designed to support the anticipated live loads, including live loads during installation, without deformation of the panel. Panels must be able to withstand a minimum live load equal to or greater than 115 Kg (253 lbs).
7. Architectural metal roof panels that are installed on curved roof decks **must** be power-curved as a continuous panel, in line with the minimum radii and metal types published in the machine **Manual** issued by the manufacturer of the panel-curving machine. Alternatively, if flat roll formed metal panels are installed on

curved roof decks a panel stress calculation **must** be completed by a professional engineer prior to installation of metal panels.

8. Mansards are considered part of the roof assembly.

9.2 Materials

9.2.1 Panels

1. All metal roof panels over 300 mm (12”) in width must be roll-formed or factory-fabricated with stiffening ribs or striations.
2. Panels fabricated with perforated fastening holes or slots must not exceed 9000 mm (30’) in length.
3. Sheet steel, copper and zinc roof panels may be roll-formed to a maximum width of 500 mm (20”).
4. Contractors **must** provide a mill certification for all metal roofing *Project*s installed under the ***RoofStar Guarantee Program***. Mill certifications **must** confirm that the sheet metal used for forming metal panels and flashings conform to or exceed one of the following standards:

    1. **Sheet Steel Materials**
        1. Aluminum-zinc alloy coated steel sheet, 0.6858 mm (0.027", 24 gauge) thick, conforming to ASTM A792 / A792M-06 SS Grade 33, AZM150 (AZ50) coating. Thickness tolerance as per ASTM A924 / A924M-06 ±0.08 mm (0.003") for sheet widths not exceeding 1500 mm (60").

            Only PVDF coatings (polyvinylidene fluoride, also referred to as PVF2) may be used on Al-Zn steel stock acceptable for use in a ***RoofStar Guarantee***.

        2. Galvanized steel sheet, 0.6858 mm (0.027", 24 gauge) thick, conforming to ASTM A653 / A653M-06 SS Grade 33, Z275 (G90) coating. Thickness tolerance as per ASTM A924 / A924M-06 ±0.08 mm (0.003") for sheet widths not exceeding 1500 mm (60").

            Only PVDF coatings (polyvinylidene fluoride, also referred to as PVF2) may be used on G90 galvanized steel stock acceptable for use in a ***RoofStar Guarantee***.

    2. **Non-Ferrous Materials**
        1. Copper sheet, 0.56 mm (.0216" 16 oz.) thick, cold rolled roofing copper to ASTM B370-91. Maximum thickness tolerance ± 0.04 mm (0.0015)

        2. Zinc sheet, 0.81 mm (0.031") ± 0.03 mm thick, conforming to European Standard EN 988-1996. Zinc grade Z1 conforming to EN 1179 that is 99.995% minimum zinc content, with addition of copper-titanium alloys. Maximum thickness tolerance variation ± 0.03 mm (0.0012").

9.2.2 Roll-forming Machines

1. Contractors who own metal panel machines are responsible to meet or exceed the panel machine maintenance standards as established by the roll form machine manufacturer.
2. Site-forming metal panel machines must be certified annually by a third party engineer. Machines must be serviceable, maintained and calibrated with supporting documentation. Records must be submitted to the RCABC annually.

9.2.3 Fasteners

1. Fasteners used to secure metal flashings and clips must be compatible with the material they contact.
2. Fasteners must be
    1. determined by the *Design Authority*
    2. appropriately sized, in both length and thread type, for the material to which they will be secured

3. corrosion-resistant screws with a low-profile head (as specified by the *Design Authority*)

3. High-domed gasketed cladding screws must be No. 8 or larger, and should be the same colour as the flashing material.
4. Sealed blind rivets are acceptable for securing two metal flashings together, but must be used to secure flashings when the roof is designed and constructed with a continuous or partial slope less than 1:6 (2" in 12").
5. Nails are not acceptable as fasteners.

9.2.4 Clips

In-seam (hidden) attachment clips may be a one-piece stationary design that provides a friction fit to the standing seam, which allows unlimited thermal movement of the panel along its length. Alternatively, attachment technology includes built in fastening strips that are formed along the panel seams during the roll forming process and two-piece floating clips that permit a greater range of thermal movement by allowing differential panel movement to take place between the two components of the clip.

1. Clips must be
    1. proprietary (not shop fabricated) and must be acceptable to the roll form machine manufacturer, for use with the metal roofing systems.
    2. compatible with the metal panel and other materials they contact.
2. Unless otherwise specified by the *Design Authority*, clips must be attached by at least two fasteners and have evenly spaced indents or guide holes for fastener placement. Attachment clips for metal roofing systems must be formed from
    1. Steel (Z275 or G90)(AZ50 or AZM150).
    2. Aluminum.
    3. Stainless Steel
3. When the roof is designed and constructed with a continuous or partial slope less than 1:6 (2" in 12") (for example, a barrelled roof), the clips must be fully supported with a neoprene pad.

9.2.5 Sealants

1. Sealants shall be
    1. non-hardening high quality butyl or polyurethane.
    2. available in either gun grade or sealant tape form.
    3. suitable for exterior use and able to resist the effects of weathering.
    4. compatible with, and able to adhere to, the materials to which they are applied
2. Sealants shall conform to any one of the following:

    1. CGSB 19-GP-5M, "Sealing Compound, One Component, Acrylic Base, Solvent Curing"
    2. CAN / CGSB-19.13, "Sealing Compound, One Component, Elastomeric, Chemical Curing"
    3. CGSB 19-GP-14M, "Sealing Compound, One Component, Butyl-Polyisobutylene Polymer Base, Solvent Curing".
    4. CAN / CGSB-19.24, "Multi-Component, Chemical Curing Sealing Compound".

9.3 Application

9.3.1 General

1. Sheet steel, copper and zinc roof panels must be installed with a continuous minimum tolerance gap of 1/8" between the heels of the panels.
2. Concealed fasteners
    1. should provide clearance for the underside of the metal panel, and
    2. must be of a material compatible with the metal clip

9.3.2 Material Storage and Handling

1. Panels must be protected against condensation between adjacent surfaces. Retain factory packaging or provide other adequate covering until material is applied.
2. Panels must be handled with non-marring slings and use a spreader bar for hoisting. If site formed panels are specified, coils must be protected from condensation and stacked in an upright manner.

9.3.3 Perimeter Edge Securement

1. Metal panels must be secured at and engaged to the eaves by a continuous metal hook strip (see **ASM Detail E1.7.3**).
2. Gable and roof-to-wall flashings must
    1. be engineer-designed to withstand wind uplift.
    2. allow for expansion and contraction.
    3. not utilize exposed fasteners.

9.3.4 Panel Terminations

1. Two weather stops must be installed at up-slope termination of each panel:
    1. The primary weather stop shall be a metal Z-closure, which must be sealed against the weather with two (2) rows of gunnable sealant or sealant tape.
    2. The secondary weather stop may be
        1. A metal Z-closure, set in sealant as described above for the primary closure.
        2. The panel bread-pan.
        3. Metal flashings turned down between panel ribs to close off openings.
2. The up-slope termination of metal panels must be turned up (bread-panned) to a height of at least 26 mm (1”), and shall in any event be equal in height to the top of seamed ribs. Turned up corners (dog ears) are not to be cut.

9.3.5 Low-slope Tie-in

1. Metal roof panels adjoining a lower low-slope roof must terminate 200 mm (8") up the slope from the finished roof surfacing.
2. Metal roof system underlay / eave protection must overlap lower low-slope roof membrane flashing by a minimum of 100 mm (4").
3. A metal counter-flashing with an exposure of at least 100 mm (4”) is required at the bottom termination of the metal panels.

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10 PERIMETER and VALLEY FLASHING

Following the typical sequence of construction, this section pertains to flashings that are often but not always installed before panels – flashings at the eaves, gable (rake) edges, along adjoining walls, or along ridges and hips.

10.1 General

10.1.1 Design

1. Flashings must be engineer-designed to resist wind uplift.
2. Where exposed fasteners are not desirable, the design must utilize continuous 'wind clips' that secure the flashing along its lower edge (see **ASM Detail E1.7.3**).

10.2 Materials

10.2.1 Metal Flashing Stock

1. Flat stock used for flashing fabrication on metal roofing systems **must** meet or exceed
    1. the grade,
    2. design thickness (gauge), and
    3. finish quality

    of the metal roof panels. See **9.2.1 Panels**.

10.2.2 Fasteners

1. Fasteners used to secure metal flashings must be
    1. compatible with the material it contacts
    2. appropriately sized, in both length and thread type, for the material to which they will be secured
    3. corrosion-resistant screws with a low-profile head (as specified by the *Design Authority*)
3. Sealed blind rivets are acceptable for securing two metal flashings together, but must be used to secure flashings when the roof is designed and constructed with a continuous or partial slope less than 1:6 (2" in 12").
4. Nails and high-domed neoprene gasketed cladding screws are not acceptable as fasteners for securing perimeter and valley flashings, and must not be used when the roof is designed and constructed with a continuous or partial slope less than 1:6 (2" in 12").

10.2.3 Sealants

1. Sealants shall be
    1. non-hardening high quality butyl or polyurethane.
    2. available in either gun grade or sealant tape form.
    3. suitable for exterior use and able to resist the effects of weathering.
    4. compatible with, and able to adhere to, the materials to which they are applied.
2. Sealants shall conform to any one of the following:
    1. CGSB 19-GP-5M, "Sealing Compound, One Component, Acrylic Base, Solvent Curing".
    2. CAN / CGSB-19.13, "Sealing Compound, One Component, Elastomeric, Chemical Curing".
    3. CGSB 19-GP-14M, "Sealing Compound, One Component, Butyl-Polyisobutylene Polymer Base, Solvent Curing".
    4. CAN / CGSB-19.24, "Multi-Component, Chemical Curing Sealing Compound".

10.3 Application

10.3.1 General

1. Metal flashings must be attached with hidden metal cleats.

2. On vertical applications with limited height, or on neoprene or EPDM form-flashings with aluminum flanges, blind rivets may be used as an alternative method of flashing attachment. Rivets shall be closed-end, dome-head type.
3. High-domed gasketed cladding screws are not acceptable.
4. Two rows of sealant are required for all metal valley and metal flashing overlaps.

10.3.2 Eave Flashings

1. Eaves flashings (see **Detail E1.7.3**) must
    1. be fabricated to hold the leading edge of the panel in place, and to allow for anticipated panel expansion.
    2. be installed over an underlying strip of eave protection membrane, which must extend
        1. onto the roof deck past the top edge of the flashing, and
        2. vertically onto the fascia (fully covered by the vertical leg of the metal flashing).
    3. extend onto the sloped deck or supporting member at least 75 mm (3”).
    4. be secured along the
        1. top flange with screws spaced in accordance with the engineered design but no further apart than 300 mm (12”) O.C.
        2. fascia utilizing a continuous clip fastened a maximum of 300 mm (12") O.C. (when external metal gutters are installed, see 9.3.2.2 below); eave flashings with a face less than 50 mm (2”) do not require a clip but must be alternatively fastened.
    5. overlaid with eave protection membrane.
2. Where external metal gutters will be installed,
    1. the eave flashing should be installed to accommodate the gutter and hangar.
    2. and gutter hangars are to be fastened behind the eave flashing, the eave flashing does not require a continuous clip and may be face-screwed together with the gutter hangar.

10.3.3 Gable (Rake) and Wall Flashings

1. Gable and roof-to-wall flashings must
    1. allow for expansion and contraction.
    2. be installed with a continuous clip fastened a maximum of 300 mm (12”) O.C.

10.3.4 Valleys

1. Drag load fastening is mandatory on all valleys.
2. Metal valley panels must
    1. be installed shingle fashion.
    2. overlap the adjacent lower panel at least 200 mm (8").
    3. be sealed at the lapped joint with two horizontal rows of approved sealant.
3. Valley dividers are required and must be a minimum of 25 mm (1") high, folded to a maximum of 60 degrees on the inside angle of the divider.
4. Exposed valley widths must be a minimum 125 mm (5") from divider to metal roof panel on each side of the divider. Increased width is recommended in high snow load areas (see **1.3.3 High Snow Loads**).
5. Hooked metal valley sections (see **Detail E1.7.5**) must incorporate the following design and installation requirements:
    1. Metal roof panels must be fabricated with a built-in hook strip returned 37 mm (1 1/2") to
        1. form a water cut-off.
        2. hook onto the valley metal panel.
    2. Valley flashings must be fabricated with a continuous hook strip and a flange (for securement to the substrate) measuring at least 76 mm (3”) wide,
        1. fastened according to the specifications of the *Design Authority*.

2. stripped in and sealed to the valley protection membrane with a self-adhered modified bituminous membrane measuring at least a 300 mm (12”) in width and applied to extend past the flashing fasteners by at least 38 mm (1 ½”).
3. Reverse laps must be sealed with a membrane-compatible sealant.

6. Unhooked metal valley sections (see **ASM Detail E1.7.6**) must incorporate the following design and installation requirements:
    1. Valley flashings must be
        1. hemmed with a return measuring at least 37 mm (1 1/2") to form a water cut-off.
        2. secured with continuous cleats
            1. fabricated from 26 Ga. flat metal stock (min. thickness).
            2. fabricated with a leg measuring at least 76 mm (3”) wide.
            3. fastened according to the specifications of the *Design Authority*.
            4. stripped in and sealed to the valley protection membrane with a self-adhered modified bituminous membrane measuring at least a 300 mm (12”) in width and applied to extend past the flashing fasteners by at least 38 mm (1 ½”).
    2. Reverse laps must be sealed with a membrane-compatible sealant.

10.3.5 Cap and Hip Flashings

See also **9.3.4 Panel Terminations.**

1. Standard cap / hip flashing must be hooked to metal Z-closures which are
    1. set in two (2) rows of gunnable sealant or sealant tape.
    2. fastened through the metal roof panel into the deck.
2. For roof slopes up to 2:3 (8” in 12”), metal cap/hip flashing must extend a minimum of 150 mm (6") over metal roof panels, measured from the back pan, and extending on each side of the ridge/hip.
3. For roof slopes equal to or greater than 2:3 (8” in 12”), the metal cap/hip flashing may be reduced by 75mm (3”) over metal roof panels, measured from the back pan and extending on each side of the ridge/hip.
4. For roof slopes greater than 1:1 (12” in 12”), an underlying support at the centre of the ridge is required to support the ridge cap flashing.

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11 PENETRATIONS and CURBS

11.1 General

11.1.1 Design

1. The design and placement of curbs, for skylights or penetrations, shall be the responsibility of the *Design Authority*.
2. Curbs
    1. must be constructed to achieve a minimum height of 200 mm (8”) above the finished roof surface (not including panel seam upstands) or highest point of a curb cricket.
    2. less than 900 mm (36”) in width may be designed with a cricket but require, as a minimum, a back-pan flashing.
    3. between 900 mm (36”) and 2400 mm (8’) in width require an architectural metal cricket with rigid support to prevent metal distortion.
    4. wider than 2400 mm (8’) must
        1. be designed to divert and drain the anticipated volume of water above the curb.
        2. incorporate a cricket, fully supported with insulation or framing and designed to direct water and snow to either side of the curb.
        3. incorporate a waterproofed gutter membrane installed over the cricket (See below. Also see **12.2 Built-in Gutters**).
3. A waterproofed gutter membrane around a curb
    1. shall have a minimum slope of 2%, along the upslope face of the curb, to direct water around the curb and toward the eaves.
    2. should be continuous along the sides of the curb, as dictated by the curb size and roof slope, or fall
    3. must direct water onto the lower metal panels.
4. Curbs and penetration flashings are normally supplied or constructed by other trades, but must be sealed by the roofing trade.
5. Flexible boot flashings for pipe-type penetrations
    1. may be used for penetrations up to 150 mm (6”) in diameter.
    2. must be located at or near the centre of metal roof panels, measured between the upstands, to avoid interference with standing seams or panel ribs.
    3. must be located on a raised panel above seam height when a penetration interferes with standing seams or panel ribs.
    4. should be located near the upper end of a slope for long panels.
    5. may not be located on the water plane when the roof slope is less than 1:6 (2” in 12”).
    6. must be fastened with high-domed gasketed cladding screws placed no more than 38 mm (1 ½”) O.C.
    7. must be set in a bed of sealant.
6. Any penetrations larger in diameter than 150 mm (6”), and all exhaust flues (B-vents), must be installed on curbs.
7. Multiple penetrations that are clustered together should be kept in the same metal panel and independently flashed or incorporated in a common curb.

11.2 Materials

11.2.1 Metal Flashing Stock

1. Flat stock used for the fabrication of penetration flashings on metal roofing systems **must** meet or exceed the
    1. grade

2. design thickness (gauge) and
3. finish quality

of the metal roof panels. See **9.2.1 Panels**.

11.2.2 Fasteners

1. Fasteners
    1. used to secure metal flashings must be compatible with the material it contacts.
    2. must be appropriately sized, in both length and thread type, for the material to which they will be secured.
    3. must be corrosion-resistant screws with a low-profile head (as specified by the *Design Authority*).
2. High-domed gasketed cladding screws must be No. 8 or larger, and should be the same colour as the flashing material.
3. Sealed blind rivets are acceptable for securing two metal flashings together, but must be used to secure flashings when the roof is designed and constructed with a continuous or partial slope less than 1:6 (2" in 12").
4. Nails are not acceptable as fasteners.

11.2.3 Sealants

1. Sealants shall be
    1. non-hardening high quality butyl or polyurethane.
    2. available in either gun grade or sealant tape form.
    3. suitable for exterior use and able to resist the effects of weathering.
2. compatible with, and able to adhere to, the materials to which they are applied.
3. Sealants shall conform to any one of the following:
    1. CGSB 19-GP-5M, "Sealing Compound, One Component, Acrylic Base, Solvent Curing".
    2. CAN / CGSB-19.13, "Sealing Compound, One Component, Elastomeric, Chemical Curing".
    3. CGSB 19-GP-14M, "Sealing Compound, One Component, Butyl-Polyisobutylene Polymer Base, Solvent Curing".
    4. CAN / CGSB-19.24, "Multi-Component, Chemical Curing Sealing Compound".

11.3 Application

11.3.1 Curbs

1. In these Standards, the
    1. front of a curb is defined as the side facing down the slope.
    2. back of a curb is defined as the side facing up the slope.
    3. top of a curb is defined as the top-most face of the curb wall.
2. All curb flashings shall be constructed on a split pan and affixed to the pan with blind rivets.
3. Split pans must be
    1. secured to the roof structure, and to adjacent panels, with cleats that are fashioned from compatible metal and fastened to the structure with screws.
    2. hooked to the cleats, and to adjacent roof panels, shingle fashion with positive laps.
    3. sealed at each lap with two parallel untooled beads of sealant.
4. All curbs must be fully flashed with a self-adhered underlayment membrane, which must extend to the top of the curb. Where possible, the membrane should extend across the top of the curb and terminate on the vertical inside face.
5. Back-pan flashings for curbs up to 900 mm (36") in width must extend
    1. past the edges of a curb by 100 mm (4"), but project no closer to the adjacent seam than 51 mm (2").

2. up the slope beneath the metal panels, to a point at least 150 mm (6”) (when measured vertically) from the base of the curb.

6. Curbs with a width between 900 mm (36”) and 2400 mm (8’) must be constructed with a cricket that
    1. is supported by rigid material to prevent metal distortion.
    2. is integrated with the curb flashing panels.
    3. extends up-slope from the back of the curb, beneath the metal panels to a point at least 150 mm (6”) (when measured vertically) from the base of the curb.
    4. has flanges which lap under the metal curb flashing at least 50 mm (2”).
    5. is closed at any seams with either of the following:
        1. welds.
        2. blind rivets, incorporating two beads/rows of sealant.
7. Waterproofed gutter membranes for curbs wider than 2400 mm (8’) must slope toward the eaves at least 2%, and shall
    1. extend up the slope at the back of the curb, beneath the metal panels, to a point at least 150 mm (6”) (when measured vertically) from the base of the curb.
    2. extend horizontally from the curb at least 250 mm (10”), to the nearest metal panel upstand.
    3. lap continuously on either side of the curb, and onto the down-slope metal panels.
    4. extend a minimum of 150 mm (6") over the lower metal roof panels, measured from the back pan.

    Fasteners for metal panels installed above the back of the curb must be placed 100 mm (4") or more above the curb base, when measured vertically.

11.3.2 Penetrations

1. Any penetration must be installed with have no less than 300 mm (12") clearance from all the outer point of any other roof penetration, edge or wall, to permit proper flashing (see **ASM Detail E1.7.8** and **ASM Detail E1.7.9**).
2. Flexible boot flashings for pipe-type penetrations 150 mm (6”) in diameter or smaller do not have to be installed on a curb but must be
    1. located so as not to interfere with standing seams or panel ribs. If interference is unavoidable, incorporate the raised panel detail.
    2. oriented diagonally to promote drainage around the flashing base.
    3. set in a continuous bead of untooled sealant.
    4. fastened with gasketed screws spaced no more than 38 mm (1 ½ “) O.C.
    5. secured around the penetration with a stainless steel clamping ring.
    6. sealed around the penetration joint with a bead of sealant.
3. Any penetrations larger in diameter than 150 mm (6”), and all exhaust flues (B-vents), must be installed on curbs (see **ASM Detail E1.7.10**).

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12 OTHER DETAILS

12.1 Snow Guards

1. While snow guards are not part of the roof assembly, they must
    1. not penetrate the metal roof assembly
    2. be designed in consultation with the structural engineer for the metal roofing system
2. The decision to use, and / or the selection of snow guards, is the responsibility of the *Design Authority*. Neither the ***RoofStar Guarantee Program*** nor the roofing contractor will accept any responsibility for damage to, or failure of, the roof system caused by the use or absence of snow guards.

12.2 Built-in Gutters

Built-in gutters (see also **ASM Detail E1.7.17**) adjoining metal roofing systems must be installed by a Contractor in order to qualify for a RoofStar five (5) or ten (10) year Guarantee:

1. Gutters shall be designed a minimum of 300 mm (12”) wide, and the depth shall not exceed the gutter’s width.
2. Only fully-adhered membranes may be used in built-in gutters, and only EPDM, PVC, TPO or 2-ply modified bituminous membranes are acceptable for this application. For single-ply membranes, the minimum thickness shall be 60 mils (1.524 mm).
3. Fully-adhered membranes must be carried up the slope, measured vertically from the maximum water level
    1. at least 150 mm (6”)
    2. more than 150 mm (6”) in regions with typical heavy snow
4. Extend the gutter membrane as eave protection by overlapping the eave membrane at least 200 mm (8”) over the gutter membrane, in shingle fashion.
5. Gutter membranes must be mechanically secured at their terminations, both on the outside of the gutter edge and on the slope beneath the metal panel system. Fasteners used to secure the gutter membrane
    1. must be placed at least 150 mm (6”) up the slope, measured vertically from the maximum water level
    2. shall be spaced no more than 300 mm (12”) O.C., but may be omitted where metal panel clips are fastened through the membrane with the same spacing
6. A gutter liner fabricated from copper sheet material, incorporating soldered seams and installed over an underlayment, is acceptable for use on copper standing seam metal roof systems.
7. A gutter liner fabricated from stainless steel incorporating welded seams and installed over an underlayment, is acceptable for use on zinc and copper standing seam metal roof systems.
8. A scupper overflow drain is mandatory and shall be placed at the maximum water level.
9. The gutter membrane must lap underneath the sloped roof assembly underlayment by at least 200 mm (8”). When the assembly is insulated, this transition may require the use of tapered insulation incorporating a drainage plane between layers of tapered insulation. See **ASM Detail E1.7.16** for an illustrated example.

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13 [Not Used]

14 [Not Used]

END