

BUILT-UP ROOFING

SECTION 6 - PRIMARY MEMBRANE

6.1 GENERAL

- .1 Built-up bituminous primary membranes may be comprised of three (3) or four (4) plies of organic or inorganic felt adhered with interply applications of hot bitumen.
- .2 Built-up bituminous membrane systems can be categorized as a conventional design, membrane applied above insulation, a protected membrane design, membrane applied below insulation, or a combination design, membrane applied between two insulation layers.
- .3 For all designs the built-up membrane shall be uniformly adhered to and supported by an accepted substrate including cant strips at vertical junctions. The primary membrane shall be joined and sealed to the vapour retarder membrane extension at perimeters and penetrations.
- .4 Application of built-up roofing systems must not be undertaken when the air temperature at roof level is colder than -18°C and a wind velocity of more than 14.5 km/h, or an equivalent wind chill factor of 1300. Built-up roofing systems shall not be applied during periods of rain, snow or similar moisture conditions.

6.2 DESIGN CONSIDERATIONS

- .1 When developing a built-up membrane system design, the design authority shall take the following items into consideration:

6.2.1 Drainage Provision

- .1 The Warranty Certificate does not warrant the roof drainage system.
- .2 The Warranty Certificate covers the watertight integrity of the primary membrane and the seal of the roof flashing component, e.g. lead flashing, drain or scupper flange. The design authority shall ensure that the drainage system is designed in accordance with the governing Plumbing and Building Code to provide positive drainage and accommodate minimum roof drainage slopes as follows:
 - a) Minimum 1:100 (1/8"/ft.) for conventional membrane designs.
 - b) Minimum 1:50 (1/4"/ft.) for protected membrane or combination designs.
- .3 Some isolated ponding water can be anticipated when drainage slope is provided.
- .4 ARCA recommends that emergency or overflow drainage be incorporated into the roof drainage systems. The Warranty Certificate requires that emergency drainage be provided in designs using "flow control" type roof drains.
- .5 Splash pads shall be installed beneath drain outlets discharging water onto lower roofs to prevent the erosion of the membrane protection and damage to the primary membrane.

6.2.2 Roof Slope

- .1 The maximum slope for a built-up membrane system is 1:6 (2"/ft.).
- .2 Built-up membrane systems incorporating organic felt plies must provide for the back nailing of the felts on slopes exceeding 1:8 (1.5"/ft.).
- .3 Built-up membrane systems incorporating inorganic felt plies must provide for the back nailing of the felts on slopes exceeding 1:12 (1"/ft.).
- .4 Protected membrane and combination designs do not require the back nailing of the felt plies regardless of whether the felts are organic or inorganic.
- .5 Back nailing of felt plies for insulated conventional roof designs will require the installation of nailers. Please refer to Section 5, Insulation, Subsection 5.4, for the requirements for spacing and installation of nailers/blocking.

6.2.3 Temporary Membrane

- .1 A minimum two (2) ply vapour retarder comprised of roofing felt adhered with hot bitumen may be used as a temporary membrane. A separator is required over wood decks and an auxiliary leveling surface is required over steel decks prior to application of the temporary B.U.R. membrane.
- .2 For two-stage construction the installation of the vapour retarder membrane is the first stage. The vapour retarder membrane shall be inspected and repaired prior to the remaining roofing components being installed.
- .3 Uninsulated conventional and protected membrane designs do not qualify for two-stage construction.

6.3 BUILT-UP ROOF MEMBRANE COMPONENTS

6.3.1 Bitumens

- .1 The bitumen used to adhere built-up roofing membranes may be roofing asphalt or coal tar pitch. Asphalt is the most common bitumen used in Alberta and shall be manufactured in compliance to CSA A123.4-98. Coal tar pitch is rarely used and shall be manufactured to ASTM Standard D450, Type 1.
- .2 Bitumens must not be heated in excess of their Final Blowing Temperature, i.e. the temperature at which the bitumen was oxidized.
- .3 Equiviscous Temperature (E.V.T.) is the recommended application temperature range for bitumen and shall be measured at the point of application. E.V.T. is provided by the bitumen manufacturer and may differ with the bitumen type.
- .4 Coal tar pitch and roofing asphalt are not compatible with each other.

6.3.1.1 Asphalt

- .1 Roofing asphalt is available in three types or grades. The selection of the asphalt type to be used is based on the roof slope and is determined as follows:
 - a) Type 1 Asphalt For slopes 1:25 (1/2"/ft.) and less
 - b) Type 2 Asphalt For slopes 1:12 (1"/ft.) and less
 - c) Type 3 Asphalt For slopes 1:6 (2"/ft.) and less
- .2 Asphalt is applied in a full application (coatings) to the membrane substrate and between felt plies at its Equiviscous Temperature (E.V.T.) application range. For organic felts it is applied at the approximate rate of 1.0 kg/m² (20lbs/100sq.ft.). For inorganic felts the approximate rate is 1.2 kg/m² (25lbs/100sq.ft.). The asphalt may be applied by hand with a roofer's mop or mechanically with an asphalt applicator. The asphalt shall be applied with sufficient coverage to ensure full adhesion of the felt ply.

6.3.1.2 Pitch

- .1 Coal tar pitch use is restricted to a maximum roof slope of 1:25 (1/2"/ft.).
- .2 Pitch shall be applied at an approximate rate of 1.5 kg/m² (30lbs/100sq.ft.) in full application to the membrane substrate and for interply mopping. Only perforated pitch saturated felts may be used.

6.3.1.3 Polymer Modified Asphalt

- .1 Polymer modified roofing asphalt shall be manufactured in compliance with ASTM D-6152, "Standard Specification for S.E.B.S. Modified Mopping Asphalt Used in Roofing".
- .2 Polymer modified asphalt use is restricted to the application of the membrane protection floodcoat and shall not be used to adhere membranes.

6.3.2 Felts

- .1 To prevent moisture infiltration roofing felt rolls shall be poly bagged during shipment and storage out of doors. Store felt rolls on end and on pallets above the roof/ground surface. Do not install roofing felts when their moisture content exceeds the felt manufacturer's equilibrium moisture content.
- .2 Built-up membrane plies shall be applied in a full application of hot bitumen, true to line, without wrinkles and vapour locks. Each ply of felt shall be carried to the top of cant strips at horizontal to vertical transitions.
- .3 When nailers are required the membrane plies shall be adhered in a full application of bitumen, in a straight four (4) ply application installed perpendicular to the direction of the nailers. Additionally membrane plies shall be mechanically fastened to each nailer with a minimum of one (1) galvanized roofing nail placed approximately 50mm (2") down from the leading edge, of each felt ply.

6.3.2.1 Organic Felt

- .1 Organic felts shall be either No. 15 asphalt saturated perforated felt manufactured to CSA A123.3-98, or No. 15 coal tar pitch saturated perforated felt manufactured to ASTM Standard D227.
- .2 The following organic asphalt saturated roofing felts meet the requirements of CSA A123.3 and are accepted for issuance of the built-up roofing Warranty Certificate:
 - a) IKO No. 15 Asphalt Felt – Perforated
 - b) EMCO No. 15 Asphalt Felt - Perforated
 - c) Hal Industries Inc. No. 15 Perforated Felt
- .3 Pressure shall be applied to each organic felt ply with a broom or squeegee during application to assure complete contact with the hot bitumen.
- .4 The specified number of felt plies, together with the membrane protection shall be applied each day. Organic felts shall not be left unprotected. If, due to exceptional circumstances, the application cannot be completed, the organic felt surface shall be sealed with a light (visible) glaze coat of hot bitumen.

6.3.2.2 Inorganic Felt

- .1 Inorganic felt shall be either Type IV or Type VI asphalt saturated fiberglass roofing felt manufactured to CSA A123.17 (ASTM D2178).
- .2 The following inorganic asphalt saturated roofing felt meet the requirements of CSA A123.17 and are accepted for issuance of the built-up roofing Warranty Certificate:
 - a) IKO IKO Glass Type IV Ply Sheet
 - b) Johns Manville Type IV – Glasply IV
 - c) Type VI – Glasply Premier
- .3 Due to the unique properties of fiberglass felt the following application techniques form part of the Built-up roofing minimum requirements for Warranty Certificate issuance.
 - a) The use of mechanical bitumen spreaders is not permitted for fiberglass felt applications.
 - b) For fiberglass felt BUR application, a straight four (4) ply application shall be the preferred application method. The 2 + 2 application method is permitted but must be completed within the same working day. The ganging of multiple rolls of felt is accepted.
 - c) For proper adhesion, individual felt plies must be hand mopped with hot bitumen applied at the high end of its equiviscous temperature (E.V.T.) range.
 - d) Fiberglass felt rolls shall be kicked out from either the insulation or deck sides of the roof. Refrain from walking on the newly applied fiberglass felts until the bitumen has set. Bitumen set times will vary with changes in the ambient temperature, from 15 minutes in cool weather to several hours during extremely warm temperatures. Point loading of material or equipment on the completed fiberglass membranes is not allowed. Personnel are not to walk on or push equipment over the newly installed membrane until the bitumen set time has been achieved.

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- e) The brooming of fiberglass felt into the hot bitumen during application is not required.
- f) Fish mouths occurring at membrane edge laps must be immediately cut and pressed into the hot bitumen.
- g) Roof transitions occurring at drain and scupper sumps, crickets, saddles, valleys and other changes in roof slope / elevation shall be reinforced with a minimum of one (1) ply of No. 15 organic felt adhered in hot bitumen. Application of the organic felt ply precedes the application of the inorganic felt primary membrane plies.
- h) Fiberglass felts cannot be used for the membrane flashing plies. The membrane flashing shall be comprised of a minimum of two (2) plies of modified bituminous membrane or three (3) plies of No. 15 organic felt.
- i) Night cut-offs waterproofing fiberglass primary membrane terminations must be completed using No.15 organic felt glazed with hot bitumen.
- j) The completed fiberglass felt primary membrane must either be glazed or have its membrane protection installed within the same working day.

6.3.3 Cants

- .1 Cants must be installed at all vertical roof junctions to support the membrane plies and to reduce their transition angle.
- .2 Cants shall incorporate a nominal 89mm (3½") wide 45° sloping face.
- .3 Wood fiberboard, perlite, fire resistant mineral board or wood may be used to manufacture cant strips. No other material may be used unless approved by ARCA Warranty Ltd.
- .4 Cants may be uniformly adhered to their supporting substrates with hot bitumen or be mechanically fastened.
- .5 Wood cants must be mechanically fastened to wood blocking supported by and fastened to the structure or the decking.

6.4 MEMBRANE PROTECTION

6.4.1 General

- .1 The membrane protection may be comprised of a bitumen floodcoat with embedded roofing gravel or a smooth surfaced emulsion or aluminum coating.
- .2 No other solution of bitumen dissolved in a solvent may be used for the membrane protection.

6.4.2 Roofing Gravel

- .1 Roofing gravel shall be approximately 10mm (3/8") nominal diameter, washed, crushed or rounded rock, relatively free of fines. Roofing gravel should be opaque, light coloured, non-porous and reasonably free of moisture.

6.4.3 Floodcoat and Gravel

- .1 Roofing gravel embedded in a floodcoat of bitumen is the most common form of membrane protection application for conventional built-up membrane systems. Polymer modified asphalt may be used for the bitumen floodcoat with asphalt adhered membranes. The floodcoat and gravel may be applied using either a single or a double application method as follows:
 - a) The single application method shall be comprised of a minimum bitumen floodcoat of 3kg/m^2 (60 lbs./100 sq. ft.) and approximately 20 kg/m^2 (400 lbs. /100 sq. ft.) of roofing gravel applied while the bitumen is hot. To reduce the effects of wind scour at the outside corners, single applications shall incorporate a double application extending out from the corner a minimum distance of 1200mm (4ft.) in each direction.
 - b) The double application method is restricted to a maximum roof slope of 1:25 (1/2"/ft.). A double application shall be proportioned so that the combined mass of the completed membrane protection is 5kg/m^2 (100 lbs./100 sq. ft.) of bitumen and approximately 30 kg/m^2 (600 lbs. / 100 sq. ft.) of roofing gravel. The first application should limit the amount of gravel so that the majority of the gravel is embedded in the hot bitumen and little or no loose gravel to be swept away. The second application shall follow the first as soon as possible to prevent dirt or moisture from entering the system between applications. Both applications shall be applied within the same working day.

6.4.4 Emulsions

- .1 Emulsion application is restricted to minimum roof slopes of 1:25 (1/2"/ft.) and temperatures above 0°C .
- .2 Bituminous emulsion coating shall conform to CGSB 37-GP-28M or 37-GP-31M.
- .3 The surface of the built-up membrane, whether organic or inorganic felt, shall be covered with a glaze coat of bitumen prior to the application of the emulsion coating. The emulsion shall be applied in two (2) coats so that the combined application rate is approximately 2L/m^2 (4 gal/100 sq.ft.). The first coat shall be allowed to set prior to the second application.

6.4.5 Aluminum Coatings

- .1 Aluminum coatings shall be restricted in use for roof slopes of 1:25 (1/2"/ft.) and greater.
- .2 Aluminum coatings shall conform to CGSB 37-GP-42M, Type 2.
- .3 Apply aluminum coatings in accordance with manufacturer's application rates over a glaze coat of bitumen or over an emulsion coat applied to the built-up membrane. Follow the coating manufacturer's recommendations for bitumen or emulsion set-up and curing times prior to the application of the aluminum coating.

6.5 MEMBRANE LOAD PROTECTION

- .1 Under no circumstance shall any equipment load be supported directly on the surface of an unprotected primary membrane.

- .2 For roof mounted equipment exceeding 91kg (200 lbs.) in mass or when roof loads exceed 5kPa (105 p.s.f.) they shall be supported on minimum 200mm (8") high curbs, sleepers or pedestals attached to the structure or decking. Roof mounted equipment includes antennae, signs, service lines, skylights, hatches and walkways. For new construction where H.V.A.C. equipment is supported by pedestals, a minimum clearance of 762mm (30") shall be provided beneath the equipment to permit installation of the roofing system. Equipment supports shall be designed by a structural engineer and shall conform to the Alberta Building Code.
- .3 Equipment loads 91Kg (200 lbs.) or less in mass, may be supported by free floating sleepers or support pads loose laid over the roofing system. Free floating sleepers shall be pressure preservative treated wood, precast concrete, metal or specialty product. Free floating sleepers or pads shall be placed on a minimum 25mm (1") thick layer of Type 4 insulation attached to the base of the supports without the use of mechanical fasteners. A ply of mineral surfaced roofing adhered to the primary membrane in an application of hot bitumen may be substituted for the Type 4 insulation protection layer.
- .4 When guy wires are used to anchor roof mounted equipment their anchorage points shall be waterproofed with 200mm (8") high curbs or with gum boxes.
- .5 H.V.A.C. units, skylights and hatches shall be supported by insulated metal or wooden curbs supported by and fastened to the structural deck and extending a minimum distance of 200mm (8") above the surface of the roofing system measured at the highest point.
- .6 To protect the primary membrane from concrete paver and/or walkway damage, a minimum 25mm(1") thick layer of Type 4 insulation shall be placed between the walkway/pavers and the finished gravel roof surface. Place the Type 4 insulation so that the roof drainage is free to flow under the pavers/walkway.

6.6 ACCEPTED FULLY ADHERED BUILT- UP ROOFING MEMBRANE SYSTEMS

.1 Organic No. 15 Perforated Asphalt Felt Systems

System	Spec No.	Felt Plies	Manufacturer
Uninsulated	O-1	Separator + 3 plies or 4 Plies	EMCO, HAL, IKO
Uninsulated Auxiliary Surface	O-2	4 Plies	EMCO, HAL, IKO
Insulated	O-3	4 Plies	EMCO, HAL IKO or Tremco Upgraded
Protected Membrane Design	O-4	4 Plies	EMCO, HAL, IKO
Combination Design Insulated	O-5	4 Plies	EMCO, HAL, IKO

.2 Inorganic Asphalt Felt Systems

System	Spec No.	Felt Plies	Manufacturer
Uninsulated	I-1	Separator + 3 plies or 4 Plies	IKO Type IV or Johns Manville Type IV & VI
Uninsulated Auxiliary Surface	I-2	4 Plies	IKO Type IV or Johns Manville Type IV & VI
Insulated	I-3	4 Plies 2 Plies + Tremco Composite Ply	IKO Type IV or Johns Manville Type IV & VI & Tremco Therm 100
Protected Membrane Design	I-4	4 Plies	IKO Type IV or Johns Manville Type IV & VI
Combination Design Insulated	I-5	4 Plies	IKO Type IV or Johns Manville Type IV & VI

6.7 OTHER ACCEPTED POLYMER MODIFIED ASPHALT ADHERED SYSTEMS

.1 Tremco Canada, Protected Membrane Design

TRA / THERMastic single ply poly- reinforced E.P.D.M./ S.B.R. rubber membrane and membrane flashing adhered with hot TRA/Thermastic 10