

RoofStar Guarantee Standards for Asphalt Shingle 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 font**. 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 October 2018 and is effective December 1, 2019. Therefore, the reader should consider all content to be new since publication. Projects bid after October 30, 2019 must conform to the Standards published in this document.

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 (October 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 (BCBC)* 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

Eave Protection means a self-adhering water-proofing underlayment of a Steep 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.

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.

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 Roof.

1.3 Design Considerations

- 1) Asphalt shingles are intended for roof slopes 1:6 and greater.
- 2) When a roof is designed and constructed so that the resulting roof slope is less than 1:6 (as, for example, dead valleys and the roof areas below a dormer), the roof area must be designed as a Waterproofing Roof Assembly.
- 3) When asphalt shingles drain into a membrane gutter, refer to **12.2 Built-in Membrane Gutters**.

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) Roofs subject to high snow loads must be designed with a supporting deck structure thick enough to support the anticipated live loads, within the acceptable deflection limits defined by the *BCBC*.
- 4) Consideration should be given to
 - 1) slope.
 - 2) entrances and exits.
 - 3) penetrations.
 - 4) valley construction.
 - 5) proper intake and exit ventilation irrespective of snow cover and drifting.
 - 6) penetrations and their functionality.

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 the RPM, 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**.

1.4 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 below in this subsection), knots, distortions or ridges. Roofing over existing shingles is not permitted.
- 2) Existing self-adhered eave protection membrane may be left in place, but must be covered with a new layer of RoofStar-accepted membrane, in keeping with the Standards in this **Manual**.
- 3) New shingles and existing rainwater gutters must be protected from incidental damage including, without limitation, damage caused by ladders.
- 4) Where a new roof is tied-in to an existing roof, the two areas must be isolated and separated by a curb joint properly constructed a minimum height of 125 mm (5"), attached to the structure and properly flashed.
- 5) 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.
- 7) documented in a written fire watch log
- 8) **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**.

1.6 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**. That said, 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 roof system 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 structure.
- 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 roofing 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 **Roofing Practices Manual** in the Accepted Materials Division of this Manual qualify for a **RoofStar Guarantee**.

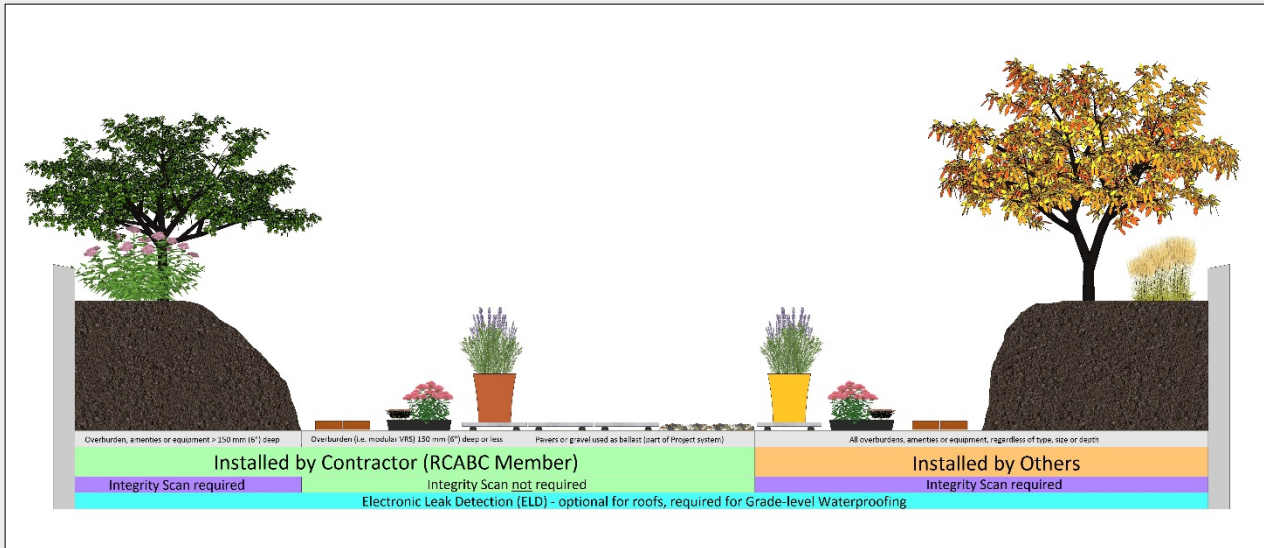
The re-use of any existing material on a Project may void the Guarantee.

- 4) 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 structure.
- 5) 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 materials or by Contractor workmanship.
- 6) Notwithstanding any of the Guarantee requirements in this **Manual**, a **RoofStar Guarantee** will not cover
 - 1) Leaks resulting from
 - 1) improper design.
 - 2) overloading.
 - 3) water entry from other building components (walls, 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
- 7) Overburdens may be installed on conventionally insulated or Protected ("inverted") roofs, but not all designs are suitable for any type, size or depth of Overburden (see **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 conventional roof assembly.
- 8) Only a fully adhered membrane may be used in a *Protected* (PMRA, or "inverted") Waterproofing Project.
- 9) **Integrity Scans:** An Integrity Scan, performed by an RGC-recognized service provider to ensure the waterproofing is leak and damage-free, is required on all Waterproofing roof and grade-level Projects when overburden, amenities or equipment are or will be installed on the completed Waterproofing Assembly by
 - 1) anyone other than the Contractor.
 - 2) the Contractor, when the overburden, amenities or equipment exceed 150 mm (6") in depth.

An Integrity Scan is not required when the Contractor installs overburden, amenities or equipment equal to or less than 150 mm (6") in depth.

See **Figure 1.1** for further reference.

Figure 1.1



- 7) **Electronic Leak Detection** is mandatory for Grade-level Waterproofing Projects, but optional for Waterproofing roofs.
- 8) **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.
- 9) **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 roofing contractor, and is inspected by a RoofStar-accepted inspection firm.
- 10) **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.
- 11) **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, 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
 - 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 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 roof 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 structure (roof 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.

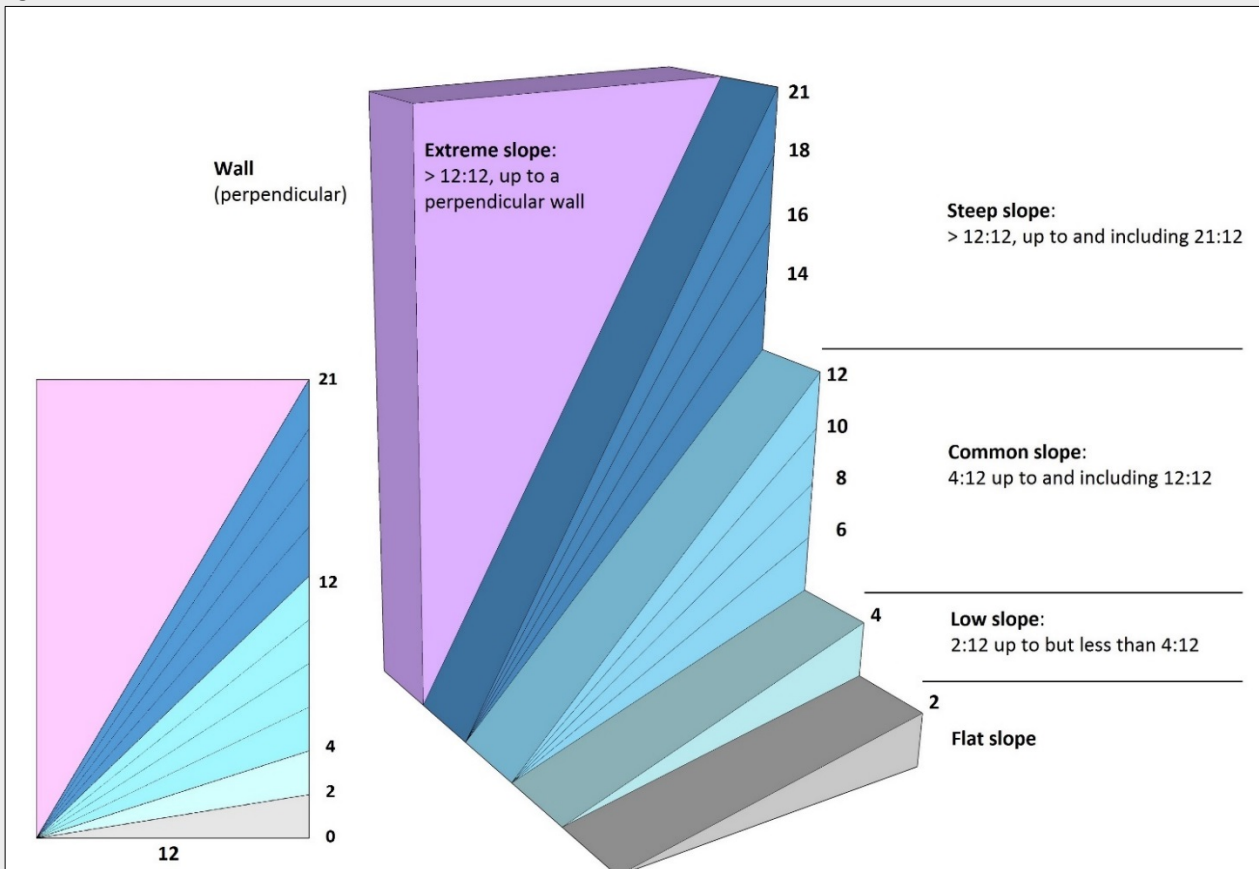
- 4) Walls, parapets, curbs, blocking and penetrations should be constructed or placed prior to the commencement of roofing work. This work is provided by other trades.
- 5) The supporting deck structure should be dimensionally stable and capable of accommodating roof system component movement.

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



2.3 Supporting Deck Types

2.3.1 General

- 1) All supporting decks must provide a suitable nailing substrate for asphalt shingles, and be acceptable to the shingle manufacturer. Suitability includes, without limitation,
 - 1) sufficient thickness for fastener holding.
 - 2) stiffness that minimizes deck deflection.
- 2) 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**.
- 3) Notwithstanding the **RoofStar Guarantee Standards** published in this **Manual**, the **RoofStar Guarantee** does not extend coverage to the supporting roof deck or to its securement, which is the responsibility of the *Design Authority* and the building contractor.
- 4) Prior to the application of the roof system, the supporting deck structure (roof deck) and other surfaces receiving membranes must be smooth, straight, clean and free of
 - 1) moisture.
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If surface drying is required prior to roofing, use blown air to facilitate this.

- 5) 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.
- 6) The supporting deck structure should be dimensionally stable and capable of accommodating roof system component movement.

2.3.2 Wood Decks

2.3.2.1 All Projects

- 1) Wood decks shall be constructed of plywood that is
 - 1) at least 12.7 mm (½") thick.
 - 2) securely fastened to supports with spiral nails at least 50 mm (2") in length.
- 2) All plywood decking (sheathing) must be securely fastened to structural supports with ring-shanked nails having a shank at least 3 mm thick and a head at least 9.5 mm in diameter. Fasteners must penetrate structural material at least 19 mm (¾").
- 3) Oriented Strand Board (OSB) and other non-veneered panels are acceptable deck materials, but the *Design Authority* is responsible to determine the grade and thickness in order to meet the required pull-out resistance for the expected fasteners.
- 4) Shiplap and dimensional lumber are not acceptable deck materials.
- 5) Knotholes and cracks in decks shall be considered defects and must be covered with sheet metal nailed in place.

2.3.2.2 Replacement Roofing

- 1) Plywood used as an overlay on existing roof decks must be at least 12.7 mm (1/2") thick and must conform to CSA 0151-04, Canadian Softwood Plywood, Grade C or better; or CSA 0121-M 1978 (R2003) Douglas Fir Plywood, Grade C or better.
- 2) When an existing roof deck is
 - 1) less than 12.7 mm (1/2") thick, or is constructed of shiplap or dimensional lumber, it must be overlaid with new plywood that
 - 1) is properly secured to structural supports.
 - 2) provides sufficient material depth for fastener penetration.
 - 2) constructed with damaged or excessively cupped shiplap or dimensional lumber (excessive cupping is considered 25 mm (1") or more when measured against the mid-span deflection of the deck), the damaged or distorted material must be removed and replaced with new material.

See also **5 DECK and WALL OVERLAYS**.

- 3) When cedar or tiles, supported by spaced strapping or board decks (plank, mill, or shiplap), are replaced with asphalt shingles,
 - 1) the existing strapping or decking must be overlaid with plywood
 - 1) conforming to the Standards in this *Manual*.
 - 2) oriented either horizontally or vertically, unless otherwise required by the AHJ.
 - 3) staggered at least 400 mm (16"), or in conformity with truss or rafter spacing.
 - 4) spaced no less than 2 mm (3/32") between panels, on all sides.
 - 5) supported fully by the strapping along the long edges of the plywood.
 - 2) plywood deck overlays must be secured in keeping with the BCBC (Div. B, 9.23), but in any event shall not be less than 23 fasteners
 - 1) spaced no more than 150 mm (6") O.C. along the edge.
 - 2) spaced no more than 300 mm (12") O.C. in the field.
 - 3) clearance to all "hot" pipes must conform to the requirements set out in the *BCBC*.

2.3.3 Steel Decks

- 1) Steel decks are not suitable for asphalt shingle application and therefore must be overlaid with a sub-deck that permits ventilation below the sub-deck. Sub-deck sheathing must meet the minimum requirements for wood decks (See **2.2.1 Wood Decks**).

2.4 [NOT USED]

2.5 [NOT USED]

2.6 Walls

- 1) Where self-adhering underlayments must be carried up intersecting walls, the substrate must be of a suitable type, and in an acceptable condition, to receive the membrane. Unsuitable substrates must be covered with an acceptable substrate or otherwise rendered in a condition acceptable to the **RoofStar Guarantee Program**.

2.7 Electrical Cables and Boxes

Electrical cables (including conduit) or boxes installed inside, on top of, or beneath a roof assembly expose roofing workers to electrical shock, and may inhibit the installation of some roof systems 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

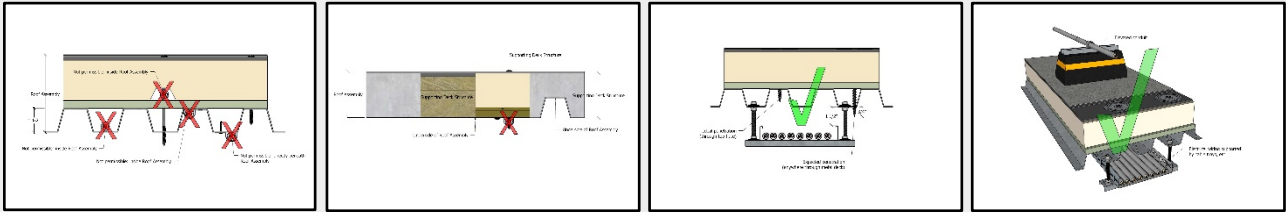
- 1) Electrical cables, raceways or boxes shall not be installed within a roof assembly (**Figure 2.7.1-1**).
- 2) Electrical cables, raceways or boxes shall not be installed on the underside of a roof assembly, unless
 - 1) the supporting deck structure equals or exceeds 76 mm (3") in thickness (**Figure 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 2.7.1-4**)

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 **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

- 1) Shingles shall be installed to resist wind, in conformity with CSA A123.51, or as specified by the shingle manufacturer, whichever requirement is greater.

3.2 Materials

3.2.2 Fasteners and Adhesives

The following minimum standards apply to any roof assembly, regardless of requirements published elsewhere.

- 1) Fasteners and adhesives must be capable of securing the roof assembly components to resist uplifting wind loads.
- 2) *The Design Authority should specify the correct type of fastener, keeping in mind*
 - 1) pull-out strength.
 - 2) corrosion resistance (contributing factors to fastener corrosion may include dissimilar metal contact, excessive building humidity, corrosive chemicals within components of the assembly, or corrosive elements provided within the building envelope etc.).
- 3) Nails (gunnable or hand-driven) for field and hip and ridge shingles must be
 - 1) manufactured in conformity to CSA B111.
 - 2) corrosion resistant (hot-dipped or stainless steel).
 - 3) at least 2 mm (12 Ga.) thick in the shank, with large 9.5 mm (3/8") heads.
 - 4) of sufficient length to penetrate through, or at least 19 mm (3/4") into, the roof deck (sheathing).
- 4) Staples may not be used to secure asphalt shingles.
- 5) Cladding Screws must be
 - 1) No. 8 (1/8") gauge or larger.
 - 2) fitted with a rubber gasket.
 - 3) compatible with, and corresponding in colour to, metal flashing material.
- 6) When the roof system incorporates an insulation assembly on the exterior side of the supporting deck structure, self-drilling screws with recessed heads must be used in combination with plates as follows:

Table 3.1 Minimum Fastener and Plate Requirements

Material	Fastener Size	Plate
Deck overlays	#12	73 mm (2-7/8") Hexagonal, 76 mm (3") Round or Square
Insulation	#12	73 mm (2-7/8") Hexagonal, 76 mm (3") Round or Square
Insulation Overlays	#12	73 mm (2-7/8") Hexagonal, 76 mm (3") Round or Square
Membranes	#14	Proprietary

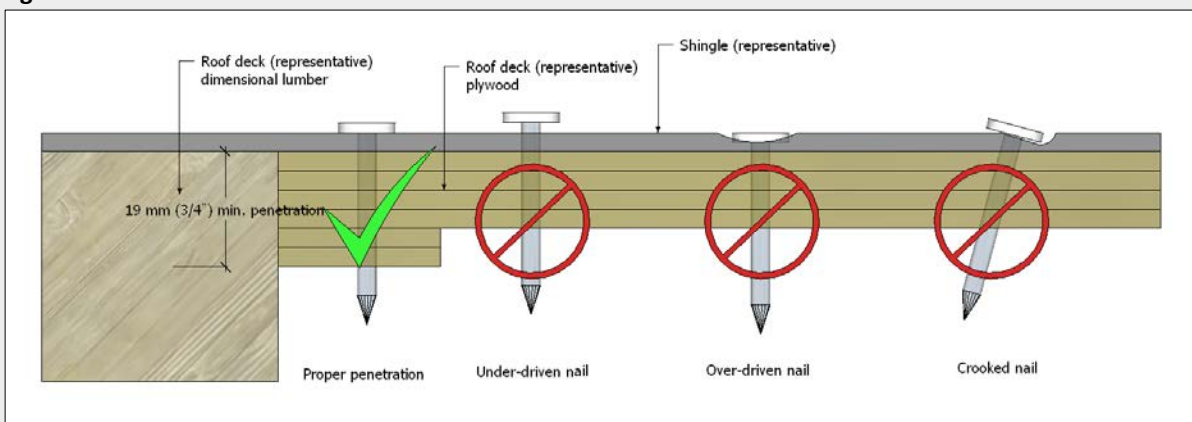
- 7) For adhered and partially adhered assemblies, adhesives must be acceptable to the manufacturers of the roof assembly components.
- 8) Bitumen is not typically used as an adhesive for insulation and other components on water-shedding roofs, but if it is specified, it must be Type 3 or SEBS. Pay attention to the slope limitations specified by the manufacturer of the product.

3.3 Application

- 1) Mechanically fastened underlayments must be installed with fasteners approved by the product manufacturer.
- 2) All asphalt shingles must be nailed within the shingle manufacturer's designated fastening zone or line. Nailing outside of the fastening zone or line is not permitted. See also **9.3.1 General** for asphalt shingle securement requirements.
- 3) Nail penetration into or through the deck must be at least 19 mm ($\frac{3}{4}$ ") when measured from the top face of the deck.
- 4) Only nails driven perpendicular to the shingle and supporting deck surface shall be deemed acceptable.
- 5) Nails must be driven
 - 1) perpendicular to the surface of the deck, and must not be under-driven, over-driven or crookedly driven.
 - 2) into or through the deck at least 19 mm ($\frac{3}{4}$ ") when measured from the top face of the deck.

See **Figure 3.1**.

Figure 3.1



- 6) When threaded fasteners are used to secure another material to a substrate, mechanical fasteners must penetrate
 - 1) steel decks at least 20 mm ($\frac{3}{4}$ ") – fasteners should penetrate the top flutes only.
 - 2) into solid dimensional lumber by at least 25 mm (1").
 - 3) through plywood sheathing by at least 19 mm ($\frac{3}{4}$ ").

These Standards may be exceeded by the fastener manufacturer's published requirements.

- 7) On **Low Slopes** and **Common Slopes** (up to 1:1 (12" in 12")), at least four (4) nails for each full shingle shall be used.
- 8) On **Steep Slopes** (1:1 (12" in 12") up to and including 21:12), at least 6 nails for each full shingle shall be used.
- 9) Notwithstanding any nailing patterns specifically accepted by the **RoofStar Guarantee Program**, shingles installed on **Extreme Slopes** (slopes greater than 21:12) shall be
 - 1) fastened with at least 6 nails per full shingle shall be used, consisting of 1 nail at each end of the shingle and double nails at each third point.
 - 2) manually cemented in place underneath each tab, immediately after installation, using a spot of asphalt plastic cement approximately 22 mm in diameter that is located at the centre of each shingle tab. This may be exceeded by manufacturer's requirements.
- 10) When partial shingles (segments), ridge or hip caps are installed, each shall be fastened
 - 1) with at least two (2) nails set in from either edge by 25 mm (1").
 - 2) with nails set no more than

- 1) 325 mm (13") apart, when installed on slopes up to and including 1:1 (12" in 12").
 - 2) 200 mm (8") apart when installed on slopes greater than 1:1 (12" in 12").
-

4 MATERIALS

4.1 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 come in contact with each other. The size of fasteners shall be determined by the *Design Authority*.
 - 5) Notwithstanding the foregoing, asphalt shingles must conform to *CSA A123.5*.
 - 6) Roofing Cement must be asphalt-base conforming to *CGSB 37-GP-5Ma*.
 - 7) Lap cement must conform to *CGSB 37-GP 4M*.
-

5 DECK and WALL OVERLAYS

5.1 General

5.1.1 Design

- 1) A roof deck overlay is installed as part of the Roof Assembly, on the top surface of the roof deck but beneath the roofing materials. On roofs covered with asphalt shingles, the most common deck overlay is plywood, installed to provide a suitable nailable surface for shingles; it often is installed over decks that are rough, uneven or gapped. Roof deck overlay materials may also be applied to other types of supporting deck structures, depending on the roof design criteria.
- 2) Wall overlays are less common on Projects using asphalt shingles, but may be required to provide a suitable surface for self-adhering membrane flashing.
- 3) For roof assemblies designed above a vaulted conditioned space, see also **6.1.3.2 Ventilation**.

5.2 Materials

- 1) Deck and wall overlays must be suitable for, and compatible with, any membrane or panel application. Plywood, measuring at least 12.5 mm (1/2") in thickness, is acceptable as a deck or wall overlay.
- 2) Walls that require resurfacing for membrane application must be covered with an accepted wall overlay. See [Accepted Wall Overlays](#).

5.3 Application

5.3.1 General

- 1) Deck overlays must be
 - 1) of sufficient thickness to allow full penetration of shingle fasteners.
 - 2) installed over any deck that is not suitable as a substrate for asphalt shingles (see **2 SUPPORTING STRUCTURES: Decks and Walls**).
 - 3) 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.
 - 4) independently fastened to the supporting deck.
- 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) Steel decks are not suitable for asphalt shingle application and therefore must be overlaid with a sub-deck that permits ventilation below the sub-deck. See also **2.2.1 Wood Decks** and **2.2.2 Steel Decks**.

5.3.3 Wood Decks

- 1) A mechanically-fastened overlay is required for any deck structure that does not meet the criteria for a suitable deck surface set out in **2.2.1 Wood Decks**. Wood deck overlays must be securely fastened with ring-shanked nails having a shank at least 3 mm thick and a head at least 9.5 mm in diameter. Fasteners must penetrate structural material at least 19 mm (3/4").

5.3.5 Walls

- 1) Where the wall surface is unsuitable to receive a membrane, it must be covered with an accepted overlay material.
- 2) Wall overlays must be
 - 1) mechanically fastened with screw fasteners placed

- 1) at the perimeters.
 - 2) at the corners.
 - 3) in the field, spaced no less than 300 mm (12") O.C. vertically and horizontally, or in alignment with structural supports of the overlay panels.
- 2) adhered with a polyurethane adhesive, applied with a continuous z-patterned ribbon spaced no less than 300 mm (12") apart, in alignment with structural supports.
-

6 AIR, VAPOUR and VENTILATION CONTROL

NOTE: See more information on [Air and Vapour Control](#) in Section 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 systems is essential to the satisfactory performance of either or both. Therefore, proper connection between air and vapour control systems is essential, and the responsibility of both the *Design Authority* and trades constructing walls and roofs.

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

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

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

6.1.2 Limitations and Exclusions

- 1) Air and vapour control layer performance is not part of the **RoofStar Guarantee**, and air and vapour control materials are not listed in the Accepted Materials section of this **Manual**. Therefore, the decision to specify air and vapour control layers, the placement of continuous air and vapour control layers in relation to a roof assembly and its components, and the selection of suitable materials for that application, is the sole responsibility of the *Design Authority*. **The Design Authority is urged to review and consider the performance characteristics of materials available for such applications.**
- 2) Neither the **RoofStar Guarantee Program** nor the roofing contractor will accept any responsibility for damage to, or failure of, the roof system caused by the use or absence of air or vapour control layers.

- 3) In some roof assembly designs, the required underlayment may serve as an air control layer, vapour control layer, or both; this is dependent upon the properties of the material to be used and will be subject to the designer's modelling of the assembly. Consult the Technical Data Sheets for suitable materials.

6.1.3 Design

6.1.3.1 Air and Vapour Control for High-Humidity Building Interiors

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

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

6.1.3.2 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 *BC 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 of this **Manual**.

- 3) Continuous proprietary 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 6.2.3 below. Therefore, while responsibility for the selection of suitable air and vapour control layers rests with the *Design Authority*, a roof designed and built to qualify for a **RoofStar Guarantee** shall not include either polyethylene sheet plastic or bitumen-impregnated kraft paper.
- 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 is 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 roofing 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) acceptable to the shingle manufacturer.
 - 2) internally reinforced to provide support for shingle caps.
 - 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 roofing contractor. Therefore, air and vapour control layers in the roof assembly must
 - 1) extend beyond the end of the roof assembly at least 100 mm (4"), in new construction, to provide sufficient room for the installation of matching control layers to so that they provide a positive (water-shedding) lap seal union between courses of material.
 - 2) be sealed to matching control layers in the wall assembly, for roof replacement *Projects*.
- 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.
- 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 over combustible materials, all joints between overlay panels, and at wall transitions, must be sealed with the primary membrane manufacturer's approved self-adhered membrane or tapes. Refer to the hot works requirements 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 steep roof assemblies 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 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 **Manual**.

7.1.2 Design

- 1) Consult the Building Code having jurisdiction for the minimum required thermal resistance of the roof assembly.
- 2) Insulation compressive strength, when applicable, must be taken into consideration by the structural engineer.
- 3) 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.
- 4) 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.
- 5) **Only heat-resistant insulation is recommended for use in an insulated, ventilated roof assembly covered with asphalt shingles. When heat-sensitive insulation is desirable, the Design Authority should calculate the anticipated maximum temperature for the upper surface of the insulation assembly and ensure the insulation material's service temperature is suitable for the design.**
- 6) Insulation assemblies with a cumulative thermal resistance greater than RSI-2.64 (R-15) (based on published values measured at 24°C) must be installed in multiple layers that are offset and staggered (see **7.3 Application**). Within that multi-layered assembly, any single layer of insulation may have a thermal resistance greater than RSI-2.64 (R-15) provided no one layer exceeds 60% of the cumulative thermal resistance of the combined assembly of insulation and insulation overlay boards.

7.2 Materials

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

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

7.3 Application

7.3.1 Layering

- 1) See **7.1.2 (6)** above.
- 2) Insulation joints must be offset or staggered at least 300 mm (12") from adjacent layers and rows.
- 3) Only thermally non-conductive clips or bars passing through the insulation assembly, or mechanically fastened bearing plates, may be used to secure and support insulation panels, or provide support for panel clips.

7.3.2 Alignment, Sizing and Support

- 1) Insulation boards must be
 - 1) firmly supported.
 - 2) 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) offset at least 300 mm (12"), both for adjacent layers and for adjacent rows.

7.3.3 Securement

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

8 EAVE PROTECTION and UNDERLAYMENT

8.1 General

8.1.1 Definitions

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

Underlayment, sometimes referred to as *Waterproof Shingle Underlayment (WSU)*, means a roll material that is either self-adhering or mechanically fastened (typically with large head nails), and which

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

See the [Glossary](#) for other terms used in this Section.

8.1.2 Design

- 1) Eave protection is required on all **Common Slope**, **Steep Slope** and **Extreme Slope** roofs, but is not required
 - 1) over unheated spaces.
 - 2) where the roof overhang exceeds 915 mm (3') measured along the roof slope from the edge of the roof to the inner face of the exterior wall.
- 2) An underlayment is required
 - 1) beneath all water-shedding roof materials, irrespective of slope.
 - 2) on vertical surfaces where roofing materials and flashings adjoin walls or curbs.
 - 3) beneath all penetration flashings.
- 3) When the roof slope is less than 1:3, the underlayment over the entire roof – in the field, on vertical surfaces and beneath all penetrations – must be self-adhering. See **8.2.1 Eave Protection and Underlayments** for material requirements.
- 4) **In all applications, a non-adhering roof field underlayment may be specified as a separation layer over any self-adhering membrane (used as eave and rake protection, or as a full underlayment on Low Slope or Flat Roofs), to separate the shingles from the membrane and thus prohibit bonding of the two. This approach may simplify future shingle replacement, as a result, spare the supporting deck structure from damage during tear-off.**
- 5) Metal flashings along the eave and rake (gable) edges are required on all Projects and must be separated from direct contact with wood surfaces. See also **10 PERIMETERS and WALLS**, and **13 METAL FLASHINGS**.

8.2 Materials

8.2.1 Eave Protection and Underlayments

For materials acceptable under the **RoofStar Guarantee Program**, see [Eave Protection & Underlayment](#).

- 1) Eave Protection must be
 - 1) self-adhering.
 - 2) have a sanded or synthetic, non-bonding top surface.
 - 3) at least **1.4 mm thick or, in the alternative, another RGC-accepted eave protection membrane supported in writing by the asphalt shingle manufacturer. Written confirmation from the manufacturer must be submitted to the Guarantor as part of the project documentation.**
- 2) Underlayments may include any of the following:
 - 1) At least one ply of 15 lb. non-perforated asphalt saturated felt conforming to *CSA A123.3 M1979* and / or *ASTM D226-95*, and as acceptable under the **RoofStar Guarantee Program** (see [Eave Protection & Underlayment](#) for shingle roofing).

- 2) RoofStar-accepted synthetic underlayment.
- 3) RoofStar-accepted self-adhering membranes with a minimum thickness **as described in 8.2.1.1 above**, for roof slopes less than 1:3 (4" in 12"). Alternatively, multiple layers of a thinner membrane may be used, but must be installed with offset vertical and horizontal seams.
- 3) **Because synthetic and fully adhered membranes vary in vapour permeability, consult the manufacturer's specifications and ventilation requirements of the British Columbia Building Code.**

8.2.2 Fasteners

- 1) While mechanical fasteners used to secure underlayments must conform to the underlayment manufacturer's requirements, the use of staples is not permitted.

8.2.3 Metal Flashings

- 1) See **13 METAL FLASHINGS**

8.3 Application

8.3.1 Eave Protection

8.3.1.1 General

- 1) Eave protection is required on all **Common Slope, Steep Slope** and **Extreme Slope** roofs, but is not required
 - 1) over unheated spaces.
 - 2) where the roof overhang exceeds 915 mm (3') measured along the roof slope from the edge of the roof to the inner face of the exterior wall.
- 2) Self-adhering eave protection is required irrespective of roof slope, and must
 - 1) overhang the fascia by at least 25 mm (1").
 - 2) extend up the slope to a point, when measured vertically from the inner face of an exterior wall,
 - 1) at least 915 mm (3'), or to a point at least 300 mm (12"), whichever is greater.
 - 2) **at least 600 mm (24"), in regions with heavy snow.**
 - 3) extend up all abutments (walls, skylights, etc.) at least 150 mm (6") above the finished roof surface.
- 3) Horizontal runs of eave protection must be positively lapped at least 50 mm (2") and end laps (vertical joints) must be at least 150 mm (6").

8.3.2 Underlayment

8.3.2.1 General

- 1) An underlayment must be installed
 - 1) 'shingle fashion' and fastened
 - 1) according to the manufacturer's published instructions, using acceptable fasteners.
 - 2) with roofing nails (in the absence of other instructions).
 - 2) parallel to the eave, and each course of underlayment must positively overlap adjacent material by
 - 1) at least 75 mm (3") along the sides, unless exceeded by the manufacturer's instructions.
 - 2) at least 150 mm (6") at the ends, unless exceeded by the manufacturer's instructions.
 - 3) beneath all water-shedding roof materials, irrespective of slope.
 - 4) beneath all perimeter flashings.
 - 5) beneath all penetration flashings.
 - 6) on vertical surfaces where roofing materials and flashings adjoin walls or curbs, at least 150 mm (6") above the roof deck.
- 2) When the roof slope is less than 1:3, the underlayment over the entire roof – in the field, on vertical surfaces and beneath all penetrations – must be self-adhering. See **8.2.1 Eave Protection and Underlayments** for material requirements.

- 3) Where negative (backward) laps are unavoidable, only a RoofStar-accepted 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.
- 4) Organic felt underlays and asphalt shingles must be applied on the same day. **To prevent wrinkling, let felt relax before installing.**
- 5) **To prevent shingles from bonding to self-adhering membranes, and simplify future roof replacement, a non-bonding underlayment may be used as a separation layer between the shingles and the membrane.**

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 1.7 mm in thickness; the second layer must be offset from the first by at least 300 mm (12"), both horizontally and vertically.
-

9 FIELD SHINGLES

9.1 General

- 1) The Standards published in this Part, and in those that follow, reflect the level of attention to design and application required by the designed slope of the roof. Shingles are water-shedding materials, and low slopes may affect the flow of water, necessitating more rigorous requirements to keep water from reaching the supporting deck structure and the conditioned space of the building.

9.2 Materials

- 1) All asphalt shingles shall be manufactured in compliance with the material standards found in *CSA A123.5*, and shall in any event
 - 1) be reinforced with fibreglass or an accepted composite reinforcement scrim and shall not be manufactured with organic materials.
 - 2) clearly mark the fastening zone or line, which must be centered on the common bond area.
 - 3) provide discontinuous adhesive strips on the bottom face of the shingle's exposure, manufactured from SEBS or an accepted material deemed equivalent or better by the **RoofStar Guarantee Program**, and free of any trails that would trap or impede the flow of water beneath the shingle.
- 2) Starter shingles or rolls must be acceptable to the field shingle manufacturer.

9.2.1 Shingles for Low Slope Roofs

- 1) Shingles must be
 - 1) expressly manufactured and accepted for application on Low Slope roofs.
 - 2) manufactured to *CSA A123.5* for fibreglass felt shingles with a minimum mass of 10.50 kg per m² (215 lb per 100 sf).

9.3 Application

9.3.1 General

- 1) See Part **3 SECURING the ROOF ASSEMBLY** for field shingle nailing requirements.
- 2) Asphalt Shingles shall be installed to *CSA-A123.51 Asphalt shingle application on roof slopes 1:6 and steeper*.
- 3) Shingles shall be kept inside the manufacturer's packaging until the time of application and must be free of damage or contamination on the sealing strips.
- 4) A starter strip or strip-type shingle is required at the eaves and rake (gable) edges, below the first course of shingles and must be installed
 - 1) flush with the edges of the underlayment.
 - 2) onto the valley metal and membrane flashings.
 - 3) with no fewer than four (4) nails (see fastening requirements in **3.3 Application**).
- 5) Each course of shingles following the first course shall be installed so that
 - 1) all vertical and horizontal lines running true, or follow a random pattern as directed by the manufacturer's printed instructions.
 - 2) shingles extend beyond (whichever is greater)
 - 1) the eaves or a fascia board approximately 37 mm (1 ½"), to lead water into eaves troughs.
 - 2) The rake (gable) flashings by approximately 12 mm (1/2").
 - 3) exposure and nailing patterns conform to the manufacturer's printed product-specific instructions.
- 6) Each succeeding course of shingles must offset according to the shingle manufacturer's published instructions, but in any even shall not be less than 125 mm (5"). Notwithstanding this requirement,
 - 1) shingle segments used to cover rafter tails shall not be bound by minimum width requirements but must be centred on the rafter tail and overlap its edges by at least 12 mm (1/2").

- 2) shingle segments used around penetration flashings and vents, or adjacent to valleys, must not be less than 200 mm (8") in width.
- 7) So-called "Dutch laps" are not permitted.
- 8) When shingles are installed in cooler temperatures (typically below 10° C), shingles must be
 - 1) hand-sealed with a shingle cement/adhesive acceptable to the shingle manufacturer.
 - 2) fastened with additional nails, as specified by the manufacturer.
- 9) When roofing work is complete, the Contractor must remove all temporary fall protection fittings and equipment.
- 10) If permanent fall protection anchor points are desirable, they must be specifically required and allocated by the *Design Authority* and incorporated into the roof design.

9.3.2 Low Slope Roofs

- 1) Shingles may not be installed on Low Slope roofs unless expressly permitted by the shingle manufacturer.
- 2) Shingles on **Low Slope** roofs must be installed over a self-adhering membrane or multi-layered membrane. See **8.3.2.2 Low Slope Roofs** for application requirements.

9.3.3 Changes in Slope

- 1) When the field roof slope changes more than 1:6 (2" in 12"), the transition in slope must be made to the following standards:
 - 1) Underlayment for the lower roof area must be brought up onto the upper roof deck at least 200 mm (8") but must extend past the top edge of the metal transition flashing by at least 50 mm (2").
 - 2) The lower roof shingles must be terminated at the slope transition line.
 - 3) A metal transition flashing is required and must be
 - 1) broken (bent) to
 - 1) bridge the transition.
 - 2) exert pressure on the lower slope shingles.
 - 2) installed over the underlayment.
 - 3) secured to the upper slope with mechanical fasteners set in from the edge of the flashing 25 mm (1") and spaced no more than 300 mm (12") O.C.
 - 4) lapped over the shingles on the lower slope at least 100 mm (4"); **a hidden cleat used to secure the lower edge of the metal flashing is recommended but not required.**
 - 4) When the angle between slopes is less than 180° (when the lower roof plane slope is less than the slope of the upper roof plane), a self-adhering membrane strip is required to overlap the upper edge of the metal flashing by at least 50 mm (2"); the membrane must extend up-slope at least 50 mm (2") past the bottom layer of underlayment and be sealed to the roof deck.
 - 5) Shingles installed on the upper slope must be started and installed as a new slope, in keeping with the Standards in this **Manual**.

See **Figure 9.1** and **Figure 9.2**. (next page)

Figure 9.1

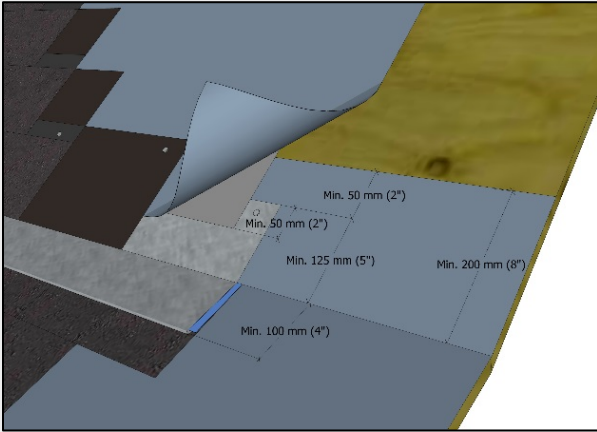
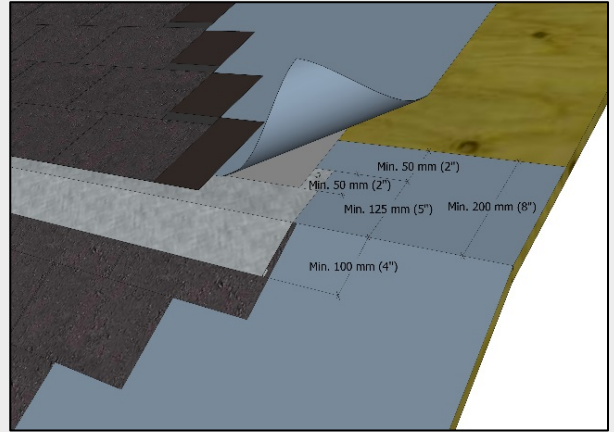


Figure 9.2



10 PERIMETERS and WALLS

10.1 General

10.1.1 Definitions

Valley means the concave angle formed by the intersection of sloping roof planes.

See the [Glossary](#) for other terms used in this **Manual**.

10.1.2 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) Metal flashings must be
 - 1) installed along all eave and rake (gable) edges, and
 - 1) extend at least 50 mm (2") onto the roof deck.
 - 2) be securely fastened to the deck with acceptable nails placed no more than 400 mm (16") O.C.
 - 2) separated from a wood substrate with self-adhered eave protection membrane or mechanically fastened underlayment.
- 3) Fascia may be covered with metal flashing and specified as part of the roof assembly.
- 4) The weathering surface of shingles must be protected from damage during the life of the roof, including damage by funneled water. Therefore, the roof design must incorporate methods for managing the flow of water from one roof surface to another.
- 5) Where a **Steep Slope** roof plane drains onto a **Common Slope** or **Low Slope** roof, the valley metal flashing must be fashioned with double inverted "V" dividers. Refer to **Figure 13.3** for valley flashing requirements.
- 6) Diverter flashings
 - 1) must be used at the bottom end of a wall that intersects a roof parallel to the slope. See **10.3.1 General (Application)** for specific requirements.
 - 2) are not mandatory at rake edges (gable ends) but are recommended to direct water away from barge rafters and exposed fascia tails, and to direct water into gutters.
- 7) Metal valleys must be used for laminate, interlocking and **Low Slope** shingle applications, and in any event are recommended for all roof designs.
- 8) Step flashings must be used to flash roof transitions with walls, parapets or curbs ranging from 90° to 120°, when measured on the face of the slope from the eave edge.
- 9) A back-pan flashing must be used when a wall, parapet or curb intersects the roof plane at 120° or more, measured on the face of the slope from the eave edge.
- 10) A head-wall flashing must be used only at the top of a sloped roof, where a wall, parapet or curb intersects the roof perpendicular to the slope or at an angle to the slope not exceeding 45° down. The flashing must be inserted behind the wall finish and extending over the top course of shingles at least 100 mm (4"). See also **10.3.5.1 Eave, Rake (Gables) and Wall Flashings**.
- 11) An apron flashing must be used at the bottom of a curb or chimney.
- 12) When a wall at the top of a slope changes plane at the corner, the corner must be flashed with a headwall flashing fashioned to turn up the slope.
- 13) Dead valleys should be avoided, but when a roof slope terminates in a dead valley, the design must conform to the Application standards in **10.3.5.2.5**.
- 14) Ridge vents may be used only on horizontal ridges. For ventilation of hip roofs, refer to **6.1.3.2 Attic Ventilation**.

10.2 Materials

10.2.1 General

- 1) Starter shingles or rolls must be acceptable to the field shingle manufacturer.
- 2) Caps used on hips and ridges must be acceptable to the field asphalt shingle manufacturer and be of the same material as the shingles.
- 3) Membranes used to flash transitions with walls, parapets or curbs must meet the Standards found in **8.2.1 Eave Protection and Underlayment**.
- 4) Membranes used in built-in gutters or dead valleys must meet the Standards found in **12.2.2 Materials**.

10.2.3 Fasteners

- 1) All fasteners must be compatible with the materials they will contact, including all metal flashings.
- 2) Cladding Screws: Minimum No. 8 ($\frac{1}{8}$ " gauge with rubber gasket grommet or washer made of metal compatible and corresponding in colour to metal flashing material.
- 3) Ridge cap fasteners must be at least 44 mm ($1\frac{3}{4}$ ") long but must nevertheless be long enough to penetrate the roof deck by at least 19 mm ($\frac{3}{4}$ ").

10.2.4 Sealants

- 1) See **13.2.4 Sealants**.

10.3 Application

10.3.1 General

- 1) The Standards in this Part may not include every possible detail the Contractor will encounter, but every installation must be executed in keeping with the following:
 - 1) Every transition in plane must be flashed (under-laid) with a non-adhering underlayment or a self-adhering membrane; the choice is slope-dependent and at the discretion of the *Design Authority*, but in any event is subject to the Standards prescribed in **Part 8**.
 - 2) The underlayment below shingles, regardless of its type, serves as the final water barrier above the roof deck.
 - 3) All materials must be installed in overlapping layers that positively shed water to a lower surface; asphalt shingles must be installed to provide double coverage.
 - 4) Materials must be secured in accordance with various Parts in this Standard.
 - 5) Water must be allowed to flow freely off the roof.
 - 6) Nails must never be exposed to water.
- 2) See Part **3 SECURING the ROOF ASSEMBLY** for shingle nailing requirements.
- 3) Metal flashings must be
 - 1) installed along all eave and rake (gable) edges, and
 - 1) extend at least 50 mm (2") onto the roof deck.
 - 2) be securely fastened to the deck with acceptable nails placed no more than 400 mm (16") O.C.
 - 2) installed at every intersection with a wall.
 - 3) separated from all substrates with self-adhered eave protection membrane or mechanically fastened underlayment.
- 4) A starter course is
 - 1) required at all eaves.
 - 2) **recommended at rake (gable) edges.**
- 5) **In valleys and at eave and rake edges, extend the underlayment over the self-adhering membrane to keep shingles from bonding to the membrane.**

- 6) When rafter tails or barge rafters extend past the eave edge and are flush with the roof deck, they should be protected
 - 1) with shingles.
 - 2) a metal cap flashing that is
 - 1) fabricated with drip edges along all three sides and a flange extending onto the roof deck surface.
 - 2) secured with at least two (2) fasteners.
- 7) Fascia flashings, when specified, must be fastened on the vertical face no more than 600 mm (24") O.C. in a staggered pattern; fasteners must be placed at least 25 mm (1") from top edge of the fascia.

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, Rake (Gable) and Wall Flashings

- 1) See **13.3.1 Fabrication** for metal flashing requirements. See also **13.3.2 Securement and Seams** for seaming requirements.
- 2) Eaves must be constructed to the following Standards:
 - 1) Metal flashing is required on all Projects.
 - 2) Eave protection or metal flashing underlayment must overhang eave fascia at least 25 mm (1"), to direct water into gutters. See also **8.3.1 Eave Protection**.
 - 3) Eave metal flashing must be installed
 - 1) above a separation layer.
 - 2) below the eave protection layer.
 - 3) so that the flashing extends at least 12 mm (1/2") past the edge of the supporting deck structure, to accommodate gutter hangars (for existing or specified gutters).
 - 4) with nails driven through the flashing leg into the roof deck no more than 400 mm (16") O.C.
 - 4) All types of shingles installed on **Common Slope** and **Steep Slope** roofs must
 - 1) be installed with a starter course along the eaves.
 - 2) overhang the fascia approximately 37 mm (1 1/2"), **or with sufficient overhang to lead water into exposed eaves trough. Extend the overhang further for Low Slope roofs.**
- 3) Rake (gable) edges must be constructed to the following Standards:
 - 1) continuous metal flashings must be installed
 - 1) above a separation layer.
 - 2) with nails driven through the flashing leg into the roof deck no more than 400 mm (16") O.C.
 - 2) Asphalt shingles must be installed so that they overlap a rake (gable) edge by at least 12 mm (1/2"), unless exceeded by the manufacturer's published requirements.
 - 3) Shingles installed on low slopes must be sealed in a bed of compatible mastic at all rake edges.
- 4) Step flashings connecting the roof to a wall must be constructed to the following Standards:
 - 1) Only new step flashings are permitted (cloning is not allowed), and step flashings shall
 - 1) extend at least

- 1) 125 mm (5") up vertical surfaces behind wall control layers (e.g. water, vapour, air) or a counterflashing (where used).
 - 2) 100 mm (4") horizontally between courses of roofing.
 - 2) have a 75 mm (3") head-lap above the shingle exposure.
 - 3) be placed flush with the butt edge (bottom) of each asphalt shingle course.
 - 4) fastened with nails located 50 mm (2") down from the top edge and 25 mm (1") in from the outside edge on the deck flange portion of each step flashing.
 - 2) Where step flashings are used, a drainage path of no less than 6 mm (1/4") and no more than 12 mm (1/2") must be provided between the edge of the shingle and the vertical face of the step flashing.
 - 3) When the fascia board extends above the finished roof surface, step flashings trimmed to the height of the fascia must be used. Cap flashings that cover the top surface of the fascia board must be joined and secured in keeping with the Standards in **13.3.2 Securement and Seams**.
- 5) Head wall and Apron flashings must be
- 1) installed behind wall control layers (e.g. water, vapour, air) or a counterflashing (where used).
 - 2) extend at least 100 mm (4") over roofing material.
 - 3) secured
 - 1) to the wall with nails set no closer than 300 mm (12") O. C. (new construction).
 - 2) through the shingles into the supporting roof deck with cladding screws
 - 1) spaced every 600 mm (2').
 - 2) located at least 25 mm (1") in from the safety edge of the flashing. Lengths of flashing may be overlapped rather than seamed; ensure that each overlap measures at least 100 mm (4") when fully caulked in the lap, or 150 mm (6") when installed without caulking in the lap.
 - 4) combined with an inside corner step flashing where a shingled slope intersects with an overhanging soffit.
- 6) A diverter flashing, to direct water into gutters,
- 1) must be installed under the first course of shingles at the junction of roof eaves and a wall and must be installed over roof material by at least 100 mm (4").
 - 2) may be installed at the lower end of a rake edge under the second course of shingles.

10.3.5.2 Valleys

10.3.5.2.1 Valley Protection Membrane

- 1) Valleys must be protected with membrane that must be
 - 1) installed in all types of roof valleys.
 - 2) an Accepted material (see **8.2.1 Eave Protection and Underlayments**).
 - 3) at least 900 mm (36") in width, or wide enough to extend past the outside edges of a metal valley flashing onto each roof field by at least 150 mm (6").
 - 4) centred along the valley.
 - 5) installed lengthwise along the valley, from the eave edge to at least 50 mm (2") past the upper end of the metal valley flashing.
 - 6) positively overlap
 - 1) lower runs of valley membrane by no less than 150 mm (6"), rolled to ensure even, full adhesion.
 - 2) membrane installed at the eaves.

10.3.5.2.2 Open Valleys

- 1) Open valleys are the only style permitted for
 - 1) lock-type shingles.
 - 2) laminated asphalt shingles.
 - 3) **Low Slope** roofs.

- 2) Open valleys
 - 1) for any slope may be constructed with a sheet metal valley flashing.
 - 2) for **Common Slope** and **Steep Slope** roofs may be constructed with one layer of granule-faced SBS-modified bituminous membrane
 - 1) measuring at least 3.7 mm thick and 1 m (39") wide.
 - 2) centred in the valley and fastened with nails spaced not more than 450 mm (18") located 25 mm (1") away from the membrane edges.
- 3) Metal valley flashings must
 - 1) be installed before any shingle application. The installation of shingle starter strips beneath the metal valley flashings is not acceptable.
 - 2) be secured to the deck
 - 1) with fasteners nailed through the metal flashing
 - 1) no more than 450 mm (18") O.C.
 - 2) approximately 25 mm (1") in from the edge of the metal flashing.
 - 2) with cleats nailed to the roof deck no more than 450 mm (18") O.C. and hooked onto the outside edges of the flashing.
 - 3) extend to
 - 1) the edge of the eaves.
 - 2) the upper end of the valley or, where a slope continues above it, beyond the valley to a point no less than 300 mm (12") past the termination of the valley.
 - 4) positively overlap adjoining lengths of flashing (shingle-style), where each overlap measures at least
 - 1) 200 mm (8") when fully caulked in the lap.
 - 2) 300 mm (12") when installed without caulking in the lap.
 - 5) have a single central upstanding diverter/divider, except where the valley is less than 1200 mm (48") long.
 - 6) have two evenly spaced upstand diverters/dividers where a **Steep Slope** roof drains onto a **Common Slope** or **Low Slope** roof. See **13.3.1 Fabrication** for metal flashing requirements.
 - 7) be sealed to the valley protection membrane with a strip of the same membrane material, when installed on low-slope roofs or in regions with high snow accumulation; each strip must measure at least 150 mm (6") in width, and must be centred along each edge of the flashing.
- 4) All shingles terminating at the valley must be
 - 1) cut so that space between the cut edges of opposite roof faces widens toward the eave.
 - 2) trimmed diagonally at upper corners on the head lap.
 - 3) secured no closer than 150 mm (6") from the valley centreline.
 - 4) no less than 200 mm (8") in width (see **9.3.1 General**).
 - 5) sealed in a bed of compatible mastic (Low Slope applications only).
- 5) So-called California-type valleys are permissible for laminated shingles, subject to approval by the shingle manufacturer, and must be constructed in keeping with the following Standards or the manufacturer's published installation requirements, whichever are greater:
 - 1) Laminated shingles used as a valley starter must be
 - 1) laid end to end vertically up each side of the installed metal valley flashing, so that their bottom edges align with and are set back from the centre of the valley by at least 50 mm (2"); use a chalk lines for guidance.
 - 2) nailed along the shingle manufacturer's designated fastening zone or line using at least four (4) fasteners per shingle (see **Part 3** for securement requirements).
 - 2) Laminated field shingles (uncut) must be
 - 1) laid perpendicular to the roof slope and overlap the valley starter shingles installed on either side of the valley centreline.
 - 2) secured no closer than 150 mm (6") from the butt edge of valley starter shingles.

- 3) completely cover the butt-end joints of valley starter shingles.
- 4) no less than 200 mm (8") in width (see **9.3.1 General**).
- 5) installed in keeping with the requirements in **Part 9**.

10.3.5.2.3 Woven Valleys

- 1) Woven valleys must be constructed only with single-layer three-tab shingles and are not acceptable for laminated shingles.
- 2) Valley shingles must be woven together as follows:
 - 1) The first course on one roof area must be laid along the eaves so that it extends across the valley, onto the adjoining roof area at least 300 mm (12").
 - 2) The first course on the adjacent roof area must be laid so that it also extends across the valley, onto the adjoining roof area and on top of the previously applied shingles.
 - 3) Continue this method, alternating from one side of the valley to the other, weaving the shingles together as subsequent courses are installed.
 - 4) Shingles must be secured
 - 1) no closer than 150 mm (6") from the valley centreline.
 - 2) both at the end of the manufacturer's designated fastening zone or line, and with an extra nail at the upper corner of the shingle.

10.3.5.2.4 Closed-Cut Valleys

- 1) Closed-cut valley may be used only on roof slopes exceeding 1:3 (4" in 12"), and only if permitted in writing by the shingle manufacturer. Closed-cut valleys may **not** be used with laminated asphalt shingles.
- 2) Shingles must be pressed tightly into the valley.
- 3) No nails may be fastened within 150 mm (6") of the valley centreline.
- 4) Two nails must be used to secure the ends of the shingles in the valley; fasten the overlapping shingles both at the end of the manufacturer's designated fastening zone or line, and with an extra nail at the upper corner of the shingle.

10.3.5.2.5 Dead Valleys and Valley Transitions

- 1) Dead valleys must be
 - 1) waterproofed following the standards for membrane gutters (see **12.2 Built-in Membrane Gutters**).
 - 2) positively drained with a minimum slope of 1:50 (2%, or 1/4" in 12")
 - 1) into one or more roof drains, **or**
 - 2) onto a lower water-shedding roof. **Transitions from waterproofing to water-shedding systems must be made** in keeping with the Standards for Waterproofing (roof) Systems. **A metal flashing incorporated with the membrane and extending at least 100 mm (4") past a juncture with a wall, to divert water adway from the wall, is required.** See also **10.3.5.5 Junctions with Waterproofing Systems**.
- 2) Where a ridge and valleys of one roof intersects another shingled roof plane,
 - 1) the valley protection membrane and metal valley flashing must be carried up the adjoining slope at least 300 mm (12").
 - 2) two self-adhering membrane patches are required:
 - 1) **Lower patch:** cover the peaked joint between valley metal flashings and extend the patch up the slope at least 150 mm (6"); the width of the patch must not exceed the exposure of the ridge cap shingles.
 - 2) **Upper patch:** overlap the lower patch by at least 50 mm (2") and extend up the slope at least 150 mm (6") past the metal.
 - 3) ridge cap shingles and the continuing courses of shingles on the main roof slope must be installed using a Split Ridge Cap Shingle Transition.

- 3) When a metal valley changes slope, direction or both,
 - 1) self-adhering valley membrane protection must be continuous across the slope transition.
 - 2) each valley must be flashed with a separate metal valley flashing.
 - 3) a flexible membrane flap (i.e. 1.524 mm (60 mil) EPDM) or accepted mouldable material must be used to bridge the slope transition; the membrane must be adhered to the lower valley metal flashing and loosely tucked beneath the upper flashing, extending at least 100 mm (4") on either side of the slope transition.
 - 4) metal valley flashings must positively overlap, ideally no less than 200 mm (8"); where the minimum overlap is not achievable, use a larger flexible membrane flap to achieve an overall overlap of 200 mm (8").

10.3.5.3 Ridge and Hip Caps

- 1) Ridge and hip caps must be
 - 1) installed according to the manufacturer's published instructions, or to these Standards, whichever are greater.
 - 2) applied to provide a minimum double coverage, including the first cap.
 - 3) secured in keeping with **Part 3**; nails must penetrate through, or at least 19 mm (3/4") into, the roof deck.
 - 4) free of exposed nails, except for the last cap; use an acceptable sealant to seal exposed nails (see **10.2.4 Sealants**).

10.3.5.5 Junctions with Waterproofing Systems

- 1) Where two roof systems intersect, materials must be compatible with each other, or must be separated from contact by an intermediate separation layer.
- 2) When an asphalt shingle roof transitions
 - 1) up a slope onto an upper waterproofing assembly (Figures **10.1** and **10.2**),
 - 1) the transition may be made with a headwall flashing and a parapet or a metal edge termination (following the requirements for either in the **RoofStar Guarantee Standards** for Waterproofing Roof Assemblies).
 - 2) the waterproofing must be completed in accordance with the Standards found in **10.3.5.4 Transitions with Water-shedding Systems** (Waterproofing Standards for any membrane type).
 - 2) down a slope onto a lower waterproofing assembly (Figures **10.3** and **10.4**),
 - 1) the waterproofing must be completed in accordance with the Standards found in **10.3.5.4 Transitions with Water-shedding Systems** (Waterproofing Standards for any membrane type).
 - 2) shingles must be started with a Starter Course.
 - 3) shingle underlayment must overlap the waterproofing flashing by no less than 100 mm (4").
 - 4) the lowest course of shingles should terminate above the waterproofed roof no closer than 100 mm (4").

Click on an image below to view the related Construction Detail.

Figure 10.1

Figure 10.2

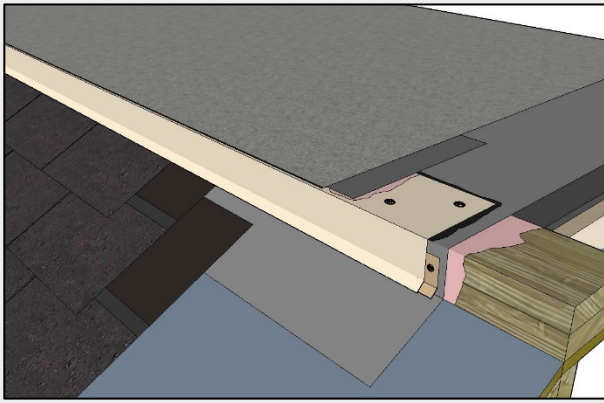


Figure 10.3

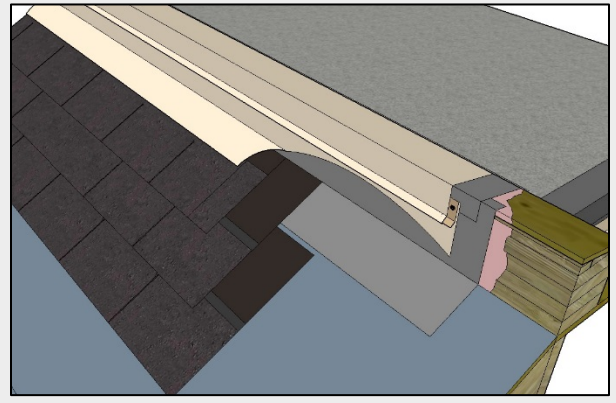
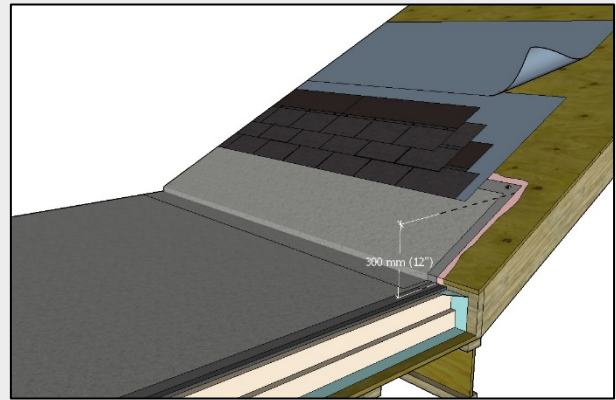
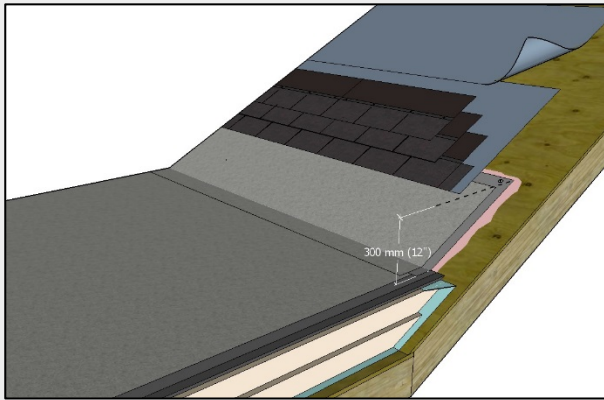


Figure 10.4



11 DRAINAGE and PENETRATIONS

11.1 General

This Part contains standards and references to membrane work that may be atypical of asphalt shingle roof construction. These are nevertheless included to address situations where multiple types of roof systems 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 Systems 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 surface of shingles must be protected from damage during the life of the roof, including damage by funneled water (such as water from rainwater leaders that spills directly onto another roof surface). Therefore, while external metal gutters are an accessory and are not covered by the **RoofStar Guarantee**, the roof design must incorporate means and methods, such as the use of rainwater gutters, leader extensions or other devices, for managing the flow of water from one roof surface to another and away from the building.
- 2) Penetrations
 - 1) must each be weatherproofed with a flashing.
 - 2) should be located away from valleys, but in any event must be situated so that the flange of the penetration flashing is at least 100 mm (4") away from the edge of metal valley pans.
- 3) 5-in-1 penetration flashings
 - 1) **are not recommended for new construction because their waterproofing installation relies on proper execution by other trades.**
 - 2) are permitted only when installed together with a properly fitted and caulked galvanized storm collar.
- 4) Curbs for skylights and other equipment must be designed with a minimum height of 150 mm (6") above the roof deck. Proprietary deck-mounted skylights with curb profiles lower than the minimum must be capable of shedding water that flows over and around the skylight structure.

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 (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 shingle manufacturer, or
 - 2) specifically accepted by the **RoofStar Guarantee Program**.

See also **6.2.2 Air Vents** for Attic Ventilation.

- 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/m² (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 1”).
 - 2) All plastic or 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.

- 3) 5-in-1 flashings (flashings manufactured with Thermoplastic Elastomers, or TPE) 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.
- 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)* for **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 plastic or 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/m² (3lb/sf).
- 6) B-vent and plumbing vent flashings must be at least 200 mm (8") in height, measured vertically from the top of the finished roof surface 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) soldered at all joints in the water plane.
 - 3) fabricated with slope to shed water.

11.3 Application

11.3.1 General

- 1) The Standards in this Part may not include every possible detail the Contractor will encounter, but every installation must be executed in keeping with the following:
 - 1) Every transition in plane must be flashed (under-laid) with a non-adhering underlayment or a self-adhering membrane; the choice is slope-dependent and at the discretion of the *Design Authority*, but in any event is subject to the Standards prescribed in **Part 8**.
 - 2) The underlayment below shingles, regardless of its type, serves as the final water barrier above the roof deck.
 - 3) All materials must be installed in overlapping layers that positively shed water to a lower surface; asphalt shingles must be installed to provide double coverage.
 - 4) Materials must be secured in accordance with various Parts in this Standard.
 - 5) Water must be allowed to flow freely off the roof.
 - 6) Nails must never be exposed to water.
- 2) All penetration and linear flashings must be separated from the underlying substrate with underlayment or a self-adhering eave protection membrane. See **8 EAVE PROTECTION and UNDERLAYMENTS**.
- 3) The flange of any penetration flashing must be at least 100 mm (4") away from the edge of metal valley pans.
- 4) Where self-adhered membranes are installed around penetrations,
 - 1) the flashing flange must be sealed to the roof deck with a horseshoe patch of self-adhering membrane that
 - 1) extends up the slope at least 200 mm (8") past the top of the flange, overlapped by the next (upper) course of underlayment.
 - 2) extends downslope from the opening at least 50 mm (2").
 - 3) extends onto the side flanges by at least 38 mm (1 ½") and beyond the sides of the flange by at least 100 mm (4").
 - 4) provides a drainage path
 - 1) of 12 mm (1/2") around the sides of the penetration upstand.
 - 2) of 19 mm (3/4") around the top of the penetration upstand.
 - 2) membrane overlaps must be hand-rolled with a membrane manufacturer's accepted roller or otherwise fully bonded.
- 5) Linear flashings used at walls, curbs or other vertical surfaces must be installed behind (covered with) any control layers, finish materials and counterflashings.
- 6) Shingles installed around a flanged penetration flashing or curb step flashings must
 - 1) be nailed outside the flange of a plastic vent; nailing through a metal flange is permissible (NOTE: when the flange is wider than 100 mm (4"), the shingle overlap must be manually tabbed).
 - 2) maintain double coverage.
 - 3) provide a drainage path of no less than 6 mm (1/4") and no more than 12 mm (1/2") between the edge of the shingles and the sides of the penetration or curb.
- 7) Where fasteners may be exposed to the weather, only cladding fasteners (screws) with gasketed washers may be used. See **13.2.3 Fasteners**.
- 8) When installing heat-welded membranes, or where construction sequencing requires it, alternatives to conventional membrane flashing should be considered. Refer to **11.3.3.2 Alternative Membrane Flashing Approaches** in the **SBS-Modified Bitumen Membrane Roof Systems** standards.

11.3.2 Roof Drains and Drainage

11.3.2.1 General

- 1) For the application of roof drains, refer to **Part 11** in the applicable Waterproofing Roof System standards.

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) 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 abrasion or erosion 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. The use of a spillway flashing is optional.

11.3.3 Penetrations and Vents

- 1) Penetration flashings must be located at least 200 mm (8") away from any adjacent penetration, upstand, edge or wall. The separation space is measured between openings, excluding the flange.
- 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) All flanged vent and penetration flashings must be
 - 1) flashed in with a self-adhering eave protection membrane 'horseshoe' as described in **11.3.1 General**.
 - 2) located no closer to the ridge than 300 mm (12"), or two courses of shingles, whichever is greater.
 - 3) secured to the roof deck:
 - 1) When the flashing is supplied with pre-drilled or moulded nail and screw holes, use nails where the fasteners are covered by shingles; use gasketed screw where fasteners will be exposed.
 - 2) When the flashing does not have any pre-drilled or moulded fastening holes, place
 - 1) nails in the top corners of flashing flange, and at the mid-point on either side of the flange, keeping nails 12 mm (1/2") from the edge.
 - 2) screws in the bottom flange - one fastener centred below the flashing upstand when it is 200 mm (8") or less in width, or two fasteners when the flashing body is wider.
- 4) Plastic vent flashings shall not be used
 - 1) for combustion or grease laden venting.
 - 2) in combination with solvent-based primers, cements or mastic.
- 5) 5-in-1 flashings
 - 1) **are not recommended for new construction because their waterproofing installation relies on proper execution by other trades.**
 - 2) are permitted only when installed together with a properly fitted and caulked galvanized storm collar.
 - 3) must be installed together with a properly fitted and caulked galvanized storm collar. When used for new construction, the plumbing trade must ensure 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.

11.3.4 Curbs

- 1) All curbs incorporated into the Water-shedding system must be
 - 1) no less than 150 mm (6") in height above the roof deck.
 - 2) 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.
 - 3) flashed on all sides with the following metal flashings, which must be fabricated, seamed and secured in keeping with **13.3 Application**:
 - 1) An apron flashing at the bottom.
 - 2) Step flashings on the sides.
 - 3) A backpan, cricket or membrane-covered cricket installed at the top.
- 2) The top edge of all metal flashings must be protected from exposure to the weather with
 - 1) curb wall finishes.
 - 2) equipment flashings.
 - 3) metal counterflashings.
- 3) Apron flashings must
 - 1) be secured to the wall or secured with gasketed screws into the roof deck.
 - 2) be wrapped around the sides of the curb by at least 100 mm (4") (see **Figure 13.8**).
 - 3) precede the installation of step flashings along the sides of the curb.
- 4) Only new step flashings are permitted (cloning is not allowed), and step flashings shall
 - 1) extend at least 75 mm (3") downslope from the corner of a vertical surface (wall or curb) and have a 75 mm (3") head-lap above the shingle exposure.
 - 2) be placed flush with the butt edge (bottom) of each asphalt shingle course.
 - 3) fastened through the deck flange of the flashing with nails placed 50 mm (2") and 25 mm (1") in from the outside edge.
 - 4) fold around the top face of a curb and extended upslope, behind and beneath the backpan.
- 5) Where step flashings are used, a drainage path of no less than 6 mm (1/4") and no more than 12 mm (1/2") must be provided between the edge of the shingle and the vertical face of the step flashing
- 6) Backpans must be installed to overlap step flashings, and must be fastened
 - 1) into the curb through the flashing upstand.
 - 2) into the roof deck along the top edge of the backpan, and 300 mm (12") down from the top of the backpan, on either side.
- 7) Curbs with widths
 - 1) up to 900 mm (36") must be flashed at the top with a backpan (see **13.3.1 Fabrication**).
 - 2) between 900 mm (36") and 1200 mm (48") must be constructed with a metal saddle (cricket) that

- 1) is supported by rigid material to prevent metal distortion.
 - 2) is integrated with the curb or chimney flashings.
 - 3) extends up-slope from the back of the curb, beneath the shingles and underlayment 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.
 - 3) over 1200 mm (48") must be designed and constructed with a waterproofing membrane installed over a rigidly constructed cricket; the membrane must extend 150 mm (6") laterally past the curb corner, and extend 75 mm (3") down the face of the roof deck, overlapping shingles. See **Part 12** for built-in membrane gutters. See also **10.3.5.2.5 Dead Valleys and Valley Transitions**.
 - 8) Shingles above the flange of a backpan or metal cricket must be installed
 - 1) at least 50 mm (2") up slope from the curb or cricket.
 - 2) secured to the roof deck no less than 200 mm (8") up slope from the curb or cricket.
 - 9) Masonry chimneys must incorporate counterflashings
 - 1) that overlap the apron flashing, step flashings and backpan.
 - 2) installed in a raked joint or cut reglet at least 25 mm (1") deep and finished with sealant or mortar (see **BCBC 9.26.4.4 Intersection of Shingle Roofs and Masonry**).
 - 10) 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.
-

12 OTHER DETAILS

12.1 Photovoltaic (PV) and Solar Water Panels

12.1.1 Design

- 1) No PV or solar water panels may be mounted on water-shedding roofs with a slope less than 1:4 (3" in 12").
- 2) All PV or solar water panels shall be
 - 1) **engineered for securement to the structure** against wind uplift.
 - 2) deck-mounted at least 150 mm (6 inches) from the finished roof surface (shingles).
 - 3) supported with hardware installed in keeping with the Standards for penetration flashings in **Part 11**.

12.1.2 Materials

(Under development)

12.1.3 Application

- 1) All PV or solar water panels shall be installed in keeping with the Standards for penetration flashings in **Part 11**.

12.2 Built-in Membrane Gutters

12.2.1 Design

- 1) When a built-in membrane gutter adjoins a RoofStar-guaranteed water-shedding roof, 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**.
- 2) Insulated waterproofing assemblies 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.
- 3) 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.

- 4) Only fully adhered membranes or acceptable metal gutter liners may be used in built-in gutters.
- 5) 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.

- 6) 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**.

- 7) 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 Section. 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.

- 8) 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.
- 9) For transitions between the built-in gutter and steep roof assemblies, refer to **10.3.6 Junctions with Waterproofing Systems**.

12.2.2 Materials

NOTE: These material standards are applicable to membrane gutters for all water-shedding systems.

- 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 1.524 mm (60 mil).
 - 2) 2-ply bituminous membranes must meet the minimum thickness requirements in **9.2.1 Composition, Thickness and Selection**.
 - 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 **13.2.1 Sheet Metal Grade and Gauge** for gauge requirements. See also *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 assembly (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, whichever is greater.
 - 3) lapped underneath the water-shedding system protection and underlayment materials (Note: when the gutter membrane is incompatible with the overlaying materials, a separation layer is required).
 - 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 roof field. Fasteners securing the membrane on the roof 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 *Design* above. Drain flanges that are bent to accommodate the side walls 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 slip sheet 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 assembly 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 [Construction Detail E1.7.16 Built-in Gutter](#) for an illustrated example.
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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 walls), or off the roof into a drainage system. Metal flashings also provide an aesthetic finish to the roof assembly. Metal flashings are not a waterproofing component, but are integral to the water-shedding function of the roof system. Refer also to **10 PERIMETERS and WALLS** and **11 PENETRATIONS, CURBS and DRAINAGE**).

Linear metal flashings include, without limitation,

- Eave and rake edge flashing
- Counterflashing
- Step and Diverter flashing
- Head wall flashing
- Fascia flashing
- Valley flashing
- Spillway 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, finish and gauge.
 - 2) seam types (if required).
 - 3) length of flashings (if different from the **Guarantee Standards** outlined below).
 - 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 roof system adjoins a waterproofing roof system, metal flashings used at the adjoining details must conform to the standards applicable in Part **13 METAL FLASHINGS** for the applicable waterproofing system.
- 5) Where a parapet meets a water-shedding roof 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 Roof Assemblies, see Part **13 METAL FLASHINGS** in the relevant membrane-specific Waterproofing Roof Systems Standards.

13.2 Materials

13.2.1 Sheet Metal Grade and Gauge

- 1) A mill certificate must be provided by the roofing contractor when requested by the *Design Authority*.
- 2) The following minimum gauges and / or weights of commonly used metals or alloys are acceptable for use in the **RoofStar Guarantee Program**.

GALVANIZED STEEL: 0.50 mm (0.0196", 26 gauge) galvanized steel sheet, conforming to *ASTM A653 / A653M-06* CS Type B, Z275 (G90) coating. Thickness tolerance as per *ASTM A924/A924M-06* ±0.08 mm (0.003") for sheet widths not exceeding 1500 mm (60").

ALUMINUM – ZINC ALLOY COATED STEEL: 0.50 mm (0.0196", 26 gauge) aluminum-zinc alloy coated steel sheet, conforming to *ASTM A792/A792M-06* CS Type B, AZM150 (AZ50) coating. Thickness tolerance as per *ASTM A924/A924M-06* ± 0.08 mm (0.003") for sheet widths not exceeding 1500 mm (60").

ALUMINUM: 0.80 mm (0.032", 20 gauge) aluminum sheet, utility quality to CSA HA Series - 1975, plain or embossed finish. Maximum thickness tolerance variation ± 0.06 mm (0.0025") based on 1200 mm (48") wide sheet.

STAINLESS STEEL: 0.38 mm (0.014", 28 gauge) stainless steel, Type 302, 304, 316, 2B finish to *ASTM A167-82*. Maximum thickness tolerance variation ± 0.04 mm (0.0015") based on 1200 mm (48") wide sheet.

COPPER: 0.56 mm (0.022", 16 oz.) copper sheet, cold rolled roofing copper to *ASTM B370-81*. Maximum thickness tolerance variation ± 0.09 mm (0.0035") based on 1200 mm (48") wide sheet.

ZINC: 0.80 mm (0.031") zinc Sheet conforming to European standard *EN 988-1996*. Maximum thickness tolerance variation ± 0.03 mm (0.0012").

Specifying authorities should indicate the type and gauge of metal required, as well as the qualifying standards. The reference standard for gauges is USS REV (metric in mm).

13.2.2 Pre-painted Finishes

- 1) When a painted finish on metal flashing is specified, only SMP and PVDF pre-painted finishes are acceptable. Where *Architectural Metal Roofing* is installed, adjoining flashings must have the same finish as the metal panels (PVDF).

13.2.3 Fasteners

- 1) Nails are acceptable as fasteners, unless otherwise specified by the *Design Authority* or prohibited by the Standards in this Manual.
- 2) All threaded fasteners used to secure metal flashings must be #8 corrosion-resistant screw or expansion fastener with a low-profile head, and must be compatible with both the metal flashing material and the substrate.
- 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) Blind rivets may be used for securing two metal flashings together.

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. When drip edges are used they must extend at least 12 mm (1/2") from the vertical face.
- 2) Eave and Rake edge flashings (**Figure 13.1**) must be fabricated with a
 - 1) leg that extends onto the supporting deck surface at least 50 mm (2").
 - 2) vertical leg that is bent to suit the slope, extending down the outside edge of the roof deck at least 12.5 mm (1/2").

Figure 13.1a (Note: not all typical materials are shown)

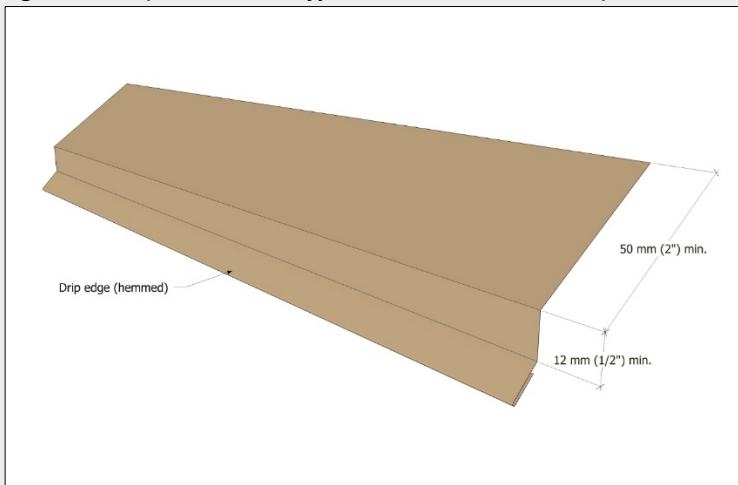
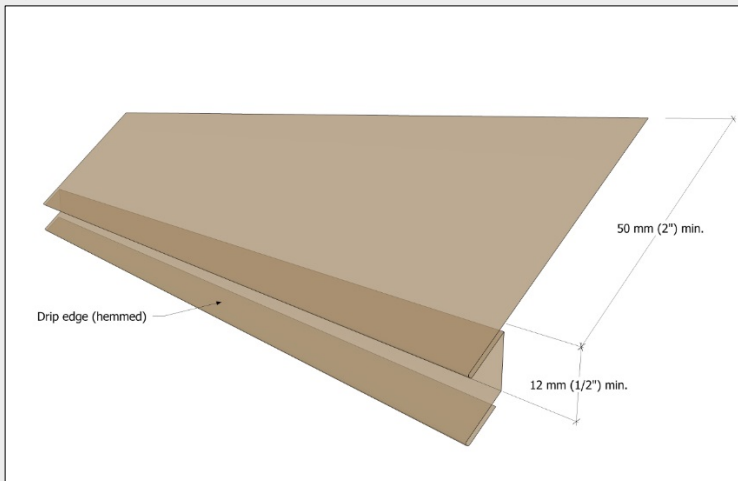


Figure 13.1b (Note: not all typical materials are shown)



- 3) Valley flashing (**Figure 13.2** and **Figure 13.3**) must be
 - 1) at least 600 mm (24") wide.
 - 2) no more than 3000 mm (10') in length.
 - 3) fabricated with
 - 1) a centre diverter (W profile), folded to a maximum of 60° (degrees) on the inside angle of the divider, at least 25 mm (1") in height.

- 2) double diverters, located 75 mm (3") from the valley pan centreline, when a **Steep Slope** roof drains onto a **Common Slope** or **Low Slope** roof surface.

Figure 13.2 (Note: not all typical materials are shown)

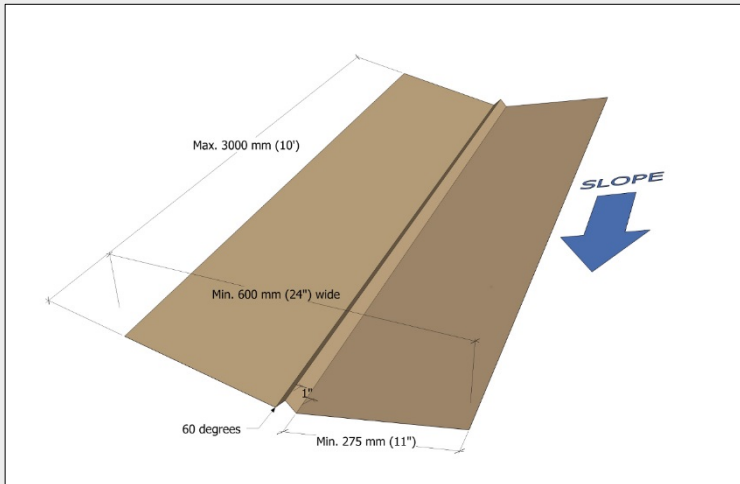
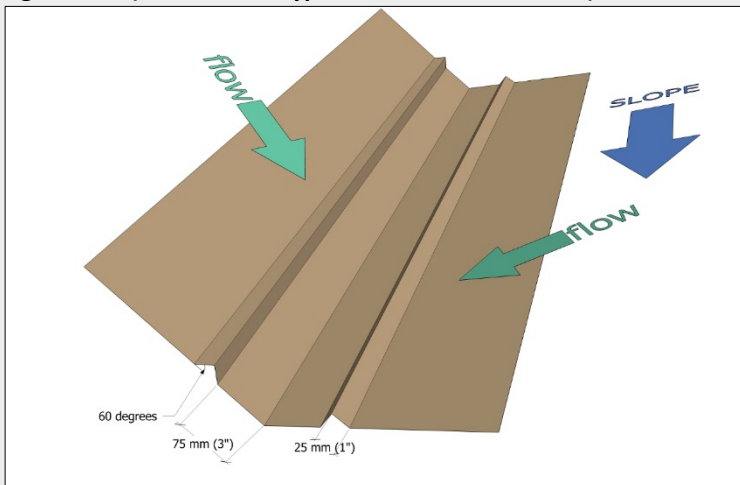
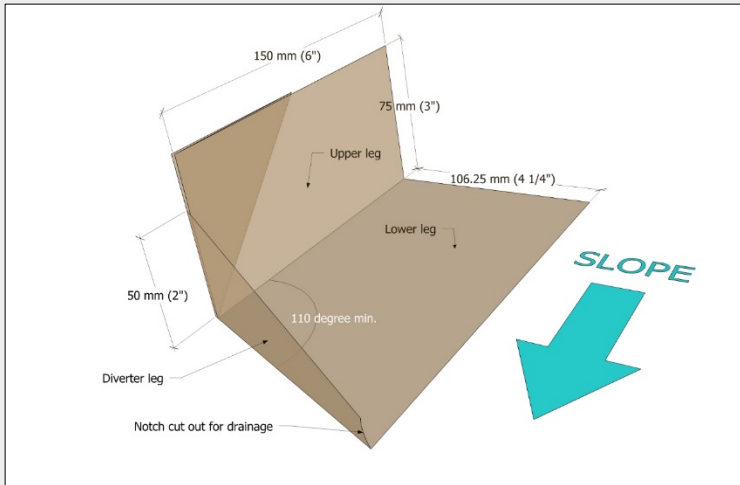


Figure 13.3 (Note: not all typical materials are shown)



- 4) Water diverter flashings (**Figure 13.4**), when used together with a step flashing at a wall, must be folded bread-pan fashion (not cut, riveted or welded), and must
 - 1) be at least
 - 1) 75 mm (3") in height above the finished roof surface.
 - 2) 150 mm (6") in length at the top of the vertical leg.
 - 2) incorporate an upstanding diverter leg
 - 1) bent at the downslope end of the flashing
 - 2) that extends downslope at least 110°.
 - 3) no less than 50 mm (2") in height where the diverter leg intersects the vertical face of the flashing.
 - 4) notched at the outer corner to form an outlet for drainage.

Figure 13.4 (Note: not all typical materials are shown)

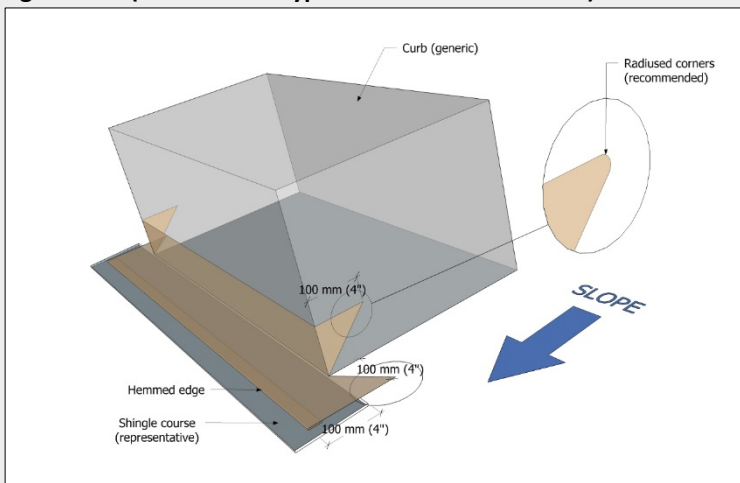


See Construction Detail **E2.7.11** for an illustrated guide.

5) Apron flashings (**Figure 13.5**) must be

- 1) fabricated to extend
 - 1) laterally past the sides of the curb or chimney, and to fold back along its sides, by at least 100 mm (4").
 - 2) downslope from the curb or chimney 100 mm (4").
- 2) over-broken (bent) so that the lower flashing leg extending onto the roof field will rest on the shingles under slight tension.

Figure 13.5 (Note: not all typical materials are shown)

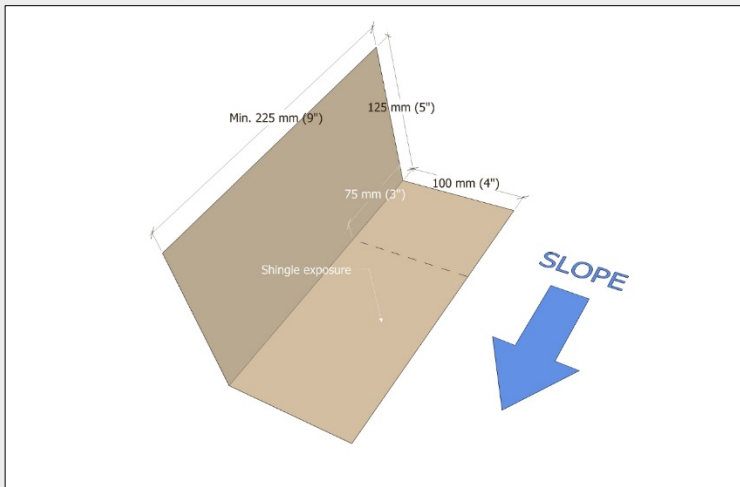


6) Step flashings (**Figure 13.6**) must be

- 1) at least 125 mm (5") in height above the finished roof surface.
- 2) at least 100 mm (4") in width.
- 3) at least 225 mm (9") in length, or fabricated to match the shingle exposure plus 75 mm (3"), whichever is greater.

Figure 13.6

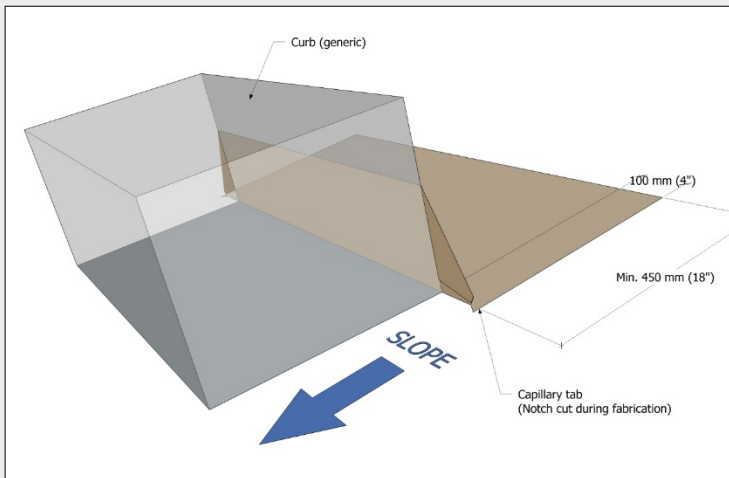
(Note: not all typical materials are shown)



- 7) Backpan flashings (**Figure 13.7**) must be fabricated
- 1) to extend at least
 - 1) 150 mm (6") up vertical surfaces.
 - 2) 450 mm (18") up the slope of the roof deck (for roof slopes less than 1:3 (4" in 12"), follow the requirements for chimney saddles in **BCBC 9.26.4.8 (5) Chimney Saddles**).
 - 3) 100 mm (4") laterally past the curb corners and folded downslope at an angle, not cut.
 - 2) with a capillary cut-out measuring between 3 mm (1/4") and 6 mm (1/2"), notched into the bottom outside corner of each side extension.

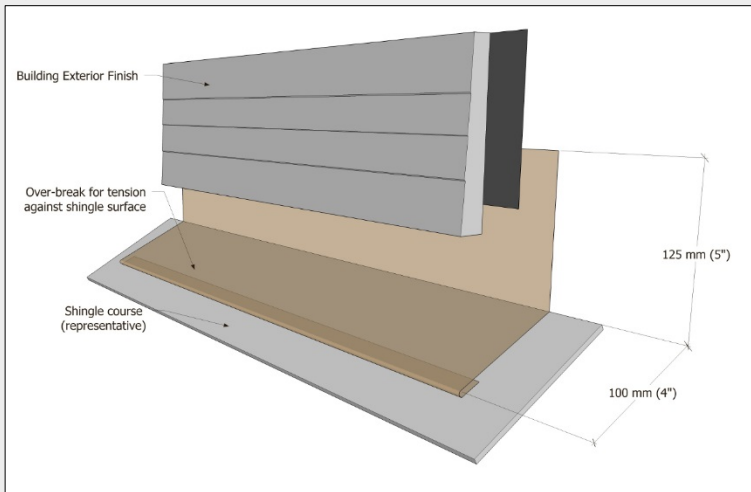
Figure 13.7

(Note: not all typical materials are shown)



- 8) Head wall counterflashings (**Figure 13.8**) must be
- 1) fashioned to the same height and width dimensions as a step-flashing.
 - 2) hemmed at the edge of the exposed leg.
 - 3) over-broken (bent) so that the lower flashing leg extending onto the roof field will rest on the shingles under slight tension.

Figure 13.8 (Note: not all typical materials are shown)



13.3.2 Securement and Seams

- 1) Unless otherwise stated in this Standard, all linear flashings (except step flashings)
 - 1) must be secured with at least two (2) fasteners, or with fasteners placed no more than 450 mm (18") O.C. (see also **10 PERIMETERS and WALLS** or **11 DRAINAGE and PENETRATIONS**).
 - 2) in protected locations may be secured with nails or threaded fasteners that penetrate the substrate at least 19 mm (3/4").
 - 3) in exposed locations must be secured with cladding fasteners.
- 2) When nails are used to secure metal flashings, they must be
 - 1) covered by other (wall or curb) materials, or by adjacent flashings, and may not be left exposed to the weather.
 - 2) installed at least 25 mm (1") above the bottom edge of expected wall or curb finishes.
- 3) With the exception of metal valley flashings, linear 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.
- 4) When hidden metal clips are specified, they must
 - 1) be fabricated from no less than 26 Gauge flat metal stock.
 - 2) be fastened no more than 75 mm (3") from the return (connecting hook).
 - 3) engage the flashing by no less than 12 mm (1/2").
- 5) Sealants must be tooled to positively shed water.

14 [NOT USED]

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RoofStar Guarantee Standards

for Asphalt Shingle Systems

Updated February 2020

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