RoofStar Guarantee Standards for
Architectural Sheet Metal (ASM) Systems

How to use these Guarantee Standards

This Standard is comprised of fourteen (14) Parts that contain the Standards, Guiding Principles, Recommendations and Reference materials necessary for the design and installation of a Project to qualify for a ***5 or 10-year RoofStar Guarantee***. Guarantee Standards specifically required to qualify for a ***15-year RoofStar Guarantee*** are listed in each relevant Part. All 15-year ***RoofStar Guarantee Standards*** must be read together with the general requirements for each Part in this Division.

Readers are advised to review relevant materials that can be accessed through the hyperlinks embedded in the body of text and visible in **blue**. Part titles shown in blue indicate hyperlinks to more relevant material that the reader is advised to consult.

Content in each Part is colour-coded according to four classes, to assist the reader in understanding:

Standards

Guiding Principles

Recommendations

Reference materials

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

Editor's note

The content of this Standard was significantly revised and supplemented in November 2018. In June 2020 new material was added and some existing content was relocated to different Parts. This last addition and revision represents the final major update of the Architectural Sheet Metal (ASM) System Standard.

Please note that the PDF highlights only the changes made since the last published revision of these Standards.

The reader is responsible to ensure that downloaded copies remain current with the online version of the ***Roofing Practices Manual***. Only the online version of these or any other ***RoofStar Guarantee Standards*** shall be considered valid for the purpose of designing and constructing a RoofStar-qualified *Project*.

For all changes made since the last major revision (November 2019), consult the official online version of this Standard. In the event of a discrepancy between this PDF and the official online version of this Standard, the official online version shall be used.

1 GENERAL

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

Assembly

means a *System* in combination with its *supporting deck* structure (adapted from *ASTM D6630-08 Standard Guide for Low slope Insulated Roof membrane Assembly Performance*).

Contractor ("contractor")

means the installer of a *Project*. For the purpose of issuing a ***RoofStar Guarantee***, *Contractor* shall be read to mean an Active Member of the RCABC.

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*.

Eave Protection

means a self-adhering water-proofing underlayment of a *Water-shedding System* roof that is applied along the eaves to prevent water ingress. Eave protection materials may also be applied in valleys or along vulnerable plane transitions.

Finished Waterproofing/Water-shedding System

means the top surface of a *Water-shedding System* or *Waterproofing System* that may include ballast or that supports *Overburden*.

Guarantor

means the RGC ***RoofStar Guarantee Program*** that issues the ***RoofStar Guarantee*** *("Guarantee")*; the two terms may be used interchangeably.

Linear Metal Flashings

are flashings cut and shaped from flat metal stock, to redirect water at roof perimeters and edges, and are used in valleys and drainage spillways.

Manual

means the ***Roofing Practices Manual***.

Project

means the designed or constructed *Waterproofing System* or *Water-shedding System*.

System

means the organization and securement of various interacting materials (apart from the supporting deck structure), designed and installed to prevent the transmission of water through the system into the conditioned space of a building (adapted from *ASTM D6630-08 Standard Guide for Low slope Insulated Roof membrane Assembly Performance*).

Underlayment

means a sheet material, either self-adhered or mechanically fastened, which serves as secondary protection beneath the water shedding roof covering of a *Water-shedding System*.

Waterproofing System

means a membrane or liquid-applied system that, regardless of slope, waterproofs a roof or structure at grade. These systems are typically installed on slopes less than 1:4 (3" in 12").

Water-shedding System

means a *roof system* that, with sufficient slope, sheds water away from a structure but does not necessarily waterproof it.

Refer to the **Glossary** for further definitions of key terms used in this *Manual*.

1.3 Design Considerations

1) Architectural Metal Roofing Systems that are accepted for use in the ***RoofStar Guarantee Program*** are roll formed, are generally non-structural (not designed to carry normal live loads), hydrokinetic (water-shedding) systems that commonly installed over solid roof *decks* or rigid insulation panels, but may also be intermittently supported when engineered to resist anticipated live loads (**9.1.1** (**6**)). Although some metal panels may also be designed for use as structural (spanning member) systems, only their use as an architectural metal panel system 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 **Part 3 SECURING the *ROOF ASSEMBLY***).
3) Compliance with ***RoofStar Guarantee Standards*** is mandatory for issuance of the ***RoofStar Guarantee*** certificate. The reader is urged to review all the Parts of this *Manual* for ***RoofStar Guarantee Standards*** applicable to all aspects of the design.
4) The ***RoofStar Guarantee Program*** covers only Architectural Metal Roofing Systems applied over solid *decking*. Structural metal *roof system*s requiring metal panels to span framing members unsupported by solid *decking* are not covered under the ***RoofStar Guarantee Program***.
5) 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 [NOT USED]

1.3.2 [NOT USED]

1.3.3 High Snow Conditions

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 membrane as eave protection and underlay.
4) placement of penetrations near the ridge line.

1.34 [NOT USED]

1.3.5 Hot Works: Design

When any portion of a *Waterproofing System* is installed with heat, the work is classified as Hot Work. Some tools used in the course of Hot Work can ignite combustible materials, and some building environments are more sensitive to fire than others, such as a building containing or in close proximity to flammable liquids. Hot work may occur during

- tear off (sparks).
- deck preparation (drying wet surfaces).
- cold temperatures (warming materials or surfaces).
- equipment use (sparks within electrical tools, or from cutting, drilling or grinding metal, concrete, stone or other hard surface products).
- membrane installation (with the means of a kettle, hot-air welder or open flame torch).

1) The *Design Authority* may specify that the contractor must maintain compliance with the RCABC Hot Work Program and consequently manage the Hot Work conducted on site.
2) When the *Project* involves Hot Work, the *Design Authority* must either
    1) pre-approve alternate applications already written within this *Manual*, when the specified application is deemed to be fire sensitive by the contractor as part of the risk assessment process.
    2) provide alternate material and application requirements in the Specification for fire sensitive locations on the Project.

See also **1.4.3 Hot Works: Contractor Requirements**.

1.3.6 Variances

When a design is unable to conform to the Standard, the *Design Authority* may apply to the RGC for a written Variance. Application must be made in writing (email correspondence is common), and the request must

1) identify the project name, its civic address and the applicable ***RoofStar Guarantee*** number (if already initiated).
2) articulate the nature of the design problem.
3) cite the ***RoofStar Guarantee*** standard reference to which the Variance will apply.
4) provide design drawings (and photographs, if available) as supporting information.

We may ask for more information in order to fully consider a request for a Variance and will issue a completed Variance only to the *Design Authority* for distribution to the *Contractor*.

A Variance may be unrestricted in its scope, or it may include one or more conditions that will affect the design and construction of the *Water-shedding System* or *Waterproofing System*, in order to accommodate the varied Standard. Occasionally, a Variance may also restrict coverage offered by the ***RoofStar Guarantee***.

Variances are issued only for the specific issue on the *Project* identified in the written request, and do not constitute general permission to depart from the published Standards in this *Manual*, for any aspect of the same *Project* or for future projects, designed or constructed by any other firm.

1.4 Scope

1) The **Guarantee Standards**, Guiding Principles, Recommendations and Reference Materials in this *Manual* pertain to both new roofing construction and replacement roofing, unless explicitly stated otherwise.

1.4.1 New Construction

1) New roof construction must utilize only newly manufactured materials, and may not incorporate recycled products, unless with the expressed, written consent of the ***RoofStar Guarantee Program***.

1.4.2 Replacement Roofing and Additions

1) Replacement roofing shall be undertaken in the same manner, and to the same standards, as new roofing and must be installed over a bare, clean and suitable deck, free of any other materials (with the exception of existing *eave protection* membrane; refer to **Part 8 EAVE PROTECTION, UNDERLAYMENT and VENTILATION**), knots, distortions or ridges.
2) 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.
3) New metal roofing and existing rainwater gutters must be protected from incidental damage including, without limitation, damage caused by ladders.
4) When replacement roofing is complete, debris must be removed from rainwater gutters.

1.4.3 Hot Works: Contractor Requirements

1) The *Contractor* must maintain the requirements of the RCABC Hot Work Program. This includes the following, without limitation:
    1) **Insurance Coverage** – limits carried on the *Contractor's* policy must equal or exceed the minimum requirements set by RCABC, and coverage must be unhindered by warranties that limit or exclude coverage when Hot Work is required.
    2) **Education and training** – workers who perform hot work must be trained by the *Contractor* and kept current with acceptable methods.
    3) **British Columbia Fire Code** – a Fire Safety Plan, preventative methods or alternative work procedures, fire watches, and the use and placement of equipment at the *Project* site must comply with the *British Columbia Fire Code* requirements for Hot Work.
    4) **Fire Safety Plan** – the *Contractor* must assess the hazards to property and persons and produce a written Fire Safety Plan prior to the start of work. The Fire Safety Plan must be kept on the *Project* site and must be kept current until the *Project* is completed.
    5) **RoofStar Guarantee Standards** – the *Contractor* must adhere to the ***RoofStar Guarantee Standards*** at each juncture where the interface of different membranes applications constitutes part of the Fire Safety Plan.
    6) **Fire Watch** – the *Contractor* must, as part of the Fire Safety Plan, conduct a fire watch
        1) that complies with the *British Columbia Fire Code*.
        2) assigned to competent, trained personnel using suitable equipment including the use of a hand-held infrared thermometer.
        3) documented in a written fire watch log.
    7) **Hot Work Notification** – notify the *Project* authority or the AHJ, as and when required, that Hot Works will be performed.

1.5 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 finished *Project* exhibits excellent workmanship. Therefore, the following Standards apply:

1) The *Contractor* must take reasonable measures to protect the *Project* from damage by the weather, during and at the completion of construction. Open penetrations and flashings must be temporarily sealed off from the weather, even when other trades are responsible to make a permanent seal or install overlapping materials. See also **4.1 General**.

1.5.1 Contractor Qualifications

1) Supervision, manufacturing and installation of a ***RoofStar-guaranteed*** Architectural Sheet 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.

1.6 RoofStar Guarantee: Coverage and Limitations

A ***RoofStar Guarantee*** is available for almost any roof design, provided it is designed and built to the Standards in this *Manual*. Nevertheless, there are limitations and conditions. They are listed on the *Guarantee* certificate, and include (without limitation) the following (as they are applicable to the type of *Project*):

1) The ***RoofStar Guarantee*** covers leaks resulting from new materials purchased, supplied and installed by the *Contractor*. All new materials incorporated into a *Project* intended to qualify for a ***RoofStar Guarantee*** must be expressly Accepted by the RGC and listed in the ***Roofing Practices*** *Manual*. Accepted Materials include (without limitation)
    1) *Primary* and *Secondary Materials*.
    2) penetration flashings and drains.
    3) roof-related linear metal flashings.

    All materials or products supplied by anyone other than an Associate Member, or which are installed by someone other than the *Contractor*, will be excluded from coverage under the *Guarantee*, and may void the *Guarantee* entirely.
2) Notwithstanding the definition of a *Waterproofing* or *Water-shedding System*, the ***RoofStar Guarantee*** does not cover the quality, installation or performance of the *supporting deck*.
3) The ***RoofStar Guarantee*** (subject to the limitations described herein or stated on the *Guarantee* certificate) is a guarantee against leaks only, caused only by a failure of new materials installed by the *Contractor*, or resulting from the *Contractor's* installation of new materials.

    The term "new materials" includes *Primary* and *Secondary Materials*, *Linear Metal Flashings*, and both penetration flashings and roof drains that have been expressly accepted for use on a *Project* designed and constructed to qualify for a ***RoofStar Guarantee***. Only materials listed in the Accepted Materials Division of the ***Roofing Practices*** *Manual* qualify for a ***RoofStar Guarantee***.

    The re-use of any existing material on a *Project* may void the *Guarantee*.
4) Notwithstanding any of the *Guarantee* requirements in this *Manual*, a ***RoofStar Guarantee*** <u>will not cover</u>
    1) leaks resulting from
        1) improper design.
        2) overloading.
        3) water entry from other building components (*wall*s, skylights, etc.).

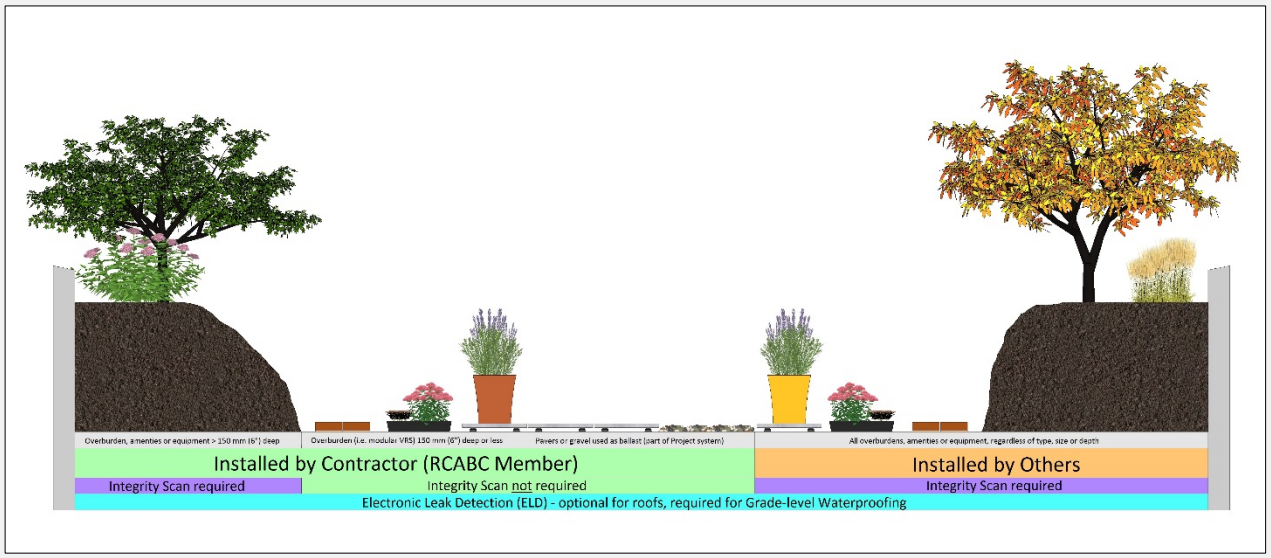
4) the failure of a drain or flashing supplied or installed by anyone other than the *Contractor*.
5) neglected maintenance of the *Project*.
6) building air leakage.
7) modifications to the *Project* made by anyone other than the *Contractor*.
8) changes in building use or occupancy.

2) drain leaders, which are not considered part of the roof *system*.
3) the costs to remove and reinstall irrigation or other services (including, without limitation, electrical and gas services).
4) replacement (new for old) of any *Overburden*.
5) damage or leaks caused by the roots of invasive plant species (for example, certain varieties of bamboo or willow), regardless of measures taken to protect the membrane.
6) a sacrificial third ply or a coating, used as a walkway or warning zone, as it is not considered part of the roof *system.*

5) *Overburdens* may be installed on a *Conventionally Insulated Waterproofing System* or *Protected ("inverted") Membrane Roof Assembly*, but not all designs are suitable for any type, size or depth of *Overburden* (see **Part 14 THE ROOF as a PLATFORM** in *Waterproofing Systems* standards). The RGC recommends that a roof supporting *Overburden* be designed and constructed as a *Protected Membrane Roof Assembly*. The ***RoofStar Guarantee*** may be void if a roof is designed and constructed with *Overburden* that exceeds the capabilities of a *Conventionally Insulated Waterproofing System*.
6) Only a fully adhered membrane may be used in a *Protected* ("inverted") *Membrane Roof Assembly.*
7) **Integrity Scans**: An Integrity Scan
    1) must be performed by an RGC-recognized service provider listed in this *Manual*.
    2) is required on all *Waterproofing Systems*, to ensure the waterproofing is leak and damage-free, when *Overburdens*, amenities or equipment are or will be installed on the completed *Waterproofing System* by
        1) anyone other than the *Contractor*.
        2) the *Contractor* but only when
            1) the total *Project* area (footprint), inclusive of planters or other waterproofed features, exceeds 18.58 m2 (200 sf), and
            2) the *Overburdens*, amenities or equipment exceed 150 mm (6") in depth.
    3) is not required when the *Contractor* installs *Overburden*, amenities or equipment
        1) equal to or less than 150 mm (6") in depth.
        2) the total *Project* area (footprint), inclusive of planters or other waterproofed features, is less than 18.58 m2 (200 sf), but the *Contractor* must nevertheless protect all membrane-covered surfaces (including *wall*s and parapets) with RoofStar-accepted protection materials immediately after the membrane is installed.

See **Figure 1.1** for further reference.

Figure 1.1



8) **Electronic Leak Detection** is mandatory for grade-level *Waterproofing Systems*, but optional for *Waterproofing Systems* on roofs.
9) **Pre-curbs and Concrete Features**
    1) When concrete *walls* or structures are constructed without a pre-curb, all concrete surfaces must be fully and continuously enveloped with the primary roof membrane.
    2) While the application of non-penetrating bonded tiling or other architectural finishes to the waterproofing membrane is acceptable for a ***RoofStar Guarantee***, and is subject to approval by the membrane manufacturer, the removal, reinstallation or replacement of any bonded finish, in order to investigate and repair leaks under the terms of the *Guarantee*, is the responsibility of others.
10) **Modifications during the Guarantee Term**
    1) RGC must be notified in writing of any modifications or repairs to the RoofStar-guaranteed *Project*.
    2) The owner must ensure that any modifications or repair work done on the *Project* during the guarantee period is performed to ***RoofStar Guarantee Standards*** by a *Contractor* and is inspected by a RoofStar-accepted observation firm.
11) **Maintenance**: the building Owner must ensure that the *Project* and its components are properly maintained. Debris in drains, caulking on or around metal flashings, and wind scouring of gravel are considered maintenance issues.
12) **Removal and Reinstallation of Overburdens**: in order to investigate and repair a leak, the ***RoofStar Guarantee Program*** must be allowed to remove *Overburdens*, to expose the membrane. The ***RoofStar Guarantee*** pays for the removal and reinstallation of accessible *Overburdens* only (subject to the limits published below), when they are installed by the *Contractor*, regardless of the *Project* design. The cost to remove, care for and reinstall any *Overburden* that exceeds these limits or conditions, which is *inaccessible* or which was supplied or installed by others, will be borne by the Owner.
    1) **Maximum coverage area**: limited to one physically defined *Project* area (no maximum size).
    2) The ***RoofStar Guarantee*** pays for removal and reinstallation of accessible *Overburdens* up to the following limits:
        1) *Extensive vegetated roof systems*, provided they are comprised of trays or other recognized modular methods and are less than 150 mm (6") in depth, exclusive of the plants.
        2) other accessible coverings, provided they are unitized (for example, pavers on pedestals) and do not exceed 1 M2 or 90 Kg (200 lb.) per unit.

3) gravel ballast and its associated drainage or protection material components, provided the ballast is less than 150 mm (6”) deep.
4) structures, furnishings or planters provided each item, or any single component of each item, is easily detachable, does not require a specialty trade, and is no heavier than 90 Kg (200 lb).

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2 SUPPORTING STRUCTURES: Decks and Walls

2.1 General

2.1.1 Definitions

Refer to the **Glossary** for further definitions of key terms used in this *Manual*.

Supporting deck ("*deck*")
means the structural surface to which the *Waterproofing* or *Water-shedding System* is applied (adapted from *ASTM D1079-18 Standard Terminology Relating to Roofing and Waterproofing*).

Deck overlay

means a panel material secured to the *Supporting Deck* in order to render the deck surface continuous or suitable for the installation of roofing materials.

Wall

means a structural or non-structural element in a building that vertically separates space. *Walls* may separate the outside environment from the interior conditioned space of a building, or they may separate one or more interior spaces from each other (adapted from *ASTM E631-15 Standard Terminology of Building Constructions*).

Wall overlay
means a panel material secured to the surface of a *wall*, to render it suitable for the installation of roofing or *wall* cladding materials.

2.1.2 Design

1) The *British Columbia Building Code*, or the building code having jurisdiction, prevails in all cases except where it is exceeded by the ***RoofStar Guarantee Standards*** published in this *Manual*.
2) Notwithstanding the ***RoofStar Guarantee Standards*** published in this *Manual*, the ***RoofStar Guarantee*** does not extend coverage to the *supporting deck* or to its securement, which is the responsibility of the *Design Authority* and the building contractor.
3) Prior to the application of the *roof system*, the *supporting deck* and other surfaces receiving membranes must be smooth, straight, clean and free of
    1) moisture.
    2) frost.
    3) dust and debris.
    4) contaminants.
    5) objectionable surface treatments.
    6) release oils.
    7) laitance.

    If surface drying is required prior to roofing, use blown air to facilitate this.
4) *Walls*, parapets, curbs, blocking and penetrations should be constructed or placed prior to the commencement of roofing work. This work is provided by other trades.
5) The *supporting deck* structure should be dimensionally stable and capable of accommodating *roof system* component movement.

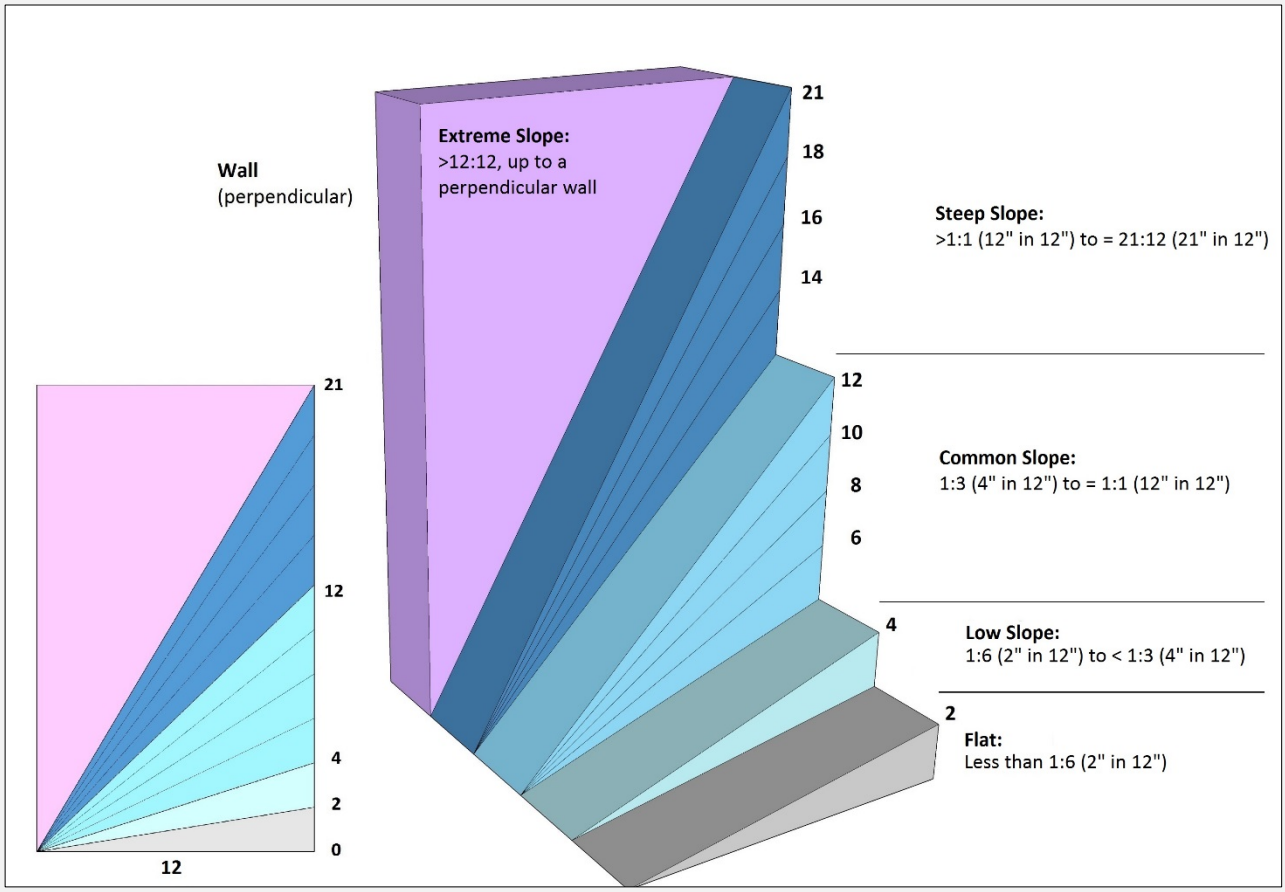
2.2 Roof Slope

1) The ***RoofStar Guarantee Program*** classifies roofs according to their function – waterproofing or water-shedding. Within each classification, slope is defined as follows:
    1) **Flat** means a roof with a slope less than 1:6 (2" in 12", or 9 degrees).

2) **Low Slope** means a roof with a slope from 1:6 (2” in 12”, or 9 degrees) up to but less than 1:3 (4” in 12”, or 18 degrees).
3) **Common Slope** means a roof with a slope 1:3 (4” in 12”, or 18 degrees) up to and including 1:1 (12” in 12”, or 45 degrees).
4) **Steep Slope** means a roof with a slope greater than 1:1 (12” in 12”, or 45 degrees) up to and including 21:12 (21” in 12”, or 84 degrees).
5) **Extreme Slope** means a roof with a slope greater than 21:12 (21” in 12”, or 84 degrees).

See **Figure 2.1** for an illustrated guide to the above definitions.

Figure 2.1



2) 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.
3) Roofs with designed slopes less than the stated minimum (such as curved applications; see also **Part 9 PANELS**) 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 **Part 9 PANELS**.
4) If proprietary systems are specified, the manufacturer's suggested minimum slope and application procedures must be followed in addition to ***RoofStar Guarantee*** requirements.

2.3 Supporting Deck Types

2.3.1 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 *decks*, 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 *decks* on all copper and zinc non-ferrous (i.e. copper, zinc) metal panel *roof system*s.
4) OSB (sheathing) is **not** an acceptable wood *deck*.

2.3.2 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*.

2.3.3 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*.

2.4 [NOT USED]

2.5 [NOT USED]

2.6 Walls

2.6.1 General

1) *Wall* surfaces must provide a be clean, dry and smooth, vertical surface suitable for the application of *roof system* materials. When the *wall* surface is unsuitable to receive waterproofing materials, it must be resurfaced with an RGC-accepted *wall overlay*. See **Part 5 DECK and WALL OVERLAYS** for material and application standards.
2) *Sheathing*, defined as a rigid panel material secured directly onto framing, is considered a *wall* surface for the purpose of this Standard.
3) *Wall* surfaces receiving waterproofing materials must extend vertically beyond the maximum height of waterproofing materials but in any event must be at least 200 mm (8") high, above the surface of the *Finished Water-shedding Assembly*. For suitable *wall* surface materials, see **2.6.2** below.
4) *Walls* and roofs commonly intersect in two ways:

3) Directly, where the *wall* structurally connects to the roof structure, so that both move together.
4) Indirectly, where the roof structure and the *wall* structure are independent of each other, so that the movement of one does not affect the other. These locations require an expansion joint.

5) The *Design Authority* must ensure a continuous connection between the *roof system* from field to perimeter, in order to control or inhibit the movement of water, air and vapour.
6) Wood or steel-stud *walls* must be sheathed with a material suitable for securing metal flashings.
7) For concrete *walls*, refer to **2.2.3 Concrete** above.

2.6.2 Material

1) Concrete surfaces must comply with the requirements set out in **2.1** (**3**). When concrete surfaces do not comply, concrete *walls* may be sheathed with any one of the following:
    1) 15.9 mm (5/8”) thick treated plywood.
    2) fibre-mat reinforced cement boards with a minimum thickness of 9.5 mm (⅜").

    Both materials must also conform to *ASTM C1325-04*.
2) For framed *walls*, the following *sheathing* material are acceptable:
    1) Moisture-resistant gypsum core boards specifically designed to receive roof membranes; boards must have a minimum thickness of 12 mm (1/2”). These panel may be installed horizontally or vertically.
    2) Fibre-mat reinforced cement boards with a minimum thickness of 9.5 mm (⅜").
    3) Plywood with a minimum thickness of 12 mm (1/2”).

2.7 Electrical Cables and Boxes

Electrical cables (including conduit) or boxes installed inside, on top of, or beneath a *roof assembly* may expose roofing workers to electrical shock and may inhibit the installation of some *roof system*s designed to resist wind uplift. Furthermore, electrical cables on, in or under the *roof assembly* expose the building and the public to both shock and fire. Hidden electrical wiring and boxed junctions can be extremely difficult to document before work begins, and while some technologies are purportedly accurate in identifying energized circuits before they are damaged, false readings make these technologies less than reliable. During replacement roofing, avoiding damage to electrical circuits from cutters and fasteners is sometimes next to impossible. It is therefore desirable to design buildings with realistic separations between electrical wiring and boxes, and roof assemblies.

For more about this topic, see the reprinted Safety Bulletin issued by the **BC Safety Authority**, republished in the November 10, 2015 **Technical Update**.

Currently, neither the *Canadian Electrical Code, Part I* nor the *British Columbia Electrical Code* explicitly prohibit, nor explicitly permit, the installation electrical cables and boxes anywhere in close proximity to a *roof assembly*. The *Design Authority* therefore has the latitude to write restrictions concerning the location of electrical installations, and consequently eliminate shock and fire hazards. To do so, apply the following standards when preparing *Project* specifications to qualify for a ***RoofStar Guarantee***.

2.7.1 New Construction

1) Electrical cables, raceways or boxes shall not be installed within a *roof assembly* (**Figure 2.7.1-1**).
2) Electrical cables, raceways or boxes shall not be installed on the underside of a *roof assembly*, unless
    1) the *supporting deck* structure equals or exceeds 76 mm (3”) in thickness (**Figure 2.7.1-2**), or
    2) the cables, raceways or boxes are installed and supported so there is a separation of not less than 38 mm measured between the underside of the *roof assembly* and the electrical installation (**Figure 2.7.1-3**).

3) Notwithstanding either (1) and (2), cables or raceways shall be permitted to pass through a *roof assembly* for connection to electrical equipment installed on the roof, provided that the passage through the roof is a part of the *roof assembly* design.
4) Electrical cables installed above the *roof assembly* should be elevated to permit proper support, roof maintenance and future replacement roofing (**Figure 7.7.1-4).**

Figure 2.7.1-1

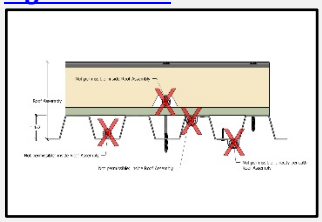


Figure 2.7.1-2

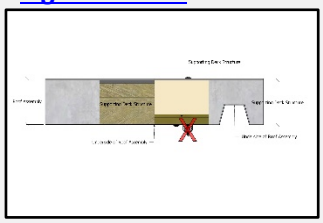


Figure 2.7.1-3

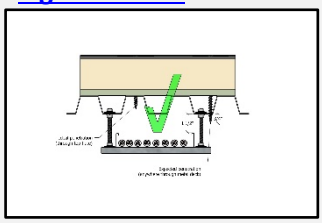
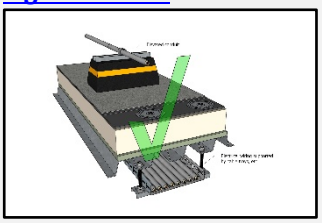


Figure 2.7.1-4



2.7.2 Replacement Roofing

1) If existing electrical cables or boxes do not conform to the standards in **2.6.1 New Construction**, the *Design Authority* must consider the attachment of the *roof system* above the electrical system, and the requirements set out in **Part 3 SECURING the ROOF ASSEMBLY**.
2) The *Design Authority* should
    1) specify protection of existing electrical cables and boxes (a 5 mm (3/16”) steel plate may be used to minimize the possibility of fastener penetration and cutter damage, but it should be understood that protection plates may interfere with mechanical fasteners used to secure the *roof system* against wind uplift, even for future replacement roofing).
    2) provide the building owner with detailed as-built drawings that accurately map the location of electrical cables and boxes.

---

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 **9.1.1 Design**. 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 system*s 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 RoofStar-accepted Architectural Sheet Metal *Roof system*s.

3.2 Materials

3.2.1 Fasteners, Clips and Cleats

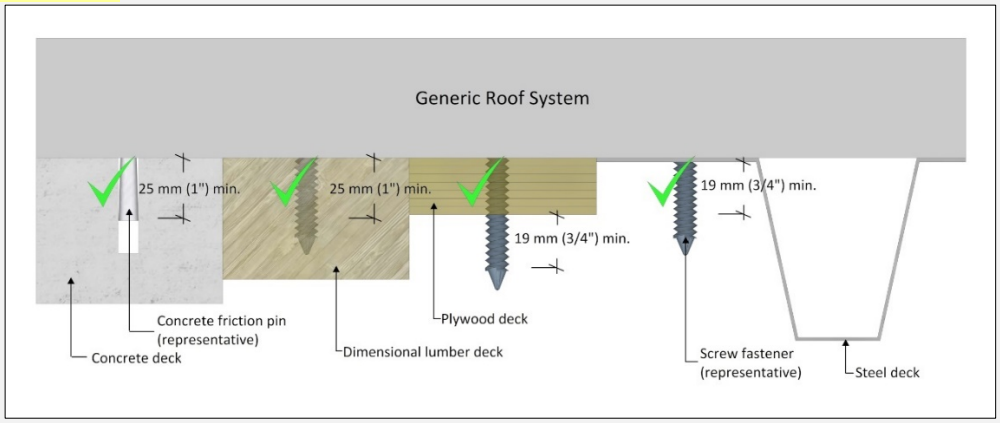
1) For specific requirements, see below under **Part 9**, **Part 10** and **Part 11**.

3.3 Application

1) All metal panels must be secured to their underlying supports with concealed fasteners. Exposed fastener securement is not acceptable.
2) Concealed fasteners should provide clearance for the underside of the metal panel and must be of a material compatible with the metal clip.
3) Regardless of where fasteners are used in the *roof assembly*, mechanical fasteners must penetrate
    1) through the bottom surface of
        1) steel *deck*s at least 20 mm (3/4") – fasteners should penetrate the top flutes only.
        2) plywood sheathing by at least 19 mm (3/4”).
    2) into solid dimensional lumber by at least 25 mm (1").

See **Figure 3.5**.

Figure 3.5



4 MATERIALS

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

4.1 Definitions

Refer to the **Glossary** for further definitions of key terms used in this *Manual*.

Primary Material means 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 category.

Secondary Material means one which forms part of a *Waterproofing* or *Water-shedding System* and which may affect the wind resistance characteristics of the entire assembly but is not necessarily exposed to the weather.

4.2 General

1) All roofing components installed by the *Contractor* must be
    1) new
    2) accepted by the ***RoofStar Guarantee Program***.
    3) manufactured by, or listed as acceptable to, the manufacturer of the primary field membrane or water-shedding material.

   A list of all Accepted Materials is published in this *Manual* (see link above).

   Also see **1.6** (**2**) **RoofStar Guarantee: Coverage and Limitations** for restrictions and limitations on any roofing material, linear metal flashing, penetration flashing or drain used on a *Project* qualifying for a ***RoofStar Guarantee.***

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 workday.
4) Metals and fasteners must be compatible with each other, to avoid galvanic corrosion which can occur when dissimilar metals contact each other.

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5 DECK and WALL OVERLAYS

5.1 General

5.1.1 Definitions

Refer to the **Glossary** for further definitions of key terms used in this *Manual*. See also **2.1.1 Definitions**

5.1.2 Design

1) When a *supporting deck* structure or *wall* is unsuitable for the application of roofing materials, it must be covered with a RoofStar-accepted overlay. See **2.1** (**3**) for *supporting deck* and *wall* surface requirements.
2) 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 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.
3) *Wall* overlays are less common on *Water-shedding Systems* but may be required to provide a suitable surface for self-adhering membrane flashing.
4) For roof assemblies designed above a vaulted conditioned space, see also **6.1.3.2 Attic Ventilation**.

5.2 Materials

1) *Deck overlays* 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**. 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 **Part 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 (min. 12.7 mm (1/2")) of either
    1) moisture resistant gypsum core board deck overlay board.
    2) plywood.

5.3.3 Wood Decks

1) A mechanically fastened overlay board is required for any *supporting deck* that does not meet the *deck* fastening criteria set out in **2.3.1 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 (refer to **Division C: Accepted Materials** in this *Manual*).
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

NOTE: See more information on **Air and Vapour Control** in **Division B: Essential Elements**.

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 system*s 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 *wall*s 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 rainwater 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 system*s 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. Therefore, 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 Division 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 *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 Design

6.1.3.1 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 System* unless effective air and vapour controls are installed.

6.1.3.2 Attic Ventilation

1) The design and selection of the ventilation system is the responsibility of the *Design Authority*, and may be achieved by incorporating into the roof design both intake and exhaust vents, including (without limitation),
    1) Eave vents
    2) Gable end vents
    3) Hip vents
    4) Static vents
    5) Ridge vents
    6) Cupolas
2) Attic (roof cavity) ventilation must
    1) meet the minimum requirements set out by the Code having jurisdiction, even in conditions where snow cover is present (see *British Columbia Building Code*, *Part 9 for Housing and Small Buildings, Section 9.19 Roof Spaces, 9.19.1.3 Clearances*). Roofs that do not provide adequate ventilation do not qualify for a ***RoofStar Guarantee.***
    2) be suitable for the
        1) slope of the roof.
        2) vented area.
        3) design and configuration of the roof structure.
    3) be provided for
        1) roofs over cathedral ceilings.
        2) compact insulated roof assemblies.

    See also *Building Ventilation* in **Division B: Essential Elements** of this *Manual*.
3) Continuous ridge venting systems
    1) are acceptable and are recommended for all areas with vaulted ceilings.
    2) may be installed on slopes 1:3 (4" in 12") and greater, but application on slopes less than 1:3 must be permitted by manufacturer's published installation instructions.

6.2 Materials

6.2.1 Air and Vapour Controls

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) Self-adhering or adhesive-applied materials should be considered as alternatives to torch-applied membranes when the substrate to which they will be applied is combustible, or when nearby structures, openings or materials present a fire hazard. In the alternative, a suitable separation or overlay material as protection from open flame is acceptable. The application of materials to a combustible surface, using a torch, is strictly prohibited.
3) 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** (**4**) 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.
4) Notwithstanding any of the foregoing, the ***RoofStar Guarantee Program*** strongly recommends that any air 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.
5) Should the air or vapour control layers be used as a temporary roof during *Project* construction by either the *Contractor* or by other trades, a minimum 2mm thick bituminous membrane is recommended.
6) 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*.

6.2.2 Air Vents

1) Vents, regardless of their type, must be either
    1) proprietary to, or privately labeled for, the shingle manufacturer, or
    2) specifically accepted by the ***RoofStar Guarantee Program***. See also **11.2.3 Penetration Flashings**.
2) Ridge vents must be
    1) fabricated from a compatible metal.
    2) acceptable to the metal panel manufacturer.
    3) suitable for slopes 1:4 and greater.
    4) constructed with internal baffles to prohibit the intrusion of
        1) insects.
        2) vermin.
        3) snow.
        4) debris.

6.3 Application

6.3.1 Air and Vapour Controls

1) Proper installation and continuity of air and vapour control layers within the *roof assembly* is the responsibility of the *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 be smooth and uniform, without wrinkles or fish-mouths, and must also conform to the manufacturer’s published requirements and the *Design Authority*’s design details.
3) All membrane side and end laps must be fully supported, in the field and at transitions with curbs, parapets, *walls* and penetrations.

    See Figures **6.3.1-1** and **6.3.1-2**.

Figure 6.3.1-1

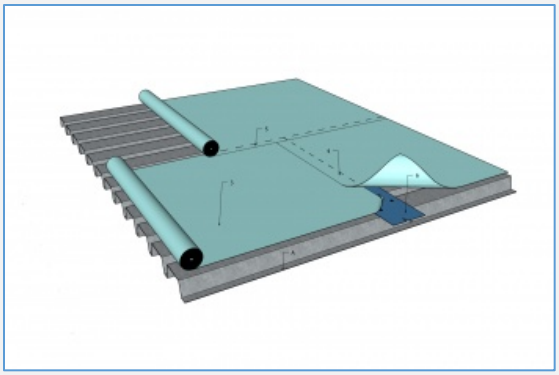
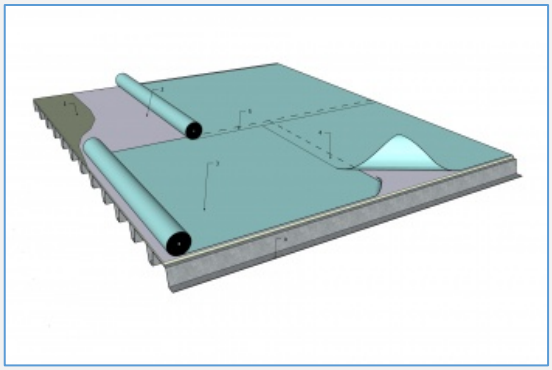


Figure 6.3.1-2



Click on either of the images above to link to the Construction Detail.

4) The application of materials to an unprotected combustible material, using a torch, is strictly prohibited.
5) All combustible materials MUST be protected from open flame by an acceptable separation or overlay material. This includes, without limitation, combustible materials
    1) on *decks*, *walls*, blocking, and cants.
    2) hidden or obscured within voids, cracks or orifices.
6) When a torch-applied base membrane is specified, all joints between overlay panels, and at roof-*wall* transitions, must be sealed with the primary membrane manufacturer’s approved self-adhered membrane or tapes. Alternatively, refer above to **10.3.3 Alternative Approaches to Membrane Flashing** in the **RoofStar Guarantee Standards for SBS Modified Bitumen Membrane Systems**.

6.3.2 Air Vents

1) Refer to **11.3.3 Penetrations and Vents** for application requirements.

7 INSULATION

7.1 General

1) Some *Water-shedding Systems* call for a compact insulated system, as for example when the roof covers a vaulted conditioned space. When this is the case, the following design, material and application requirements, principles and recommendations apply.

7.1.1 Definitions

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 heat from 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.

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.

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

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 **Part 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.
4) While minimal insulation panel thicknesses are permissible for some designs, the *Design Authority* should consider the constructability of the *roof system* from a material handling perspective. Therefore, when materials are by their nature breakable, the specifier should consider specifying a thicker panel.

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. When thermally non-conductive clips or bars are utilized on a *Low Slope* roof, they must be embedded in, and fastened through, a compatible sealant (see **9.2.5 Sealants**).

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 **Part 3 SECURING the *ROOF ASSEMBLY***.

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8 EAVE and VALLEY PROTECTION, UNDERLAYMENTS and VENTILATION

8.1 General

8.1.1 Definitions

Eave and Valley Protection

means a self-adhering membrane applied in valleys and in parallel courses on the roof *deck* 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.

Separation Layer

(sometimes referred to as a "slip sheet") means a roll material installed directly below metal roof panels to

1) inhibit bonding of the metal panels to underlying materials, such as bitumen-based underlayments or *eave protection* membranes, or
2) permit the passage of vapour out of the *roof system*.

A *separation layer* by itself does not function as a *ventilation layer*.

Underlayment

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

1) immediately over the *supporting deck*.
2) to provide secondary protection between the *Water-shedding System* materials and the building interior.
3) to keep *Water-shedding System* materials from adhering to the *deck*.

Ventilation 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 *separation layer*; it creates a ***ventilation space*** intended to

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

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

8.1.2 Design

1) *Eave and Valley Protection*
    1) must be installed on the *supporting deck*.
    2) is required for all RoofStar-guaranteed Architectural Sheet Metal *Roof systems*. *Eave protection* must be a RoofStar-accepted self-adhered modified bituminous membrane.
    3) may also serve as an air or vapour control, or as both, when installed in combination with the *underlayment*. See also **6.1.2** above.
    4) 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) *Underlayments*
    1) are required over the entire *supporting deck* surface.
3) A *separation* space beneath metal panels

1) is required on slopes less than 1:3 (4” in 12”).
2) is recommended when the roof slope exceeds 1:3 (4” in 12”). See **8.1.2** (**4**).

4) Ventilation may be achieved by either of the following options:
    1) Support the metal panels with entangled mesh having a thickness of at least 7 mm (1/4”) and secure the panels with standard panel clips supported on EPDM pads equal in thickness to the entangled mesh (**9.2.4** (**3**)). See also **8.2.4 Ventilation**.
    2) Elevate unsupported metal panels above the underlying substrate materials by at least 10 mm (3/8”) and secure the panels with tall panel clips; EPDM pads and entangled mesh are not required. This approach is acceptable to the *Guarantor* provided the *Design Authority* supplies the Guarantor with written engineering certification that
        1) the clips will adequately secure and support the elevated panels.
        2) the clips will adequately secure and support the elevated panels.

8.2 Materials

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

1) Materials used for *eave or valley protection*, as an *underlayment* or as a *separation layer* must
    1) be selected from the list of Accepted Materials.
    2) not damage the painted finish of roof panels (a scratched or marred finish may result in panel corrosion).
2) When a material not listed in the Accepted Materials is specified for application in an Architectural Sheet Metal Roof *system*, the *Design Authority* must request a written Variance from the *Guarantor*.
3) 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) Membranes used for *eave and valley protection* must be
    1) self-adhering.
    2) have a sanded or synthetic, non-bonding top surface.
    3) at least 1 mm thick when the roof slope exceeds 1:6 (2” in 12”).
    4) at least 3 mm thick when the roof slope is less than 1:6 (2” in 12”).

8.2.2 Underlayment

1) For *Common Slope* roofs (sloped from 1:6 (2" in 12") 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 *Low Slope* roofs (sloped less than 1:6, or 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) Refer to **Division C: Accepted Materials** of this Manual.

8.2.4 Ventilation Layer

1) Entangled mesh used in a ventilation cavity must be
    1) at least 7 mm (1/4") thick.

2) capable of supporting the weight of the *roof system* and its anticipated live loads (see **9.1.1**(**9**)).

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.
2) *Valley protection* membranes must be
    1) the same materials used for *eave protection*.
    2) at least 1000 mm (39”) wide and centred on the valley.
    3) positively lapped and sealed to the *eave protection* membrane.
3) Where curbs are incorporated into the roof design, they must be flashed with the same material used for *eave and valley protection*. See **11.3.4 Curbs** for additional requirements.

8.3.2 Underlayment

8.3.2.1 General

1) All *roof assembly* components installed above the *supporting 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.

8.3.2.2 Low Slope Roofs

1) In addition to the General requirements above, *Low Slope* roofs may be fully covered with
    1) one layer of self-adhering *eave protection* membrane equal to or exceeding the minimum thickness requirements, or
    2) multiple layers equal to or exceeding 1.4 mm in thickness; the second layer must be offset from the first by at least 300 mm (12”), both horizontally and vertically.

8.3.3 Separation and Ventilation Layers

1) A *separation layer* (slip sheet) is required when
    1) metal panels or flashings come in direct contact with any bituminous underlayments that do not have a tri-laminate facer.
    2) soldering is to be done.
2) Horizontal runs of the *separation layer* 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”), a *ventilation space* beneath the metal panel must be incorporated with either of the following:
    1) clips incorporating panel support tabs 10 mm (3/8”) above the top surface of the clip base.
    2) a continuous layer of entangled mesh no less than 10 mm (3/8”) in thickness.

9 PANELS

This Part covers metal panels that are site-formed by contractors or manufactured by a supplier, for installation in an Architectural Sheet Metal Roof *system*. Both options are listed under the **Accepted Architectural Sheet Metal Roofing** table of this *Manual*.

9.1 General

9.1.1 Design

1) To qualify for a ***RoofStar Guarantee***, all Architectural Sheet Metal Roof *system*s must be professionally engineered and documented on a Schedule S form (Specialty engineering; see the *British Columbia Building Code*, 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**)
    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 design 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
3) Shop drawings for each *Project* detail, which may be drawn by the *Contractor*, must be reviewed by the Accepted observer and returned to the ***RoofStar Guarantee Program*** administrator verifying conformity to the ***RoofStar Guarantee Standards*** prior to the start of construction.
4) Each construction detail must be reviewed during a field review and documented in the observer's RGC field review report, to verify conformity to the ***RoofStar Guarantee Standards***.
5) Some limitations and conditions apply for slopes less than 1:6 (2" in 12"). See **2.2 Roof Slope** for ***RoofStar Guarantee Standards***.
6) 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:

Table 9.1 Minimum Requirements for Seam Types and Heights

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)

7) 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.

8) 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.

9) 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).
10) 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.
11) 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) The *Contractor* **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 Architectural Sheet Metal *Roof system*s.
    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) EPDM foam pads used to support panel clips must be sufficiently dense and thick (after compression) to equal the thickness of the ventilation layer. See also **9.3.3 Panel Securement** and **8.3.3 Separation and Ventilation Layers**.

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 Cur*ing*
    2) CAN / CGSB-19.13, Sealing Compound, One Component, Elastomeric, Chemical Cur*ing*
    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) 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.
3) 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.
4) 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 Panel Securement

See also **10.3.5 Perimeters and *Walls***, together with **13.3 Application** for linear metal flashings.

1) See **Part 3** (**SECURING the *ROOF ASSEMBLY***) for general panel securement standards.
2) All metal panels must be mechanically secured against gravitational (drag) loads.
3) When the roof is designed and constructed with a *ventilation space* (layer) immediately beneath the metal panels, panel clips must be secured using one of the following options:
    1) Standard-height clips (matching the height of panel seams) that are fully supported with a closed-cell EPDM foam pad
        1) fabricated
            1) with sufficient density and thickness (after compression) to equal the thickness of the *ventilation layer*.
            2) at least 18.75 mm (3/4") larger, in width and length, than the bearing plate it will support.
        2) installed over a *separation layer* when the *underlayment* is bituminous.
    2) Clips fabricated 10 mm (3/8") taller than the panel seams, secured with fasteners into their supports and fully embedded in a compatible sealant (see **9.2.5 Sealants**). When this approach is used, the panels must be engineered to support anticipated live loads without deformation (ref. **9.1.1** (**5**)).
4) Metal panels must be secured at, and engaged to, the eaves by a continuous metal hook strip (see **ASM Detail E1.7.3**).

9.3.3 Panel Terminations

1) All panel terminations at the top of a slope
    1) must be turned up (bread-panned) to match the panel seam height. Turned up corners (dog ears) are not to be cut.
    2) must be flashed with a positively shedding cap, hip or *wall* flashing (see **10.3.5 Perimeters and *Wall*s**).
2) When panels terminate at the top of a *Common Slope* or *Low Slope* roof (slopes up to and less than 1:1 (12" in 12")), they must be closed with additional metal Z-closure
    1) set in two (2) rows of gunnable sealant or sealant tape.
    2) fastened to the metal roof panel or fastened through the panel into the deck (when the fasteners are intended to serve as drag load securement).

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10 PERIMETERS and *WALLS*

Following the typical sequence of construction, this Part 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) *Linear Metal Flashings* described in any Part of this Standard are considered necessary and integral to the scope of a *Project* designed and constructed to qualify for a ***RoofStar Guarantee***. Furthermore, only new *Linear Metal Flashings* may be specified and installed; reuse of any existing linear metal flashings is prohibited and may void the *Guarantee*. See also **1.6 RoofStar Guarantee: Coverage and Limitations.**
2) The *Design Authority* is responsible to specify continuity so that intersecting *systems* are positively connected. See **10.3.2 Sequencing.**
3) Flashings must be engineer-designed to resist wind uplift.
4) Where exposed fasteners are not desirable, the design must utilize continuous 'wind clips' that secure the flashing along its lower edge (see **ASM 10.1.1 Eave & Rake Flashing (Mechanical Seam)**).
5) All cap and hip flashings designed for *Common Slope* and *Low Slope* roofs (slopes up to but less than 1:1 (12" in 12")) must be secured with hooked 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.
6) Cap and hip flashings designed for *Steep Slopes* (roofs with a slope greater than 1:1 (12" in 12")) may be
    1) secured with metal Z-closures installed in keeping with the standards in **10.3.5.3** (**1**).
    2) secured to the standing seams with acceptable fasteners. Further protection from the weather may be accomplished by turning down the hip or cap flashing turned down between panel ribs to close off openings.

10.2 Materials

10.2.1 Valley Protection Membrane

1) See. **8.2.1 Eave and Valley Protection** for material requirements.

10.2.2 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**.

10.2.3 Fasteners

1) Fasteners used to secure *Linear 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*).
2) Sealed blind rivets are acceptable for securing two *Linear 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").
3) 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").

10.2.4 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) *Linear 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 *Linear Metal Flashing* overlaps.

10.3.2 Sequencing

1) *Projects* must follow proper sequencing. This means that materials must be installed so that they interface with other materials, systems or assemblies, including those installed by other trades, in "shingle fashion" by positively overlapping them below or above. Occasionally, the coordination with other trades requires some adaptation to this standard. When that is the case, any Variance to proper detail sequencing must be approved by the *Design Authority* in writing.

10.3.3 [NOT USED]

10.3.4 [NOT USED]

10.3.5 Perimeters and Walls

10.3.5.1 Eave, Gable (Rake) and Wall Flashings

1) Eaves flashings (see **ASM 10.1.1 Eave & Rake Flashing (Mechanical Seam)**) 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.
3) 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.
4) Gable and roof-to-*wall* flashings must
    1) be engineer-designed to withstand wind uplift.
    2) allow for expansion and contraction.
    3) be firmly secured
        1) to a *wall* using a concealed continuous clip fastened a maximum of 300 mm (12”) O.C. Exposed fasteners are not permitted.
        2) to the metal panels using
            1) a metal Z-closure set in two (2) rows of gunnable sealant or sealant tape and fastened through the metal roof panel into the deck.
            2) exposed fasteners installed through the flashing into panel ribs.

10.3.5.2 Valleys

10.3.5.2.1 Valley Protection Membrane

1) *Valley protection* membrane must be installed in keeping with the requirements in **8.3.1**.

10.3.5.2.2 Valley Flashings

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 **ASM 10.3.1 Hooked Valley Flashing**) 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 10.3.2 Unhooked Valley Flashing**) 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.

10.3.5.3 Cap and Hip Flashings

See also **9.3.3 Panel Terminations.**

1) All cap and hip flashings installed on *Common Slope* and *Low Slope* roofs (slopes up to and less than 1:1 (12” in 12”)) 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) Cap and hip flashings installed on *Steep Slopes* (roofs with a slope greater than 1:1 (12” in 12”)) may be
    1) hooked to a metal Z-closure installed in keeping with the standards in **10.3.5.3** (**1**).
    2) mechanically fastened to the standing seam with an acceptable fastener.
3) 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.
4) 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.
5) 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.

10.3.5.4 Transitions with Waterproofing Systems

1) Where two *roof system*s intersect, materials must be compatible with each other, or must be separated from contact by an intermediate separation layer.
2) When a *Waterproofing System* assembly transitions
    1) down a slope onto a lower *Water-shedding System*, the waterproofing membrane must lap over the *Water-shedding System* by no less than 50 mm (2").
    2) up a slope and beneath a *Water-shedding System*,
        1) the field membrane or membrane flashing must extend up the water-shedding slope <u>at least</u>
            1) 200 mm (8”), plus 75 mm (3”) for the overlap by the *Water-shedding System*, when measured vertically from the water plane, or 150 mm (6”) when measured vertically from the maximum water level.
            2) 300 mm (12”) plus 75 mm (3”) for the overlap by the *Water-shedding System*, when measured vertically from the water plane or maximum water level, in regions with typical heavy snow.
        2) the termination of the membrane on the slope must be mechanically secured, separately from the Water-shedding System.
        3) fasteners for the *Water-shedding System* must be at least 200 mm (8”) above the finished surface of the *Waterproofing System* (when measured vertically from the water plane), or 300 mm (12”) for regions with heavy snow.
        4) the metal *roof system underlayment/eave protection* must overlap lower *Waterproofing System* membrane flashing by a minimum of 100 mm (4"), and metal panels must overlap the *Waterproofing System* by at least 150 mm (6”). A metal counter-flashing with an exposure of at least 100 mm (4”) is required at the bottom termination of the metal panels.
    3) with a *wall*, *wall* membranes and finishes must positively lap membrane flashing by at least 75 mm (3").

3) When a *Waterproofing System* transitions to a *Water-shedding System* by way of a built-in gutter, the gutter membrane must be carried up the slope (when measured vertically from the maximum water level)
    1) at least 150 mm (6”), or
    2) at least 300 mm (12”) in regions with typical heavy snow.

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11 DRAINAGE and PENETRATIONS

11.1 General

This Part contains standards and references to membrane work that may be atypical of Architectural Sheet Metal System construction. These are nevertheless included to address situations where multiple types of *roof system*s intersect or overlap, or where membrane gutters are employed (see also **12.2 Built-in Membrane Gutters**). The reader is advised to read this Part with consideration to the entire scope of the *Project* design and its construction. Other Standards for Waterproofing *Roof system*s may also apply.

11.1.1 Definitions

Curb

means an elevated box or platform that is supported by the roof structure, is protected from the weather and is used to support or surround building mechanical units, chimney vents, skylights or structural anchor points. The front of a curb is defined as the side facing down the slope; the back of a curb is defined as the side facing up the slope.

11.1.2 Design

1) The design and placement of curbs, for skylights or penetrations, shall be the responsibility of the *Design Authority*.
2) Curbs and penetration flashings are normally supplied or constructed by other trades but must be sealed by the *Contractor*.
3) Curbs
    1) must be constructed to achieve a minimum height of 200 mm (8”) above the surface of the *Finished Roof/Waterproofing Assembly* (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**).
4) A waterproofed gutter membrane around a curb
    1) shall have a minimum slope of 2%, along the up-slope 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.
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 Membrane Flashing

1) Membranes used to flash (strip in) penetrations shall be the same material used for *eave and valley protection*. Refer to **8.2 Materials** (**Part 8 EAVE PROTECTION and UNDERLAYMENT**).

11.2.2 Roof Drains and Overflows

1) Drains and overflows used in membrane gutters may be found in any of the **Waterproofing *Roof systems* Standards**. The reader is advised to consult the relevant standard for design, material and application requirements.

11.2.3 Penetration Flashings

1) Penetration flashings, regardless of their type, must be either
    1) proprietary to, or privately labeled for, the metal panel manufacturer, or
    2) specifically accepted by the ***RoofStar Guarantee Program***.
2) Penetration flashings should be selected for their ability to inhibit the intrusion of vermin and insects into the *roof assembly* and building interior.
3) Mechanical penetration flashings:
    1) Lead plumbing vent flashings must each be
        1) fabricated with sheet lead material weighing no less than 14.65 Kg/m^2 (3lb/sf).
        2) properly sized for the pipe.
        3) supplied with a settlement cap made from the same materials (the inside collar of the settlement cap must fit vertically inside the pipe opening by at least 25 mm (1”)).
    2) All metal penetration flashings (including mechanical exhaust vents but excluding natural airflow vents) must be
        1) manufactured with materials and methods that meet or exceed the requirements set out in *CSA B272, Prefabricated Self-Sealing Roof Vent Flashings*.
        2) permanently marked with the standard number.
        3) tested by an accredited third party to verify compliance with the required Standard.
        4) properly sized for the penetration, both in diameter and height.
        5) watertight and seamless or, in the alternative, fabricated with fully hot-welded joints.
        6) fabricated with a hot-welded or seamless flange at least 100 mm (4") wide, around the bottom of the flashing.
        7) flexible or sloped to suit the roof slope.
        8) fitted with a clamping galvanized storm collar or settlement cap.

        These flashings include, without limitation, galvanized B-vent and polymeric flashings.
4) Natural air flow vents must be
    1) Type B or C ventilators manufactured to conform to or exceed the requirements set out in *CAN3-A93-M82 (R2003*) *Natural Airflow Ventilator for Buildings*.
    2) permanently marked with the standard number.
    3) tested by an accredited third party to verify compliance with the required Standard.

4) fabricated from corrosion-resistant metal (painted or unfinished).
5) manufactured with a base flange that measures
    1) at least 75 mm (3”) wide on the up-slope side of the flashing.
    2) at least 50 mm (2”) along the vertical sides, and along the bottom side of the flashing.

5) Sheet lead flashings must be fabricated with sheet lead material weighing no less than 14.65 Kg/m^2 (3lb/sf).
6) B-vent and plumbing vent flashings must be at least 200 mm (8") in height, measured vertically from the surface of the *Finished Roof/Waterproofing Assembly* to the opening or top of the flashing.
7) Goose-neck flashings must be fabricated to accommodate environmental conditions (wind and snow).
8) Storm collars must be fabricated so that they slope downward approximately 45° from the penetration and are at least 50 mm (2”) wide.
9) Chimney chase caps must be
    1) galvanized metal meeting the material standards for metal flashings in **Part 13**.
    2) fabricated with penetration collars at least 150 mm (6”) in height.
    3) soldered at all joints in the water plane.
    4) fabricated with slope to shed water.

11.3 Application

11.3.1 General

11.3.2 Roof Drains and Drainage

11.3.2.1 General

11.3.2.2 [NOT USED]

11.3.2.3 [NOT USED]

11.3.2.4 [NOT USED]

11.3.2.5 [NOT USED]

11.3.2.6 External Metal Gutters

1) External gutters and downspouts are not covered by the ***RoofStar Guarantee***.
2) Notwithstanding other standards in this Part, when a roof drains onto another roof, the drainage of water must be controlled to eliminate or mitigate damage from water flow. The use of splash pads, when appropriate for the location, is strongly recommended.
3) The use of downspouts, installed by the *Contractor* or other trades and laid directly against the slope of the roof to connect an upper roof drainage to lower gutters, is acceptable under the ***RoofStar Guarantee Program***, provided the material is strongly secured both at the top and the bottom, and the issue of dissimilar metal corrosion can be eliminated.

11.3.3 Penetrations and Vents

1) Membrane protection for 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.
2) Each roof penetration must have its own flashing (except where a purpose-made flashing is designed for multiple penetrations), and must
    1) be suitable for the slope and penetration.
    2) be properly fitted to form or permit a seal around the penetration.

3) incorporate properly fitted settlement caps (where applicable).
4) not be used with multiple pipe roof penetrations.

3) Penetration flashings must be located at least 300 mm (12”) away from any adjacent penetration, upstand, edge or *wall*. The separation space is measured between openings, excluding the flange. (see **ASM 11.1.1 Pipe Flashing** and **ASM 11.1.2 Pipe Flashing, Split Panel**).
4) Any penetrations larger in diameter than 150 mm (6”), and all exhaust flues (B-vents), must be installed on curbs (see **ASM 11.2.1 Curb, Split Panel**).
5) Pipe-type penetrations 150 mm (6”) or smaller in diameter do not have to be installed on curbs but may be flashed with flexible boot flashings for pipe-type penetrations 150 mm (6”) provided
    1) the penetration is fitted with a properly sized and caulked galvanized storm collar.
    2) the flexible boot flashing is
        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 and permits at least 12 mm (1/2”) drainage past the corners.
        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 but when a clamping ring cannot be installed, the top of the flashing must be protected with a caulked galvanized storm collar.
        6) sealed around the penetration joint with a bead of sealant.
    3) the plumbing trade (for new construction only) ensures the
        1) flashing is not distorted.
        2) storm collar is securely fitted and sealed.
6) When a pipe-type penetration extends above the top edge of the roof flashing, the penetration must be fitted with at least one galvanized clamping storm collar; seal the top edge of the collar with an evenly applied, untooled bead of sealant at least 10 mm (3/8”) wide. When a double storm collar is specified, the collars must be approximately 25 mm (1”) apart, and each must be independently sealed.
7) Where a purpose-made flashing does not fit the penetration, the joint between the penetration and the flashing must be sealed using one of the following methods:
    1) Fit a site-formed non-bituminous flexible roof membrane storm collar and secure it to the flashing and penetration with stainless steel clamps.
    2) Apply a shrink-wrapped termination secured with a stainless-steel mechanical compression strap.

    Regardless of the method, sealant must be applied between the penetration and the collar or shrink-wrapping.

8) Chimney chase caps that are included in the scope of roofing work must be
    1) fabricated to meet the requirements set out in **11.2.3 Penetration Flashings**.
    2) fully supported beneath the flashing.
    3) waterproofed beneath the cap flashing with a RoofStar-accepted self-adhered eave protection membrane installed according to the membrane manufacturer’s written instructions (ref. 8.2 Materials).
    4) sealed at the penetration collars with the waterproofing membrane.

11.3.4 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) Skylights
    1) installed on curbs meeting the minimum height requirements (see **11.1.2 Design**) must be waterproofed and flashed in keeping with the Standards for curbs.
    2) with proprietary curbs must, regardless of their height, be sealed to the roof deck following the Standards for penetration and vent flashings.
6) Back pan
    1) membrane protection must extend
        1) at least 100 mm (4”) up the face of the penetration (on insulated assemblies).
        2) to the top inside edge of curbs.
        3) 900 mm (36") up the slope from the curb transition.
        4) onto the field, past the curb at least 150 mm (6”).
    1) Membrane protection be a high-temperature rated membrane.
7) 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.
8) Curbs with a width between 900 mm (36”) and 2400 mm (96”) 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.
9) 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.
10) 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.

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12 OTHER DETAILS

12.1 Snow Guards

1) While snow guards are not part of the roof *system*, they must
    1) not penetrate the metal roof *system*.
    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 *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

12.2.1 Design

2) When a built-in membrane gutter adjoins a RoofStar-guaranteed *Water-shedding System*, the gutter waterproofing must be constructed by the roofing *Contractor* to be included by the ***RoofStar Guarantee***. Built-in membrane gutters that drain a roof not covered by a ***RoofStar Guarantee*** are not eligible for a ***RoofStar Guarantee***.
3) Insulated *Water-shedding Systems* that drain into a built-in gutter must abut solid blocking at the gutter edge that provides
    1) a stop for the insulation assembly.
    2) a solid substrate for the securement of flashings and membranes.
4) The *Design Authority* is responsible to design the gutter for its anticipated capacity, with consideration given to
    1) rainfall and snow load calculations for the building location.
    2) drain type, size and flow rate.
    3) size and placement of the overflow drain.

    For rainfall and snow load capacities, refer to the *British Columbia Building Code, Div. B, Appendix C, Table C-2* which lists various types of loads, including rain and snow loads, for specific reference locations throughout the province.
5) Only fully adhered membranes or acceptable metal gutter liners may be used in built-in gutters.
6) The gutter membrane must be designed to extend up the slope (when measured vertically from the maximum water level)
    1) at least 150 mm (6”).
    2) at least 300 mm (12”) in regions with typical heavy snow.

    or to a point (when measured vertically) at least 600 mm (24”) from the inside face of the exterior *wall* of the building.
7) New gutters shall be designed with a minimum width of 300 mm (12”) and a depth not exceeding the gutter’s width. At least 100 mm (4") clearance on the horizontal plane is required between any gutter *wall* and the
    1) the edge of the drain bowl for spun drains.
    2) the edge of the drain leader for flat spun or welded drains.

    Cast drains must be installed according to the requirements set out in **11.3.2 Roof Drains**.
8) To qualify for a ***RoofStar Guarantee***, existing gutters should be redesigned if their capacity is undersized, but must nevertheless incorporate an overflow drain in keeping with the Standards in this Part. Where the primary drain in an existing gutter is undersized for the capacity of the gutter, the primary drain must be replaced with a properly sized drain.
9) An overflow drain must be located at least
    1) 100 mm (4”) above the primary gutter drain.

2) 25 mm (1”) below any mechanical fasteners used to secure the adjoining *roof assembly*.

10) For transitions between the built-in gutter and steep roof assemblies, refer to **10.3.5.4 Transitions with Waterproofing Systems**.

12.2.2 Materials

NOTE: These material standards are applicable to membrane gutters for all membrane-based waterproofing systems; hence, references to various membrane types.

1) Only EPDM, PVC, TPO, 2-ply modified bituminous membranes or reinforced PMMA are acceptable for this application:
    1) Single-ply non-bituminous membrane thickness must be no less than 60 mils (1.524 mm).
    2) 2-ply bituminous membranes must meet the minimum thickness requirements in **9.2.1 Composition, Thickness and Selection** (**RoofStar Guarantee Standards for SBS Modified Bitumen Systems**).
    3) Reinforced PMMA liquid membrane systems approved for field use, applied on an accepted SBS-modified base membrane.
2) A metal gutter liner may be fabricated from
    1) copper sheet material, incorporating soldered seams.
    2) stainless steel, incorporating welded seams.

See **12.2.3 Application** below.

12.2.3 Application

1) All gutter membranes must be installed according to the membrane manufacturer’s published instructions.
2) Gutter membranes must be
    1) installed perpendicular to the gutter length.
    2) carried up an adjoining *Water-shedding System* (measured vertically from the maximum water level)
        1) at least 150 mm (6”), or
        2) at least 300 mm (12”) in regions with typical heavy snow.
    3) lapped under and sealed to the adjoining membranes at least 150 mm (6”).
    4) installed in keeping with Application requirements in this *Manual*.
3) Gutter membranes must be mechanically secured at their terminations, both on the outside of the gutter edge and on the field. Fasteners securing the membrane on the field must be placed at least 150 mm (6”) above the maximum water level. Securement fastener spacing shall be no more than 300 mm (12”) O.C.
4) Gutter drains and overflows must be installed in keeping with the design requirements outlined in **12.2.1 Design**. Drain flanges that are bent to accommodate the side *wall*s of the gutter must be mechanically fastened to the gutter *wall* before membrane application. Refer to the ***RoofStar Guarantee Standards*** for roof drains in any of the waterproofing *roof assembly* ***Guarantee Standards***.
5) A metal gutter liner
    1) fabricated from copper sheet material must incorporate soldered seams.
    2) fabricated from stainless steel must incorporate welded seams.
    3) must be installed
        1) over an adhered single-ply membrane no less than 2.3 mm (bituminous membranes) or 60 mils (non-bituminous membranes).
        2) with a *separation layer* between the membrane and the metal liner to prevent damage to the membrane caused by the liner at its joints.
6) When an adjoining *Water-shedding System* is insulated (typically ASM only), the transition from gutter to the water-shedding assembly may require the use of tapered insulation incorporating a drainage plane between layers of tapered insulation. See **ASM 12.1.2 Built-in Gutter Assembly** for an illustrated example.

13 METAL FLASHINGS

13.1 General

This section pertains to *Linear Metal Flashings* (different from penetration or ventilation flashings), fabricated from sheet metal in various lengths (segmented) and designed to divert water away from vulnerable surfaces (such as *wall*s), or off the roof into a drainage system. *Linear Metal Flashings* also provide an aesthetic finish to the *roof assembly*. Refer also to **Part 10 PERIMETERS and *WALL*S** and **Part 11 PENETRATIONS, CURBS and DRAINAGE**).

Linear Metal Flashings include, without limitation,

- Eave and rake edge flashing
- Counterflashing
- Head *wall* flashing
- Fascia flashing
- Valley flashing

13.1.1 Definitions

Refer to the **Glossary** for further definitions of key terms used in this *Manual*.

13.1.2 Design

1) The *Design Authority* must specify
    1) metal type, painted finish and gauge (no less than 24-gauge)
    2) seam types (if required).
    3) length of flashings (if different from the ***RoofStar Guarantee Standards*** published in this *Manual*).
    4) method of attachment (concealed or exposed fasteners).
2) Design drawings must detail metal flashing profiles desired for the *Project*.
3) Roof materials that are UV-sensitive must be protected with metal flashings.
4) Where a *Water-shedding System* adjoins a *Waterproofing System*, *Linear Metal Flashings* used at the adjoining details must conform to the standards in **Part 13 METAL FLASHINGS** for the applicable waterproofing system.
5) Where a parapet meets a *Water-shedding System*, the parapet shall be waterproofed in accordance with the ***RoofStar Guarantee Standards*** for the applicable waterproofing system used on the parapet. See also **10.3.6 Junctions with Waterproofing Roof Assemblies**.
6) For linear metal flashings applied to *Waterproofing Systems*, see **Part 13 METAL FLASHINGS** in the relevant Waterproofing Systems standards for roofs.

13.2 Materials

13.2.1 Sheet Metal Grade and Gauge

1) 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 *Linear Metal 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").

2) Where a *Waterproofing System* adjoins and Architectural Sheet Metal System, *Linear Metal Flashings* must be fabricated from 24-gauge steel stock.

13.2.2 Pre-painted Finishes

1) When a painted finish on *Linear Metal Flashings* is specified, only PVDF pre-painted finishes are acceptable. Where a *Waterproofing System* adjoins an Architectural Sheet Metal System, painted adjoining flashings must be finished with PVDF.

13.2.3 Fasteners

1) Fasteners used to secure metal flashings and clips must be compatible with the material they contact.
2) Fasteners must be
   1) specified by the *Design Authority* and appropriately sized, in both length and thread type, for the material to which they will be secured.
   2) corrosion-resistant screws with a low-profile head.
3) Cladding fasteners (screws) with gasketed washers, used as exposed fasteners for metal flashing, must be No. 8 or larger, and must be made of metal compatible with, and corresponding in colour to, 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.

13.2.4 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*

13.3 Application

13.3.1 Fabrication

1) Drip edges are not required, but strongly recommended for flashings around the outside perimeter of a building, in order to protect *wall* finishes, and when drip edges are used they must extend at least 12 mm (1/2”) from the vertical face.
2) All flashings, regardless of their profile or application, must be hemmed.
3) The vertical leg of any metal flashing that overlaps roofing material must be at least 75 mm (3") in height, exclusive of the drip or hemmed edge, when measured between each break.

13.3.2 Securement and Seams

1) Unless otherwise stated in this Standard, all *Linear Metal Flashings* must be secured with hidden clips
    1) fabricated from flat metal stock 24-gauge or heavier.
    2) fastened no more than 75 mm (3") from the return (connecting hook).
    3) that engage the flashing by no less than 12 mm (½").
2) Except for metal valley flashings (see **10.3.5.2.2 Valley Flashings**), *Linear Metal Flashings* may be overlapped rather than seamed. Each overlap must be no less than
    1) 100 mm (4”) when fully caulked in the lap.
    2) 150 mm (6”) when installed without caulking in the lap.
3) Sealants used in exposed locations must be tooled to positively shed water.

14 [Not Used]

END OF STANDARD