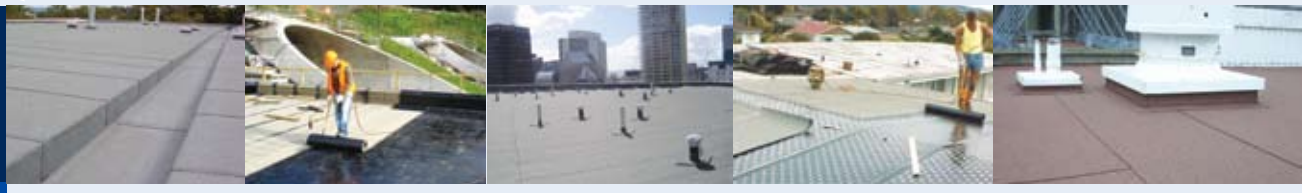
MEMBRANE GROUP
New Zealand Inc.



Code of PRACTICE

for

Torch-on Membrane Systems

for

Roofs and Decks

(for the selection, design and installation of modified reinforced bituminous materials)

Prepared by the MEMBRANE GROUP NEW ZEALAND Inc.

Published October 2008

....setting best practice in waterproof membranes...

0. Preliminary

0.1 Representation

This Code of Practice was prepared by members of the Membrane Group NZ Inc, comprising the following companies:

- Ardex New Zealand Ltd, www.butynol.co.nz
- Bostik New Zealand Ltd, www.bostik.co.nz
- Equus Industries Ltd, www.equus.co.nz
- Hitchins New Zealand Ltd, www.hitchins.co.nz
- Jaydex International Ltd, www.jaydex.co.nz
- Nuplex Construction Products, www.nuplex.co.nz
- Sika (NZ) Ltd, www.sika.co.nz
- Skellerup Viking Roofing and Waterproofing, www.skelleruproofing.co.nz
- Waterproofing Systems Ltd, www.waterproofing.co.nz

0.2 Copyright

For further information, contact: info@membrane.org.nz.

0.3 Comments and Notification of Errors or Omissions

Comment on information contained in this Code of Practice is welcome. Please send all comments to: info@membrane.org.nz.

0.4 Document History

This Code of Practice for Torch-on Membranes, 1st Edition, was printed in October 2008.

The Membrane Group will review and update the information contained in this Code of Practice when and as required. Refer to the website (www.membrane.org.nz) for the most recent updates of information contained within this Code of Practice.

Re-printed hardcopies will contain any ratified change(s) as at the time of printing.

Revised downloadable copies will be available from the MGNZ and member websites as soon as any changes are ratified.

Version	Date	Reason(s) for Amendment
1st Edition	October 2008	
1st Draft Edition	September 2005	Draft version distributed for selected industry comment

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0.5 Disclaimer

Although the information contained in this Code of Practice has been obtained from sources believed to be reliable, the Membrane Group NZ Inc. makes no warranties or representations of any kind (expressed or implied) with regard to the accuracy, adequacy, currency or completeness of the information, or that the information is suitable for any specific or intended use.

Compliance with this Code of Practice does not imply or guarantee immunity from breach of any statutory requirements, the New Zealand Building Code or relevant Standards.

This Code of Practice does not set out to restrict the use of any materials, system, or application method. The final responsibility for the correct selection, design and specification rests with the Designer and for its satisfactory execution with the Applicator.

While most data has been compiled from case histories, trade experience or testing, small changes in the working environment can produce marked differences in performance. The decision to use a particular component or system and in what manner, is made entirely at the reader's own risk. A particular material and methodology may need to be modified to meet its intended end use and environment.

Each Building Consent Authority (BCA) is responsible for assessing, on a case-by-case basis, what actions they must take to be "satisfied on reasonable grounds" that the relevant requirements of the Building Code have been met except when a compliance document has been submitted. The BCA and building officials are also responsible for deciding whether to take their own legal or other professional advice to assist them with that assessment. This document is not a substitute for that professional advice.

This document is intended as guidance only, and is not specific to any particular project. While the Membrane Group NZ Inc. has taken care in preparing this document, it should not be relied upon as establishing compliance with all the relevant requirements of the Building Act 2004 or the Building Code in all cases that may arise.

0.6 Related Documents and Standards

The following documents relate to this Code of Practice. Readers should ensure that they access the latest versions of all related documents, including amendments, if any. In the case of New Zealand and joint Australian/New Zealand Standards, these can be viewed on the Standards New Zealand website at www.standards.co.nz. In the case of other documents, these can be accessed through the list of websites set out in section 0.7.

0.6.1 New Zealand Standards

NZS 3101:2006 Parts 1 & 2 Concrete structures standard – The design of concrete structures

NZS 3109:1997 Concrete construction

NZS 3114:1987 Specification for concrete surface finishes

NZS 3602:2003 Timber and wood-based products for use in building

NZS 3603:1993 Timber structures standard

NZS 3604:1999 Timber framed buildings

NZS 3640:2003 Chemical preservation of round and sawn timber

NZS 4203:1992 Vols 1 and 2 General structural design and design loadings for buildings

0.6.2 Joint Australian/New Zealand Standards

AS/NZS 1170.2:2002 Structural design actions – Wind actions

AS/NZS 1604.3:2004 Specification for preservative treatment – Plywood

AS/NZS 2269:2004 Plywood – Structural

AS/NZS ISO 9001:2000 Quality management systems – Requirements

0.6.3 Australian Standards

AS 4055:1992 Wind loads for housing for other constructions

0.6.4 Other International Standards

ASTM C1257-06a Standard test method for accelerated weathering of solvent-release type sealants

ASTM D5-05a Standard test method for penetration of bituminous materials

ASTM D36-06 Standard test method for softening point of bitumen

ASTM D4799-08 Standard practice for accelerated weathering test conditions and procedures for bituminous materials

ASTM D 5147-07a Test methods for sampling and testing modified bituminous sheet material

ASTM E96/E96M-05 Standard test methods for water vapor transmission of materials

ASTM E154-08 Standard test methods for water vapor retarders used in contact with earth under concrete slabs, on walls, or as ground cover

BS EN 13707:2004 Flexible sheets for waterproofing

CGSB-37-GP 56M Lap joint strength, longitudinal and transverse

EN 1107-1:2000 Determination of dimensional stability Part 1: Bitumen sheets for roof waterproofing

EN 1109:2000 Bitumen sheets for roof waterproofing, determination of flexibility at low temperatures

EN 1110:2000 Bitumen sheets for roof waterproofing, determination of flow resistance at elevated temperatures

EN 1296:2001 Bitumen, plastic and rubber sheets for roof, method of artificial aging by long-term exposure to elevated temperature

EN 1849-1:2000 Determination of thickness and mass per unit area, Part 1: Bitumen sheets for roof waterproofing

EN 1928:2000 Bitumen, plastic and rubber sheets for roof waterproofing – determination of watertightness

EN 12691:2006 Bitumen, plastic and rubber sheets for roof waterproofing – determination of impact resistance

EN 12730:2001 Bitumen, plastic and rubber sheets for roof waterproofing – determination of resistance to static loading

EN 13707:2004 Definition and characteristics of reinforced bitumen sheets for roof waterproofing

EN 29073-1:1992 Textiles – test methods for non-woven textiles – determination of mass per unit area

ETAG 006:2000 EOTA (reference document): Systems of mechanically fastened flexible roof waterproofing membranes

ETAG 006 System of mechanically fastened flexible roof waterproofing with the CE mark

ISO 9001:2000 Quality management systems – requirements

0.6.4 Other Documents

IB33 Specification and Production of Concrete Surface Finishes, Cement and Concrete Association of New Zealand, www.cca.org.nz

Index of Codes of Practice on Torch-on Membrane Roof Systems (RILEM 120-MRS), http://www.rilem.org

New Zealand Building Code, 2004, The Department of Building and Housing, www.dbh.govt.nz

UEATC Technical Guide for Assessment of Roof Waterproofing Systems, www.ueatc.com

Working at Height Safety Guide - Best Practice Guidelines for Working at Height, www.sitesafe.org.nz

0.6.5 New Zealand Legislation

Building Act 2004

Building Regulations 1992 including the Building Code

Health and Safety in Employment Act 1992

0.7 Related Websites

- American Society for Testing and Materials – www.astm.org
- Building Research – www.buildingresearch.org.nz
- British Standards Institute – www.bsi.co.uk
- Canadian General Standards Board – http://www.pwgsc.gc.ca/cgsb/
- Cement and Concrete Association of New Zealand – www.cca.org.nz
- Commonwealth Scientific and Industrial Research Organisation (Australia) – www.csiro.au
- Department of Building and Housing – www.dbh.govt.nz
- Deutsches Institut Für Normung – www.din.de
- European Committee for Standardization – www.cenorm.be
- European Union of Agrément. Also known as the European Union for Technical Approvals or Union Européenne pour L'Agrément Technique dans la Construction – www.ueatc.com
- Joint Accreditation System of Australia and New Zealand – www.jas-anz.com.au
- International Union of Laboratories and Experts in Construction Materials, Systems and Structures – www.rilem.org
- Membrane Group NZ Inc. – www.membrane.org.nz
- New Zealand Legislation – www.legislation.govt.nz
- Roofing Association of New Zealand – www.roofingassn.org.nz
- Site Safe – www.sitesafe.org.nz
- Standards Australia – www.standards.org.au
- Standards New Zealand – www.standards.co.nz

0.8 Foreword from the Department of Building and Housing

The Membrane Group New Zealand Incorporated has asked the Department of Building and Housing to write a foreword to this Code of Practice for Torch-on Membranes.

There has been much consideration in recent times of the weathertightness of timber framed buildings, particularly those with low pitched or flat roofs where the ingress of moisture may cause the eventual breakdown of materials and lead to the formation of mould, mildew and health problems for inhabitants.

This new Code of Practice focuses on Torch-on Membrane Systems for roofing and decks because of their longstanding use in the construction industry.

The Department congratulates the Membrane Group on its initiative in producing this Code of Practice for Torch-on Membranes. It is encouraging to see industry groups creating their own guidance and codes of practice to complement Departmental guidance and Compliance Documents. Note however, that this Code of Practice is not part of the Department's Compliance Documents or range of guidance documents.

As part of the development of this Code of Practice, the Department understands that there has been wide industry consultation with those sectors regularly associated with torch-on membranes. It is due to the extensive contributions of the Membrane Group and the many other contributors that this Code of Practice has been produced. It is therefore a publication reflecting substantial experience for the selection of and achieving weathertight detailing for torch-on membrane cladding to roofing, decks and gutters, etc.

Torch-on membranes are an alternative solution to the Department's Acceptable Solution E2/AS1. However, we look forward to this document becoming a useful resource for the industry to assist with the selection, design, installation and assessment of torch-on waterproofing systems.

0.9 Introduction

This Code of Practice was developed to provide information on the selection, design and installation of torch-on membrane systems in New Zealand (see footnote concerning the Pacific Islands[1]). It represents current industry best practice for all aspects of torch-on membrane systems that would be expected on a work site.

This Code of Practice should be used by all sectors of the building industry when applying any torch-on membrane system for waterproofing. For example, it aims to assist:

- Suppliers who supply the market by providing minimum benchmark performance criteria for their product
- Specifiers by giving a guide to selecting the most appropriate product for the required application
- Designers by giving a guide to specifying and detailing the use of torch-on membrane systems
- Building consent officials by setting out benchmark information for the issuing of a building consent
- Applicators by giving benchmark information for installation methodology
- Site supervisors by giving access to benchmark installation requirements
- Building Consent Authorities (BCA) by giving benchmark information for on-site inspections
- Suppliers who accredit companies and/or their staff for the application of their product by knowing the minimum levels of the required industry training and competencies
- The Owner to have peace-of-mind that the torch-on membrane system has been correctly specified and detailed by the Designer in conjunction with the Supplier, installed by the Applicator and signed-off by the BCA as part of the Code Compliance Certificate (CCC).

This Code of Practice was developed by the major Suppliers of torch-on membrane products in New Zealand, with input from targeted industry organisations. The draft was then released for selected industry comment before final publication.

This Code of Practice has been set out in the expected project sequence for the use of any torch-on membrane system. Specifically, it will help in selecting the correct product for the required application, ensuring that construction details meet the current industry best practice methodology, and that physical installation practices on site are effective, safe, consistent and orderly.

It is recognised that the needs of the industry will change over time and that changes to this Code of Practice or additional information may be required. Thus it is intended that this Code of Practice will be regularly reviewed.

Based on the collective experience of the torch-on membrane Suppliers in New Zealand and Contractors and Specifiers within the roofing industry, this Code of Practice is published with the intention of maintaining and improving performance standards of torch-on membrane systems, materials and their application. Further, this Code of Practice may be used to develop recommended training criteria and set installation methodology benchmarks for the industry.

[1] This information is also intended to be applicable to torch-on membrane system installations in the Pacific Islands. However, Designers, Suppliers and Applicators must check with appropriate Building Consent Authorities for any local building compliance issues, which may take precedence over this Code of Practice.

1. Scope and Limitations

The Membrane Group New Zealand Inc (the Membrane Group) is a free association of people in the industry who represent membrane marketers, installers and other persons or entities with an interest in the use and installation of membrane products.

The purpose of this Code of Practice is to define and ensure high standards of conduct in relation to the use and installation of membrane products and wherever possible to exceed the minimum requirements for products and installation required by law or manufacturer's specifications. Furthermore, it is the purpose of this Code of Practice to promote best trade practice standards and in turn foster confidence in the Codes of Practice methodologies both from the building industry and consumers.

A member of the Membrane Group undertakes to comply with the Rules and Codes of Practice of the Membrane Group. Acceptance and observance of the Rules and Code is a condition of membership. Additionally, it is a requirement of membership that all Members ensure that all agents acting on their behalf are fully conversant with the provisions of this Code of Practice.

Persons or entities that are not members of the Membrane Group are invited to accept and observe this Code of Practice, but it is important to remember that this Code of Practice applies only to the conduct and behaviour of Members. In addition, it should be noted that this Code of Practice does not apply to contractual disputes. Disputes over contractual rights and obligations should be dealt with under the provisions of the particular contract between the parties. It is not the purpose of this Code of Practice to alter contractual rights or obligations between parties - any such disputes should be referred to the courts/an arbitrator or other dispute resolution mechanisms.

This Code of Practice is not and does not purport to be a New Zealand Standard, but reflects the Membrane Group's commitment that membranes and all other materials and installation methodologies associated with membrane products must maintain a high standard in order to ensure public and industry confidence in the membrane industry is preserved.

Adherence to this Code of Practice in no way reduces a Members' responsibilities to comply with the Commerce Act 1986 and the Fair Trading Act 1986, and with other legislative requirements including the Building Act 2004, the Building Code and New Zealand Standards.

This Code of Practice is intended for use in New Zealand by all sectors of the building industry to provide best trade practice guidelines for the selection, design and installation of torch-on membrane systems for general commercial applications and otherwise for residential buildings that comply with NZS 3604:1999 Timber framed buildings.

The required minimum properties of materials are listed and relevant test methods are referenced. Specific performance limits where applicable are included to assist in the specification of a torch-on membrane system.

This Code of Practice specifically addresses decks and roofs to be covered with a torch-on membrane system and provides information on fully protected torch-on membrane systems on roofs e.g. a concrete slab over.

This Code of Practice for Torch-on Membrane Systems covers reinforced modified bitumen membranes. "Torch-on" is a commonly used phrase in this industry, and within the scope of this Code of Practice it covers all types of reinforced modified bitumen membranes, their selection, system, and all methods of installation and adhesion for the surfacing and waterproofing of buildings and structures.

This Code of Practice does not cover use in below ground applications, for example tanking or retaining walls. It is intended that these applications will be covered in other Codes.

This Code of Practice does not cover the structure upon which the torch-on membrane system is to be applied, except where minimum construction standards are required.

This Code of Practice is not designed to constitute or provide a work specification; however the information contained in this Code of Practice will provide assistance for work specification.

This Code of Practice requires the use of materials that meet all the performance requirements set out. Further documentation may be required in order to prove adequacy.

2. Definitions

The following definitions apply in relation to this Code of Practice only as they may have alternative meanings elsewhere in the industry.

NOTE – Some definitions below may not appear in this document but are included as they are commonly-used terminology in this industry.

Term	Definition
Acceptable Solution	An Acceptable Solution prescribes one way of complying with the provisions of the Building Code. Designs that comply with a compliance document must be accepted by the Building Consent Authority as complying with the provisions of the Building Code. Acceptable Solutions form part of the compliance documents produced by the Department. See Alternative Solution.
Adhesion	Bitumen members are adhered (or bonded) to the substrate by either heating the underside of the membrane, laying in a liquid bonding compound or by self-adhesive.
Adhesive Bonded	A method for bedding and adhering bituminous membranes onto substrates where an adhesive compound is applied to the substrate and the membrane is then embedded into the adhesive. See also “Cold Lay, Cold Laid”.
Alligatoring	Random minor cracking of the surface bitumen of the torch-on membrane.
Alternative Solution (may also be referred to as a “Performance Based Design solution”)	Alternative Solutions are design and construction solutions that are beyond the scope of the compliance documents as published by the Department. An Alternative Solution is a design solution that differs totally or partially from the solutions offered by the compliance documents but can be shown to comply with the Building Code. As such they are “stand-alone” solutions, which must be considered and approved on their individual merits by a Building Consent Authority. See Acceptable Solution.
APAO	Amorphous polyalphaolefin.
APP Modified	Bitumen modified by the addition of atactic polypropylene during the sheet manufacturing process.
Applicator	Any company approved by the Supplier to install its product. The company must be approved by the Supplier, work within recommended trade practices, and undergo sufficient training to ensure that the product is installed as required by the Supplier. Note that work installed by such a company may become an option under the DBH’s Licensed Building Practitioner programme or become part of “restricted work”.
Atactic Polypropylene	See APP Modified.
B2/AS1	The Acceptable Solutions form part of the Compliance Document for Building Code Clause B2 “Durability”. Buildings designed and built to B2/AS1 are deemed by the Department to comply with the performance requirements of Clause B2.

Ballast	An anchoring material laid over the torch-on membrane to add weight to assist in holding the membrane in place, particularly to resist uplift by wind. Usually gravel-like material, aggregate or loose-laid concrete pavers. Also provides UV and physical protection to the torch-on membrane, improved appearance, and drainage.
Base Layer, Base Sheet	The under or first layer (sheet) of a multi-layered (sheet) modified reinforced bitumen membrane system that incorporates overlaps joints welded.
BCA	See Building Consent Authority.
Bio-resistance	Resistance to degradation by biological attack.
Blister	An enclosed pocket of vaporised water and/or solvent trapped between substrate and the torch-on membrane or between impermeable layers of the torch-on membrane.
Bond Breaker	A material used to prevent adhesion between two elements to allow substrate structural movement and reduce stress on the torch-on membrane layer.
Bonding	See Adhesion
Buckling	An upward elongated tenting displacement (rippling) of the Torch-on membrane due to movement in the substrate or structure.
Building Code	The First Schedule to the Building Regulations 1992 that sets national, mandatory standards for building work. All building work in New Zealand must comply with the Building Code. The Building Code is performance-based and specifies how a building and its components must perform, as opposed to how the building must be designed and constructed.
Building Consent Authority (BCA)	Building Consent Authorities issue building consents, undertake inspections during construction and issue Code Compliance Certificates, notices to fix and compliance schedules. A BCA is a territorial authority, regional authority or private body that has been registered by the Department of Building and Housing after having been assessed and accredited by the Building Consent Accreditation Body. The BCA must have demonstrated that the necessary resources, capabilities and systems and processes are in place to meet the accreditation regulations/standards.
Cap Sheet	The top or finish layer to a torch-on membrane system.
Cavity Ventilation	A ventilation system that allows the venting of air or moisture from the space between the substrate of a deck or a roof and the ceiling below. See also Substrate Ventilation.
CCC	See Code Compliance Certificate.
Chalking	The degradation or oxidisation of the bitumen or coating surface.
Code Compliance Certificate (CCC)	A code compliance certificate is a formal statement issued by a Building Consent Authority at completion of building work that the building work carried out under a building consent application complies with the building consent.
Cold Lay, Cold Laid	Where a membrane is applied to a surface without being torched-on. This could be with the use of a self-adhesive membrane or a liquid-bonding compound. Also used in situations where heat or naked flames may be dangerous, eg to the Applicator or due to proximity to flammable materials. See also Adhesive Bonded.

Cold Roof	Where there is a cavity between the roof structure and ceiling, the principal thermal insulation is placed at or immediately above the ceiling so that the roof covering and structure are at a temperature closer to that of the exterior of the building. See also Warm Roof, Insulated Roof, Inverted Roof.
Compliance Document	These include Verification Methods (a prescriptive design solution with a calculation or test procedure) and Acceptable Solutions (design details for construction) found in the non-mandatory Compliance Documents that the Department of Building and Housing produces that are an approved way of complying with the Building Code. Designers are not obliged to use Compliance Documents, and may put forward their own alternative solution proposal.
Composite Modified	Two or more bituminous components with reinforcement manufactured to create one single torch-on membrane layer.
Compression Bar	See Termination Bar.
Copolymerisation	A chemical reaction that results in the bonding of two or more dissimilar monomers to produce large, long-chain molecules, which are copolymers.
Cove, Coving	See Fillet.
Creep	The deformation of the bituminous torch-on membrane caused by the movement of the torch-on membrane, due to lack of bonding, thermal stress or loading.
Cross Ventilation	Air movement in a roof cavity between vents.
Deck	Areas covered by a torch-on membrane which can be expected to have regular access and activity occurring on them.
Defects Liability Period	A period stipulated in a construction contract (or sub-contract) during which any defects or unsatisfactory performance is the responsibility of the Contractor (or sub-contractor). See also Post-installation Maintenance.
Deflection	Displacement (bowing or sagging) of the structure or substrate such that ponding may occur.
Degradation	A deleterious change in the chemical structure, physical properties or appearance of the bituminous torch-on membrane or coating.
Delamination	Delamination can describe 3 possible scenarios: • Separation within a single layer torch-on membrane system • Separation between the layers of a multi-layered torch-on membrane system, or • Separation of the torch-on membrane system from the substrate.
Department, The	The Department of Building and Housing, incorporating the Building Industry Authority after its dissolution in 2004.
Designer	The Designer is the person who specifies the product to be used and who prepares the installation design details. NOTE – With the proposed introduction of the Licensed Building Practitioner (LPB) system by the Department from 2009, the person who selects the product and/or designs the installation will need to meet the proposed LBP Designer criteria and qualifications.

Dew Point	The temperature at which air is saturated with moisture, and condensation will occur on a cool surface.
Double Layer System	Two layers (sheets) of a modified reinforced bitumen membrane fully heat bonded together with overlaps joints of both layers welded.
Dropper	Placed at the low point of a gutter or roof to allow water to flow into the surface water system. It can be a proprietary preformed component or can be produced on-site from a formed bitumen torch-on membrane.
Dual Modified	See Composite Modified.
E2/AS1	The Acceptable Solutions form part of the Compliance Document for Building Code Clause E2, "External Moisture". Buildings designed and built to E2/AS1 are deemed by the Department to comply with the performance requirements of Clause E2.
Eaves Venting	A grilled space or gap at the eaves or soffit to provide venting of the roof cavity.
Elongation	The ability of the bituminous torch-on membrane to be stretched by the application of a force.
Embedment	Installation of the bituminous torch-on membrane into a bituminous compound adhesive.
Embrittlement	The loss of flexibility or elasticity of the bituminous torch-on membrane or coating.
EPS	Extruded polystyrene sheets.
Exposed Membrane System	A membrane system that is directly exposed to UV and/or weathering.
External Waterproofing Area	The area that the torch-on membrane system is being applied to. It may include, but is not limited to, roofs, gutters, inverted roofs, decks, balconies, terraces, podiums, bay-window hoods, planter boxes and roof gardens.
Extruded Polystyrene (XPS)	Extruded Polystyrene (XPS) foam is extruded closed cellular foam with uniform fine air cells that are not inter-connected and therefore is water impermeable and dimensionally stable.
Fillet, Angle Fillet	Used to ease the transition of an internal angle for the torch-on membrane and to accommodate expected movement in the Substrate. Triangular in shape. Minimum dimensions are ex 20 x 20mm. Usually timber but may be concrete, plaster or a composite material. Timber Fillets must be treated to at least H3.1.
Finish Layer	See Cap Sheet.
Flashing	Component used to weatherproof or seal the edges of the torch-on membrane system at all perimeters and penetrations. May be of custom-formed membrane, or other rigid or flexible waterproof material, that drains or deflects water away.
Flood Test	Procedure of controlled retention of water over the torch-on membrane to determine the effectiveness of waterproofing.
Glass Mat	A woven or non-woven glass fibre reinforcement mat within a bituminous torch-on membrane for dimensional stability.
Gutter Linings	Torch-on membrane systems used to line water collection channels.

HDEPS	High-density extruded polystyrene sheets.
Heat Welding	Method of melting and fusing together the overlapping layers of the bituminous torch-on membrane.
Installation	The installation of a modified reinforced bitumen membrane system.
Installation Instructions	Instructions provided by the Supplier of the torch-on membrane covering the recommended installation procedures for their product.
Installer	See Applicator.
Insulated Roof	Has insulation either between the substrate and the torch-on membrane system, or sandwiched between layers of membrane in a multi-layer system. See also Cold Roof, Inverted Roof, Warm Roof.
Inverted Roof	A variant of the Warm Roof, where the principal thermal insulation is placed above the roof covering, so that the structural deck and support are at a temperature close to that of the interior of the building. See also Cold Roof, Insulated Roof, Warm Roof.
Lap	The laying of one sheet over another to form a joint that is then heat welded to form a waterproof bond.
Layer	A single layer (sheet) of a modified reinforced bitumen membrane with overlaps joints welded.
Licensed Building Practitioner (LBP)	Since November 2007, people in the building industry have been able to apply to be licensed in a range of classes depending on the work they do. In total, there are 13 licensing classes covering things like carpentry, site supervision, design and some specialist trades, like roofing and plastering. From after November 2010, it is intended that “restricted building work” will only be able to be done or supervised by licensed practitioners – specific details are still being developed by the DBH. To become licensed, people have to show they have the skills, knowledge and experience to do their work competently. There is a formal assessment process and once licensed, LBPs have to maintain their skills and knowledge with ongoing learning in their particular field. As the torch-on membrane systems will invariably form part of the waterproofing system for the building and thus be classified as restricted work, it is likely that Installers/Applicators will be required to become or otherwise be supervised by a LBP.
Loose-laid Torch-on Membrane System	A torch-on membrane system that is not attached to the surface except under laps, perimeter of roof and penetrations.
Low Slope Roof	A low slope roof has a slope of not more than 80 and not less than 1.50. See also Pitched Roof.
Low Temperature Flexibility	The ability of the torch-on membrane material to remain flexible at low temperature.
Main Contractor	The person, company or body that contracts the Applicator to install the torch-on membrane system.
Maintenance	See Post-installation Maintenance.

Manufacturer	The manufacturing company that produces the torch-on membrane components and may provide the recommended methods of installation to ensure product performance. The company may not sell or market products itself in New Zealand. This function is normally performed by licensed or nominated Suppliers.
Material Safety Data Sheet (MSDS)	Data sheet with specific health and safety information for a specific product.
Mechanically-fastened	Where the modified bitumen membrane is attached at defined intervals or areas to the substrate by mechanical fasteners.
Membrane	A reinforced, modified bitumen sheet that is impervious to liquid water.
Mineral-surfaced Sheet	A modified bitumen membrane sheet with natural or synthetic granules bonded to the upper surface primarily as UV protection and secondly to provide an aesthetic finish.
Modified Bitumen	Bitumen that has been modified through the inclusion of one or more polymers to provide the desired performance properties.
MSDS	See Material Safety Data Sheet
Multiple Layer System	Multiple layers (sheets) of a modified reinforced bitumen membrane, two of which must be fully heat bonded together with overlaps joints of both layers welded.
Overflow Outlet	An outlet, which provides overflow drainage of excess water in a gutter, deck or roof structure. See Scupper.
Parapet Box Outlet	See Scupper.
PEF	Polyethylene foam, which can be either a strip or rod, used as backing or a bond breaker for sealants or mortar fillings.
Performance Based Design	See Alternative Solution.
Pinned	Fixed at regular intervals with flat-headed annular grooved clouts.
Pitched Roof	A roof having a slope of greater than 80. See also Low Slope Roof.
Plinth	Any formed construction designed as a support. For the purposes of this Code of Practice, such plinths are required to be protected by the torch-on membrane system.
Ply	See Layer. Also describes component layers within a layer (sheet) of a modified reinforced bitumen membrane.
Polyester Fabric	A non-woven polyester reinforcement fabric within a bituminous torch-on membrane for tensile strength.
Ponding	Where water sits for more than 48 hours due to, for example, insufficiently designed roof falls, construction detail impediments (e.g. raised lap joints), or post-construction sagging in the Substrate.
Post-installation Maintenance	Maintenance or remedial work carried out after the completion of the contract, including any contracted defects liability period. This is the responsibility of the Building Owner. Any such maintenance must comply with the conditions of the maintenance statement/manual provided by the Applicator or Manufacturer. See also Defects Liability Period.

Primer	A material applied to the substrate prior to the membrane to enhance adhesion of the membrane system. Most often a liquid bituminous material.
Protected Roof Torch-on Membrane	A torch-on membrane system that has been fully covered and protected by, for example, a concrete slab, ballast, pavers or an asphalt layer.
Puncture Resistance	The extent to which the torch-on membrane material can withstand the action of a sharp object without perforation. Measured as the force required to be applied by a standard tool to cause the tool to penetrate the torch-on membrane system.
Rainwater Head	A fabricated rainwater collection device above the downpipe into which surface water flows from the roof or gutter. See also Sump.
Raised Surface	A removable top surface of the deck. Normally comprised of pre-cast concrete pavers or timber frame overlaid with slats (duck boards) supported on a profiled protection sheet or composite pad to provide drainage and easy access for maintenance of the torch-on membrane.
Re-cover	Over-sheathing or resurfacing of an existing bituminous membrane with a new and compatible bituminous torch-on membrane system.
Re-roofing	Removing and replacing the existing torch-on membrane with a new and compatible bituminous torch-on membrane system.
Ridge Vent	A vent system installed along the crest of a hip or ridge to allow warm moist air to dissipate.
Rippling	See Buckling.
Roof	Upper covering of building that provides weathertightness. A roof is not expected to have any activity occurring on it, apart from maintenance. See also Deck.
Sagging	The downward displacement of the structure or Substrate such that ponding may occur.
SBS Modified	Bitumen modified by the addition of Styrene Butadiene Styrene during the sheet manufacturing process.
Scupper	A rainwater outlet, allowing water to drain through a penetration in a wall, parapet or enclosed balustrade. Can be custom-formed on-site or a proprietary fitting used.
Self-adhesive	Where the underside of a bitumen membrane has a soft pliable bitumen compound designed to adhere to the substrate without any additional bonding compound or requiring the application of any heat.
Selvedge Edge, Selvege Edge (Note alternative spellings)	Longitudinal edge of a torch-on membrane sheet upon which the granular mineral surface is omitted during the manufacturing process to improve the adhesion of the welded overlap.
Sheet	Membrane supplied in rolls, when laid referred to as a layer. See also Layer.
Silting	Residue after evaporation of water. An indication of ponding.

Single Layer System	A torch-on bituminous membrane system that consists of one layer directly bonded to the substrate or over a perforated venting layer where the venting layer is not considered as a layer as it does not contribute to the waterproofing performance of the torch-on bituminous membrane system.
Sleeve	A device secured to the substrate to allow penetrating service pipes or ducts to move independently to the substrate and its torch-on membrane.
Slip Layer	See Bond Breaker
Solar Reflective Coating	Light coloured coating to reduce heat absorption by the reflection of solar radiation and to protect the membrane from UV radiation. Often of an aluminium pigment composition.
Specifier	See Designer.
Spun-bond	A type of non-woven fabric formed from continuous fibre filaments bonded without an intermediate step.
Styrene Butadiene Styrene	See SBS Modified.
Substrate	The material to which the membrane is applied, usually plywood or concrete. Note that it is possible for the substrate to be acceptable but for the substrate surface to be unacceptable. See also Substrate Structure and Substrate Surface.
Substrate Structure	The structural element upon which the substrate is fixed. See also Substrate and Substrate Surface. Note that the structure may be independent of the substrate, eg a plywood substrate on a steel roof structure.
Substrate Surface	The face of the substrate to which the torch-on membrane is to be applied. Note that it is possible for the Substrate Surface to be acceptable and for the Substrate to be unacceptable. See also Substrate Structure and Substrate.
Substrate Ventilation	A ventilation system that allows the venting of air or moisture from the substrate of a deck or a roof. See also Cavity Ventilation.
Sump	Box-like structure with bottom or side outlet for drainage placed at the lowest point in gutters or roofs. Can be made from either plywood lined with torch-on membrane, fabricated metal, or a proprietary preformed or moulded material.
Supplier	A company that supplies modified bitumen membrane system components, provides training for Applicators in the use and installation of the product range in accordance with the Manufacturer's recommendations and this Code of Practice. NOTE – All membrane sheets are imported and that no modified bituminous membranes are manufactured in New Zealand.
Surface Water	All naturally occurring water, other than sub-surface (or ground) water, which results from rainfall on the site or water flowing onto the site, including that flowing from a drain, stream, river, lake or sea.
System	A single or multiple-layered installation of torch-on membrane(s). The minimum number of layers can be determined from Figure 2 and Tables 5 and 6.

Tear Strength	The maximum force (edge tear) that can be applied to a torch-on membrane at the edge before it will tear (similar to tearing a sheet of paper in half, see also Tensile Strength).
Tensile Strength	The maximum force (pulling stress) that can be applied to a torch-on membrane so that it is stretched without splitting or breaking apart. (Similar to gripping a piece of tissue paper at opposite ends with two hands and pulling the hands apart till the tissue splits.) See also Tear Strength.
Tenting	See Buckling.
Termination Bar	A flat metal trim that protects an exposed edge of a torch-on membrane system and is mechanically fixed in place.
Thermal Self-Adhesive	Where the underside of the reinforced bitumen base sheet membrane has a soft pliable bitumen compound designed to initially stick to the substrate and to become fully bonded when heat is applied by torching over a cap sheet.
Top Sheet, Top Layer	See Cap Sheet.
Torch-on Membrane	A reinforced, modified bitumen sheet membrane that is installed by heating the membrane to soften the underside of the bitumen mass to ensure adhesion to the substrate, plus all overlaps and flashings. Base sheets can be self-adhesive or bedded in a liquid-applied compound with overlaps heat welded.
Torching on	The process of applying heat to the underside of the membrane to bond the membrane to the substrate or to another layer.
Traffic	Light traffic is maintenance foot traffic only. Heavy traffic is vehicular traffic (motorised or manual).
Uplift, Wind Uplift	The effect of negative air pressure (suction) immediately above the roof surface caused by the passage of wind over or around a building. Generally greater at the roof edges, ridges or obstructions. Can also refer to positive air pressure applied underneath the torch-on membrane. Can cause loss of adhesion of the torch-on membrane to its substrate.
UV	Ultra-violet light.
Vapour Migration	The movement of water vapour under pressure.
Vent Layer, Ventilation Layer, Venting Layer	A perforated, fleece-backed or groove-backed (profiled) or smooth-backed modified reinforced bitumen membrane spot adhered or mechanically fixed to the substrate to allow air to circulate freely and which is not a waterproof layer in a multiple layered system. (See p31, 4.6.1, “V1, Perforated Vent Layer”) OR A fleece-backed, groove-backed (profiled) or smooth-backed (spot adhered) modified reinforced bitumen membrane which allows air to circulate freely, with overlaps joints welded and which is a waterproof layer in a multiple layered system. (See p31, 4.6.2, “B1, Vent Sheets”)
Vented Multiple Layer Torch-on Membrane System	A torch-on roofing membrane system where the base layer is only partially bonded to the Substrate to allow the movement of water vapour from beneath the torch-on membrane to the atmosphere.
Ventilation	See Cavity Ventilation, Substrate Ventilation.

Verification Methods	Verification Methods are compliance documents and are methods of test or calculation by which materials or construction methods can be shown to meet the provisions of the Building Code.
Warm Roof	Whether there is a cavity or not between the roof structure and ceiling, the principal thermal insulation is placed immediately above the roof covering so that the roof covering and structure are at a temperature close to that of the interior of the building. See also Cold Roof, Insulated Roof, Inverted Roof.
Waterproof, Waterproofing	The complete and total resistance of a building element to the ingress of any moisture, whether as liquid or vapour.
Water-resistant	Relates to a material that will restrict the rate of water passing through it, but is not impermeable to water.
Watertight	Relates to a material able to withstand a water test under positive head.
Weathertight, Weathertightness	Terms used to describe the resistance of a building to weather. Weathertightness is not necessarily waterproofing, but rather where water is prevented from entering and accumulating behind cladding in amounts that can cause undue dampness or damage to the building elements.
Water Vapour Barrier	A torch-on membrane having a resistance to the passage of water vapour.
Welded	The bonding or fusing together of two surfaces or materials by the application of heat.
XPS	See Extruded Polystyrene.

3. Framework of Building Regulations

3.1 General

All torch-on membrane installations must comply with the Building Code, with specific regard to clauses B2 Durability and E2 External Moisture.

New Zealand has a performance-based building code, the Building Code, which sets out objectives, performance criteria and functional requirements for all buildings. The Building Code applies equally throughout the country – how these requirements are met is the individual responsibility of the Building Owner and their Designer/Specifier.

Building controls exist to ensure buildings are safe and healthy to live and work in. The framework for setting out these controls is in three parts:

1. The **Building Act 2004** sets out the law on building work.
2. The **Building Regulations 1992** contain the mandatory Building Code, and also the rules about building consents and building inspections.
3. The **Building Code** sets out performance standards that all building work must meet. It consists of two preliminary clauses and thirty-five technical clauses and covers aspects such as moisture control, durability, access, fire safety, services and facilities, etc. Each technical clause consists of the following three levels:
   - (i) **Objectives** – The social objectives that the building must achieve
   - (ii) **Performance** – The criteria the building must meet in order to comply
   - (iii) **Functional requirements** –What the building must do to satisfy the social objective.

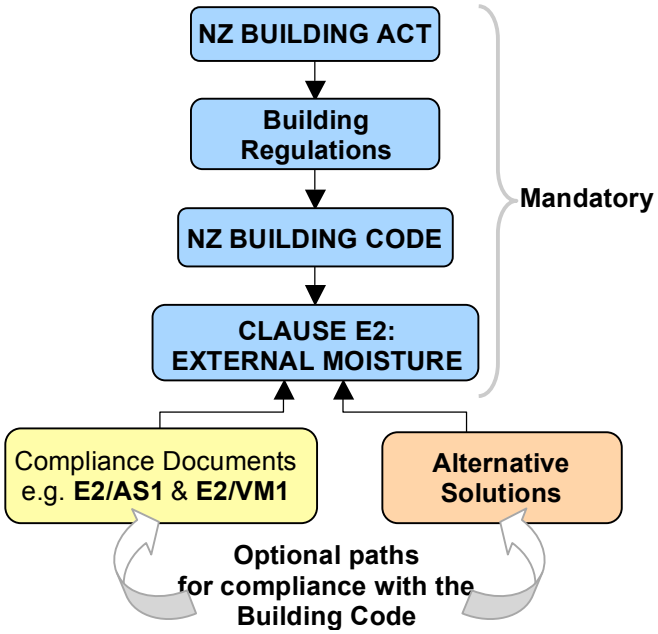


Figure 1 – Hierarchy of building legislation

The hierarchy of compulsory building legislation is illustrated in Figure 1 in the top four boxes while underneath there are various optional paths to Building Code compliance, for example with Compliance Documents or Alternative Solutions. There are other paths to compliance not shown such as through product certification or determinations. Figure 1 shows only one of the 35 clauses of the Building Code as an example.

The Department issues compliance documents (previously known as “Approved Documents”) containing “Acceptable Solutions” and “Verification Methods” which provide prescribed, specific solutions and methods that are deemed to comply with the Building Code. Compliance documents provide specific details for design and construction (i.e. “how to do it”). If complied with, a Building Consent Authority must accept that compliance with the Building Code is met.

The compliance documents are not mandatory and following them is only one way of complying with the Building Code. Designers/specifiers may choose to use a different method. For building designs or building elements outside the scope of the compliance documents there is no option but to use an “alternative” means of compliance.

3.2 Alternative Solutions

A Building Consent Authority will require sufficient evidence to be satisfied, on reasonable grounds, that a particular consent proposal will meet the objectives and functional provisions of the relevant Building Code clauses.

Therefore, in contrast to acceptable solutions within the compliance documents, alternative solutions are subject to the approval of the Building Consent Authority. Some ways to demonstrate that an alternative solution proposal will meet the relevant parts of the Building Code.

Torch-on membrane systems are not specifically contained within compliance documents, so they must be presented in the consent application as a proposal for an alternative solution. Therefore sufficient evidence of compliance may be required for Building Code clauses such as B2 Durability, E1 Surface Water, E2 External Moisture or F2 Hazardous Building Materials.

3.3 Proof of Compliance

The onus of proof of compliance is with the Building Owner (or their agent such as a Designer/Specifier, Engineer, or Builder). The Owner/applicant must provide sufficient evidence showing that the proposal meets the provisions of the Building Code. When the design is complex, the standard of proof will be significant – the building consent applicant's word that it will work is not usually sufficient.

3.3.1 New Zealand Building Code Clause B2, Durability

The following italicised information is an extract from the Building Code (the numbering is as per the Building Code).

The durability of any torch-on membrane system must not be less than the durability requirements as prescribed in Clause B2 of the NZ Building Code, i.e. not less than 15 years.

B2.1 The objective of this provision is to ensure that a building will throughout its life continue to satisfy the other objectives of this code.

Functional Requirement

B2.2 Building materials, components and construction methods shall be sufficiently durable to ensure that the building, without reconstruction or major renovation, satisfies the other functional requirements of this code throughout the life of the building.

Performance

B2.3.1 *Building elements must, with only normal maintenance, continue to satisfy the performance requirements of this code for the lesser of the specified intended life of the building, if stated, or:*

- *(a) The life of the building, being not less than 50 years, if:*
  - *(i) Those building elements (including floors, walls, and fixings) provide structural stability to the building, or*
  - *(ii) Those building elements are difficult to access or replace, or*
  - *(iii) Failure of those building elements to comply with the NZ Building Code would go undetected during both normal use and maintenance of the building.*

(b) 15 years if:

(i) Those building elements (including the building envelope, exposed plumbing in the subfloor space, and in-built chimneys and flues) are moderately difficult to access or replace, or

(ii) Failure of those building elements to comply with the NZ Building Code would go undetected during normal use of the building, but would be easily detected during normal maintenance.

(c) 5 years if:

(i) The building elements (including services, linings, renewable protective coatings, and fixtures) are easy to access and replace, and

(ii) Failure of those building elements to comply with the NZ Building Code would be easily detected during normal use of the building.

***B2.3.2** Individual building elements which are components of a building system and are difficult to access or replace must either:*

(a) All have the same durability, or

(b) Be installed in a manner that permits the replacement of building elements of lesser durability without removing building elements that have greater durability and are not specifically designed for removal and replacement.

Performance B2.3.1 applies from the time of issue of the applicable code compliance certificate. Building elements are not required to satisfy a durability performance which exceeds the specified intended life of the building.

3.3.2 New Zealand Building Code Clause E2, External Moisture

Objective

***E2.1** The objective of this provision is to safeguard people from illness or injury which could result from external moisture entering the building.*

Functional Requirement

***E2.2** Buildings shall be constructed to provide adequate resistance to penetration by, and then accumulation of, moisture from the outside.*

Performance

***E2.3.1** Roofs shall shed precipitated moisture. In locations subject to snowfalls, roofs shall also shed melted snow.*

***E2.3.2** Roofs and exterior walls shall prevent the penetration of water that could cause undue dampness, or damage to building elements.*

***E2.3.3** Walls, floors and structural elements in contact with the ground shall not absorb or transmit moisture in quantities that could cause undue dampness, or damage to building elements.*

***E2.3.4** Building elements susceptible to damage shall be protected from the adverse effects of moisture entering the space below suspended floors.*

***E2.3.5** Concealed spaces and cavities in buildings shall be constructed in a way which prevents external moisture being transferred and causing condensation and the degradation of building elements.*

***E2.3.6** Excess moisture present at the completion of construction, shall be capable of being dissipated without permanent damage to building elements.*

3.3.3 The "4-Ds" Principles

As part of the weatherproofing system, the design and installation of any torch-on membrane system must comply with the requirements of Clause E2 of the Building Code.

The new Acceptable Solution, (E2/AS1, Amendment 2) for Building Code clause E2, External Moisture, was issued on 1 July 2005. The underlying philosophy of the changes is the adoption of the "**4Ds**" principles of water management in buildings. The 4Ds will ideally be incorporated into a design and are:

Deflection – that is, keeping rain away from potential entry points by using features like eaves or flashings.

Drainage – providing "paths" for water that leaks through a cladding to drain away. Drained cavities are an example of this.

Drying – removing any remaining moisture behind the cladding that does not drain away – principally through ventilation or diffusion.

Durability – making sure materials used to construct walls and roofs have an appropriate level of durability for the situation they will be used in.

Other key elements of the Acceptable Solution E2/AS1, include:

- The introduction of a risk management approach to weathertightness design through a risk assessment tool called the risk matrix. That is, the more at risk a building is of leaking (based on a range of factors such as complexity of design and exposure to wind), then the greater the level of protective features required.
- The introduction of a drained and drying cavity – depending on the risk matrix score and the chosen wall cladding.
- Greater detail for the design of moisture protective features such as flashings and cappings for parapets.
- More detail around designing problematic areas like decks, balustrades and balconies.

3.4 Implied Warranties in Contracts for Building Work

From 30 November 2004, implied warranties to protect consumers took effect under sections 396-399 of the Building Act 2004. These implied warranties are implied in all building contracts for household units, whether specified in the contract or not.

These warranties include the expectation that the work of builders, specialist trades and developers will be done competently and use suitable materials. The warranties are implied despite any provision to the contrary in any agreement. It is not possible to contract out of these provisions.

3.4.1 Written Guarantees / Warranties

Written guarantees/warranties from a Contractor (or Applicator or Supplier) are an assurance that rests between the contracting parties, such as the Building Owner and the Contractor/Subcontractor. However, assurances from a Contractor regarding their workmanship are usually to confirm that the installation was carried out in accordance with the plans and specifications and Supplier's recommendations.

The protection provided by written guarantees/warranties is commonly misused as evidence that the requirements of Clause B2, Durability, of the NZ Building Code, will be satisfied. As evidence of durability must be provided as part of an application for consent, the BCA should consider the requirements of B2, Durability, when assessing and approving building consent applications. Thus, many Building Consent Authorities (BCA) request a copy of a guarantee/warranty at the completion of application.

Any guarantee/warranty for workmanship that a Contractor offers to the Building Owner does not relieve the BCA from responsibility to inspect the work. For the BCA to satisfy itself that the consent application, construction and completed work meets the Building Code performances and building consent conditions, it may need to carry out adequate and thorough checks and inspections.

3.4.2 Producer Statements

A Producer Statement is a statement expressing the author's view that plans, specifications, or completed works comply with the technical requirements to satisfy some or all requirements of the Building Code. A Producer Statement will usually be issued by a recognised specialist, for example, an engineer, architect or competent contractor. It is up to the Building Consent Authority (BCA) to decide whether or not to rely on such a statement. These documents have no specific status in law, but they can still be accepted and considered by a BCA as part of the plans and specifications.

4. Product: Properties, Selection, Specification

4.0 General

A fundamental requirement of any torch-on membrane system is that it must provide protection from all weather conditions likely to be experienced during its design life. All individual layers in a torch-on membrane system must be watertight, and together the whole system must be waterproof.

This section sets out the minimum properties of any component of a torch-on membrane system.

Three aids have been developed in this Code of Practice to help select the most appropriate torch-on membrane system:

- Table 5, Possible Torch-on Membrane Systems lists the most common combinations of membranes that can form a waterproof membrane system
- Figure 2, the System Selection Flow Chart, shows the range of options based on the surface to which it is being applied and the required service life of the membrane
- Section 4.6, Range of Torch-On Membranes, lists membranes developed for standard and specialised service conditions.

4.1 Scope and Limitation

This Code of Practice gives information for the selection of the appropriate torch-on membrane system, detailing, installation and finish.

The design of the substrate structure is the responsibility of the Designer. The information provided in this Code of Practice will assist the Designer, but it is the Designer's responsibility to ensure that the substrate and/or substrate structure design will meet the full requirements of the Building Code.

Application limitations may include (but are not limited to) high traffic areas, plant rooms, commercial and industrial discharge areas, chemical storage and any other arduous use or condition. In such instances, refer to the Supplier and/or Designer to ensure an appropriate system is selected.

4.2 Test Methods and Performance Criteria

This Code of Practice is based on existing New Zealand practice supplemented with European practice and performance criteria. Europe is the region where most major modified bitumen membrane Manufacturers, or their holding organizations, are based. The European Standards organisation (UEAtC) gives both a coherent framework for the evaluation of the performance of torch-on modified bituminous membranes and a definitive and wide ranging set of Standards (called European Norms) for the testing of such membranes.

Equally, ASTM, CGBS and DIN have also developed similar testing criteria, which can be used to show performance capability.

While the purpose of this section is to ensure that material of an assured quality is supplied to site, it should be noted that these performance criteria are quite distinct from on-site performance, which can be influenced by on-site installation practice and local service conditions.

Selected test methods and performance criteria of membrane components are set out in Tables 1 to 4. All tests relate to the properties of the torch-on membrane itself. If a torch-on membrane meets the requirements, then it will also comply with the as-laid tests stipulated in the UEAtc Technical Guide, and which are generally also included in Manufacturers and Suppliers literature.

In interpreting the tables and product literature, the following empirical definitions should be noted:

• MDV = Manufacturer's Declared Value	This is the value of a physical property, expressed as a norm with stated maximum/minimum deviation, consistent with production practice (e.g. tensile strength 750N ± 20%)
• MLV = Manufacturer's Limiting Value	This is the value of a physical property, defined as an absolute minimum or maximum as appropriate (e.g. thickness >3.8mm).

Table 1 – Sheet Properties

Property	Examples of Test Methods	Code Value (MDV, MLV)	Acceptable Deviation
Thickness	EN 1849-1	As per Table 6	± 5% of MDV
Mass/Unit Area	EN 1849-1	This value will depend on the Manufacturer's declared end-product mass/unit area.	Mineral ± 15% MDV Plain ± 10% MDV
Fines Content	Soxhlet Extraction	Maximum 25%	± 5% of MDV
Reinforcement Weight (mass/unit area)	EN 29073 Pt1 ASTM D6509	Polyester Cap Sheet Minimum 180g/m^2 Glass Base Sheet Minimum 50g/m^2 Polyester Base Sheet Minimum 120g/m^2	± 10% of MDV

Table 2 – Performance Requirements

Property	Examples of Test Methods	Code Value	Acceptable Deviation
Resistance to Wind Uplift	ETAG 006 adapted to 4.3.2 of UEAtc Technical Guide	Test results reported in kPa	Not applicable. Results are used in design calculation
Resistance to Static Load	EN 12730	Maximum: Single Layer L15 Multi Layer L25	Nil
Resistance to Impact	EN 12691 (15mm ø tool)	Maximum: SBS I-10 APP I-20	Nil
Watertightness	EN 1928 Method A	Minimum 10Kpa	Nil
Dimensional Stability **(Free Shrinkage)**	EN 1107-1	≤ 0.5% Multi Layer ≤ 0.5% Single Layer	Nil
Flexibility at **Low Temperature**	EN 1109	APP Modified ≤ -10^0C SBS Modified ≤ -15^0C	-10^0C at time of manufacture

Table 3 – Aging Properties: Exposure to Temperature

Exposure to Temperature (24 weeks at 70^0C)		
Property	**Examples of Test Methods**	**Code Value**
Flexibility	EN 1296 and EN 1109	Non Cracking ≤ 0^0C Maximum deviation of ±15^0C from initial low temperature flexibility
Flow Resistance at Elevated Temperature	EN 1296 and EN 1110	APP Modified ≥ 125^0C SBS Modified ≥ 100^0C

Table 4 – Aging Properties: Exposure to Water

Exposure to Water (1 week immersion at 230^0C)		
Property	**Examples of Test Methods**	**Code Value**
Flexibility at Low Temperature	EN1296 and EN1109	Maximum deviation of ±5^0C from initial low temperature flexibility

4.3 Properties of Materials

The performance requirements for materials are generally set out in 4.3.1 to 4.3.12. A balance of values for the listed attributes is desirable, though they must remain within the levels of acceptable performance for any given attribute. Some of these requirements are a general expression rather than a specific measurement of specific requirements as detailed in Tables 1 to 4.

4.3.1 Tensile Strength

The torch-on membrane must have sufficient tensile strength to resist stresses caused by internal and external forces imposed upon it. Torch-on membranes should never be expected to perform as structural members.

4.3.2 Elongation at Break

The torch-on membrane must have sufficient elasticity to prevent rupture due to elongation.

4.3.3 Tear Resistance

The torch-on membrane must resist tearing or ripping when subjected to anticipated external and internal forces. This is particularly relevant when used in exposed conditions.

4.3.4 Bond Strength to Substrate

Where the torch-on membrane is of a bonded or partially bonded type and used in exposed conditions it must have sufficient adhesion to resist applied forces without failure. Forces can result from wind loads, thermal movement, settlement and movement from discontinuity of substrate.

4.3.5 Water Vapour Transmission

Water vapour transmission through the external water proofing system must be adequate to prevent build-up of vapour pressure under it.

4.3.6 Abrasion Resistance
The torch-on membrane must withstand any anticipated and reasonable wearing. Possible abrasive causes are vehicular and pedestrian (if trafficable), wind-blown elements or other objects dragged across the surface.

4.3.7 Water Absorption
Water absorption must be limited so as to prevent the torch-on membrane from becoming unserviceable, e.g. due to a loss of strength, bond or a change in elasticity.

4.3.8 Temperature Resistance
The torch-on membrane must remain fully serviceable under design service conditions.

4.3.9 Heat Aging
Heat aging effects must be limited so as to prevent the torch-on membrane becoming unserviceable, for example due to a loss of strength or elasticity.

4.3.10 UV Protection
All torch-on membrane systems require an approved form of UV protection to prevent the degradation of the bituminous material.

If the membrane will be exposed on completion, the recommended protective measures include either:

- Embedded mineral granules. Selecting mineral membranes which comply with the technical requirements of this Code of Practice will ensure the mineral is well embedded (rolled-in) into the membrane to ensure non-shedding of mineral resulting in bald patches, or
- The Supplier's proprietary coating system. A high-performance reflective coating system is required to provide long term protection, as recommended by the Supplier.

4.3.11 Membrane Protection
If not exposed, the membrane can be protected by a range of design options, including being buried in gardens, overlaid with concrete or asphalt, or overlaid with pavers, ballast, tiles or raised removable surfaces such as timber decks. Specific detailing of such protection will be critical to the success or otherwise of the protection.

4.3.12 Other Properties
Other properties of torch-on membranes may be of particular significance depending on type of torch-on membrane, design of system and service conditions. These can include torch-on membranes designed and manufactured to (including but not limited to):

- Withstand root attack
- Provide a degree of fire resistance
- Provide insulation and noise control
- Allow for moisture ventilation
- Permit additional reinforcement for heavy industrial use
- Enable the collection of (potable) water for drinking

4.4 Durability/Maintenance
The durability requirements under the Building Code clause B2 Durability are that the membrane cladding system must be sufficiently durable to ensure that the building, without reconstruction or major renovation, continues to satisfy the performance requirements. In general terms, the torch-on membrane system must remain weathertight (as required by E2 External Moisture) and perform as required to provide not less than 15 years durability (as required by B2 Durability).

When a protective coating is used, it is intended to provide protection for a minimum of 5 years. Therefore, to meet the 15-year durability, the torch-on membrane system must be checked, maintained and resurfaced within a 5 to 7-year cycle. See section 8.

4.5 Product Performance

The manufacture of the reinforced modified bitumenous membrane must be quality controlled throughout the complete process from raw materials to the finish, including research and development.

Quality controlled manufacturing must be based on constant and regular internal self-checks and monitored by an issuing authority. The Manufacturer and the internal testing department must be ISO 9001 certified.

4.6 Range of Torch-on Membranes

Modified reinforced bitumen membranes as defined below can be applied either by torching on, setting in a liquid bedding compound or with a peel and stick self-adhesive on the underside of the sheet.

There is a wide range of torch-on membranes able to be used in a wide range of combinations. Possible systems are set out in Table 5. Each application meets a specific situation requirement, differing in composition (SBS, APP and composite), type and weight of reinforcement, surface finishes and profiles, properties, and characteristics.

This section covers the range of membranes that are suitable for New Zealand conditions, first the standard products most commonly used (4.6.1 to 4.6.7), then membranes with special properties or uses (4.6.20 to 4.6.25).

Designers should check with the Supplier that all torch-on membrane components are compatible.

The range of membranes listed in Table 6 is currently the most frequently used membranes in New Zealand. Other standard membranes or custom-designed membranes are available or are being developed with new advanced resins, reinforcement and finishes for specific design requirements.

4.6.1 Perforated Vent Sheet (V1)

A thin fibreglass reinforced bituminous membrane which has a regular pattern of 20mm to 40mm diameter holes (perforations) and is loose-laid over the substrate. When the next membrane layer is applied, the bitumen runs through the perforations and adheres to the substrate. The bond to the substrate surface is approximately 30%, thereby providing air spaces for moisture to dissipate.

This perforated vent sheet offers no waterproofing in itself and therefore is not considered to be part of the waterproofing membrane system.

There is a wide range of vent sheets available. If thinner than 2.0mm or only mechanically fastened throughout the sheet, then like the perforated vent sheet, it is not considered to form a layer of the waterproofing system.

4.6.2 Vent Sheets (B1)

Vent sheets of SBS or APP, polyester or glass reinforced 50-120+ g/m2 with overlapped seams and end-welded are considered a separate layer in a multi-layered torch-on membrane system.

They may achieve the venting effect by being mechanically fastened within the laps, by being spot-adhered, or having a profiled- or fleeced-back.

An APP glass fibre reinforced membrane 2.0mm minimum, mechanically fastened under overlap or spot adhered, can be used as the base sheet for a ventilation system.

The underside of the vent sheet can vary from fleece (non or partial bonding), undulating either in ridges, blobs or strips of soft bitumen to provide partial bond (approximately 60%) and moisture dissipation.

4.6.3 Base Sheet (B2, B3)

The base sheet forms the first layer of a multi-layered bituminous modified bitumen membrane system. Base sheets range in thickness from 2.0 to 4mm, comprised of either SBS or APP bitumen and reinforced by spun-bound polyester cloth, fibreglass or composition of both at weight of 120+ g/m^2.

They are torched on or adhesive-bonded fully adhered (unless of a vent type), overlapped and welded at side seams and ends. Some have a thermal self-adhesive underside for a full bond or a partially vented bond and achieve total bond when the cap sheet is torched on. Other types of base sheets may be mechanically fastened, being specifically designed with stabilised reinforcement to ensure dimensional stability and to avoid wrinkling.

4.6.4 Cap Sheet Smooth (C1, C2)

A cap sheet of SBS or APP modified reinforced bituminous membrane with a thickness of 3 to 5mm is reinforced with non-woven spun-bound polyester fabric with or without fibreglass strands at a weight of 180+ g/m^2 with a top surface finish of fine sand, talc or surfacing cloth that, if left exposed, will require over-coating.

4.6.5 Cap Sheet Mineral (C3, C4)

A cap sheet of SBS or APP modified reinforced bituminous membrane with a film thickness of 4 to 5mm (although more commonly referred to in weight from 3.5 to 4.5kg/m²), is reinforced with non-woven spun-bound polyester fabric with a top surface of mineral granules embedded in the bitumen. The selvedge edge (seams) is smooth (not coated in mineral) to allow full bitumen-to-bitumen bonding.

4.6.6 Metal-Faced Cap Sheet (SP7)

This cap sheet is an SBS modified reinforced bituminous membrane of film build 3 to 4mm, reinforced with a polyester fabric, and with a profiled face pre-finished with a fine metal foil sheeting.

Metal-faced cap sheets can only be applied over a multi-sheet modified bitumen membrane system of a film build not less than 6mm total.

4.6.7 Re-roof Cap Sheet (SP6)

This is a variation of the mineral-faced cap sheet, with a vented underlayer to permit any trapped moisture in the substrate, under or within the existing membrane, to dissipate.

Some cap sheets may be SBS for colder regions as defined in NZS 3604, other types of modified bitumen or a mixed layered composition. They can also have a multi-layered reinforcement of polyester, fibreglass reinforced polyester and fibreglass mat. Some could have a top surface with a needle-punched fabric.

The underside of the vent sheet may be either fleece-backed (non or partially bonded), or undulating with ridges, blobs or strips of soft bitumen to provide partial bonding (approximately 60%) to aid moisture dissipation.

(NOTE – Item numbers 4.6.8 to 4.6.19 are reserved for possible future product inclusions.)

4.6.20 Fire Retardant Membranes (SP1)

Modified bituminous membranes that incorporate non-toxic flame retardant additives are reinforced with a non-woven spun-bound polyester fabric of 160+ g/m² weight to a film thickness of 4mm or 4.5kg/m², and finished with protective minerals.

4.6.21 Garden (Root Resistant) Membranes (SP2)

Modified bituminous membranes that incorporate an anti-root additive are reinforced with non-woven spun-bound polyester fabric of 180+ g/m² with a smooth finish. These are designed to be used as the cap sheet in a multi-layered system for roof gardens or garden boxes etc.

4.6.22 Composite Membranes (C4)

Two or more bituminous components are combined in the factory to create one single bituminous modified bitumen membrane with an overall thickness of 4 to 5mm, with a smooth or mineral finish. This usually has an SBS under-layer with reinforcement (in the centre) of non-woven spun-bound polyester fabric with fibreglass strands or matting at 180+ grams m² and a topping layer of an APP modified bitumen.

4.6.23 Protection and Drainage Membrane

A modified reinforced membrane has a profiled top face, usually of raised round indentations or dimples, which can provide protection to the waterproof membrane system. It can also aid drainage or fused adhesion for an overlay system.

4.6.24 Sound Deadening Membrane

A modified reinforced membrane incorporates a high-build fleece (or other material) to its underside to provide sound deadening properties when used in a double-layer membrane or an inverted roof system. Any such membrane will only be part of a total sound-deadening system.

4.6.25 Surface Finish

The exposed face of bitumen membranes in New Zealand is usually pre-finished with either mineral embedded, plain (fine sand or talcum surface), or a metal face. After installation, a protective coating must be applied to plain membranes as a component of the system.

Table 5 – Possible Torch-on Membrane Systems

EXPOSED MEMBRANE SYSTEMS

Single Layer

- Concrete surface roof, no traffic with an APP and/or SBS 4 to 5mm thick membrane (C2, C3 or C4).

Double Layer

All double layer systems must be a minimum of 6mm in total.

- Concrete surface roof or deck subject to heavy traffic with a 2 to 4mm SBS or APP Base Sheet (B2 or B3 or B4) and overlaid with 3 to 5mm APP Cap Sheet (C2, C3 or C4).
- Plywood surface deck or large roof subjected to light traffic with a 2 to 4mm Base Sheet (B2 or B3 or B4) and overlaid with 3 to 5mm APP Membrane (C2, C3 or C4).
- Plywood surface roof/deck subjected to heavy traffic with a 2 to 4mm Base Sheet (B2 or B3 or B4) and overlaid with 4 to 5mm APP Membrane Cap Sheet (C3 or C4).

Triple Layer

All triple layer systems must be a minimum of 7mm in total.

- Concrete or plywood substrate that incorporates a Vent Sheet (B1) overlaid with a 2 to 4mm Base Sheet (B2 or B3 or B4) and finished with 3 to 5mm APP membrane Cap Sheet (C2, C3 and C4).

NON-EXPOSED MEMBRANE SYSTEM

The substrate must provide falls and the membrane is completely overlaid with concrete, asphalt, tiles, pavers, duckboards etc.

Single Layer

- Concrete surface with a 4mm APP or SBS membrane (C2, C3 or C4) with a 3mm to 5mm

Double Layer

- Concrete or plywood surface with either a vented Base (B1) or 2 to 4mm SBS or APP Base Sheet (B2 or B3 or B4) and finished with 3 to 5mm SBS or APP Cap Sheet (C2, C3 or C4), to give a minimum total of 6mm.

Triple Layer

- Concrete or plywood surface with a Vent Sheet (B1), Base Sheet (B2 or B3 or B4) and finished with a Cap Sheet (C2, C3 or C4).

NOTE – Where required the above systems could incorporate a perforated Vent Sheet (V1) or a non-overlapped welded joint Vent Sheet thinner than 2mm, to dissipate moisture vapour. This additional layer does not constitute another layer in terms of defining single, double or triple layered membranes.

5. Design

5.0 General

Torch-on membrane roofing systems are often considered to be the cure-all material where it is not possible to provide a fall or slope to a roof plane or deck. While torch-on membranes will keep water out where there is no fall, it is well recognised that providing adequate fall to the roof area enhances the serviceable life of the membrane system, and minimises ponding and the risk of moisture ingress into the structure.

This Code of Practice requires the following falls:

- The minimum fall for a roof is 1.5^0, which is equivalent to 1:40
- The minimum fall for a deck is 1.0^0, which is equivalent to 1:60
- The minimum fall for a gutter is 0.5^0, which is equivalent to 1:100

Situations other than these are subject to specific design and outside the scope of this Code of Practice. Such situations can be readily resolved with dialogue between the Designer and Supplier, for example where:

- The span of the supporting structure is large, outside the scope of NZS 3604
- Creep or settlement of the supporting structure may occur

Other factors that may require the provision of more rather than less fall to the substrate and/or structure under a torch-on membrane roof system include (but are not limited to) the following items, which are all outside the scope of this Code of Practice. For such situations, consult the Designer and/or an Engineer for specific design:

- The likelihood of snow loads
- The building is in an area known for high rainfall intensities
- The building is in an area known for high wind loads, as defined in NZS 3604, where greater uplift pressures will be developed

5.1 Membrane Component Selection

5.1.0 General

The most important factor to be considered when selecting a torch-on membrane roofing system is the specific use to which the roof or deck will be put.

In combination Figure 2 and Table 6 will suggest a torch-on membrane system to provide the necessary protection from water or moisture ingress for the given situation. To this end:

- Figure 2, the System Selection Flow Chart, gives the major selection criteria of site and project specific situations in conjunction
- Table 6, Available Torch-on Membrane Layers lists the possible torch-on membrane system layers or combinations thereof

5.1.1 Material Selection

The membrane system selected from Figure 2 is the minimum recommended “fit-for-purpose” system. However, the Designer, Supplier, Applicator or Owner may recommend, suggest or request a more robust system.

When the recommended torch-on membrane system is determined from Figure 2, select the component layer(s) from Table 6 according to the system properties required.

In most selection situations, the greater the number of layers to a torch-on membrane system the better the waterproofing protection offered will be.

Some of the factors to be considered include:

- Wind zone – One of the major potential failures of torch-on membrane systems is delamination due to wind uplift. NZS 3604:1999, section 5 – Bracing Design, shows how to determine the wind zone in different areas of New Zealand.
- Amount of expected foot traffic – Direct foot traffic on any torch-on membrane system increases the possibility of damage to the membrane. If it is expected to be subject to daily foot traffic at any time of the year, e.g. for BBQs during the summer months, then it is recommended that the torch-on membrane be protected in some manner, e.g. tiled, boarded, decked, concreted or asphalted finish over. If sporadic use is likely, e.g. during scheduled maintenance checks, then soft shoes only should be worn if possible, or the membrane protected with temporary boards or an extra sacrificial traffic layer.
- Amount of expected vehicular traffic – For situations where vehicular traffic is expected, it is required that protection, whether temporary or permanent, be laid.
- Size of deck/roof – Care and attention to detail is required for any area to be covered by a torch-on membrane system. However, a larger roof/deck (greater than 40m^2 as specified in E2/AS1) will require additional detailing and care during installation. It is more likely that a large deck/roof will have many service penetrations, plant fixed on the roof, a greater number of scuppers, more membrane joints, possibly expansion or control joints for either the torch-on membrane system or the structural support under the torch-on membrane.
- Roof system – See section 2 Definitions for whether the roof is a cold/warm/insulated/inverted roof. Each roof system may have different substrate or intra-torch-on membrane system ventilation requirements.
- Temperature variation or prevailing weather conditions – Bitumen becomes more viscous in warmer weather and more brittle in colder weather. Modified bitumens such as SBS and APP offer specific properties designed to accommodate such requirements i.e. SBS in freeze-thaw conditions and APP in hot climates. Consult the Supplier to determine which bituminous composition system will work best.
- Snow loadings – Specific pitch and roof design may be required.
- Roof slope – If the roof slope is greater than 10° above the horizontal, full adhesion bonding between all layers of a torch-on membrane system must always be used.
- Chemical environment – Torch-on membranes may be unsuitable in the presence of hydrocarbons, oils or fats, which will act aggressively to break down the bituminous composition and lead to the eventual failure of the torch-on membrane system.
- Substrate – This Code of Practice considers concrete or treated plywood substrates and other substrates.
- For an existing roof – the type and age of the torch-on membrane already installed.
- Bituminous torch-on membranes come in a variety of colours. Where there is a requirement for a coloured finish, this will be accomplished either by the application of a proprietary surface coating, finish or the use of a coloured mineral granule. If heat build-up is of concern, the use of a light colour should be considered. In no circumstances should general roof or house paint be used for coating modified bitumen surfaces.
- Inspection and maintenance. As an integral part of the waterproofing system of the building, maintenance of the torch-on membrane systems must be provided for as part of the overall maintenance programme for the whole building. Visual inspections to determine any required repairs and/or preventive maintenance must be carried out at least annually. Areas subject to changing seasonal conditions e.g. autumnal leaf build-up may require more regular inspections.
- Potable water. A torch-on membrane can be used for the collection of potable water if over-coated with a coating specifically designed for that purpose, or if the membrane has been developed and proven for this use.

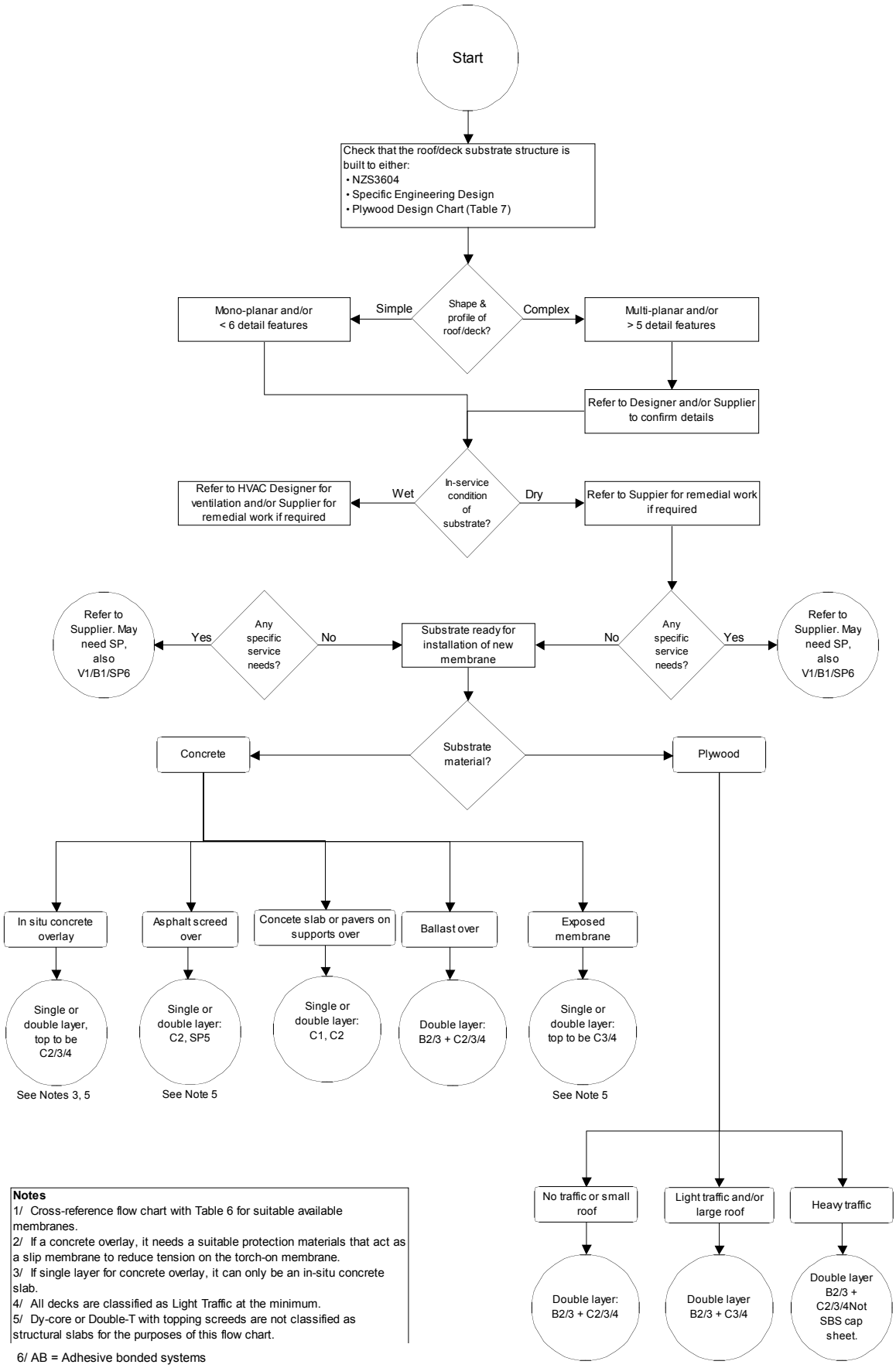


Figure 2 – System Selection Flow Chart

Table 6 – Available Torch-on Membrane Layers

TYPE (See 4.6.1 to 4.6.25 for descriptions)	**DESCRIPTION** **(Minimum thickness, usage or finish)**	**APP**	**SBS**	**APAO or Other**
Moisture Movement Layer				
V1	Ventilated (Perforated)	Yes	Yes	Yes
Base Sheets				
B1	Venting (Partial Bond)	Yes	Yes	No
B2	2mm	Yes	Yes	No
B3	3mm	Yes	Yes	No
B4	4mm	Yes	Yes	No
Cap Sheets				
C1*	3mm Plain Finish	Yes	Yes	No
C2*	4mm Plain Finish	Yes	Yes	Yes
C3	4mm Mineral Finish	Yes	Yes	Yes
C4	5mm Mineral Finish	Yes	Yes	No
Special Purpose Cap Sheets				
SP1	Fire – Retardant	Yes	No	Yes
SP2	Root – Resistant	Yes	Yes	Yes
SP3	Mechanical Fixing	Yes	Yes	Yes
SP4	Adhesive Bonded	Yes	Yes	Yes
SP5	Asphalt Overlay	Yes	Yes	Yes
SP6	Moisture Movement Control	Yes	Yes	Yes
SP7	Metal Foil Finish	No	Yes	No

* Must be coated if exposed.

NOTES –

1. Perforated or mechanically fixed moisture movement layer materials (V1) are not included as part of the torch-on membrane system determined by use of Figure 2, the System Selection Flow Chart, but are additional to the torch-on membrane system.
2. The user must ensure that, at all times, the components of a system are sourced from a single Supplier.
3. If plain sand or talc finish cap sheets are specified, then a compatible paint finish must also be used to ensure adequate system durability, and the correct maintenance regime nominated to comply with Clause B2 Durability, of the Building Code.
4. We do not recommend tiling over a torch-on membrane system with a thin-bed direct adhesive as this has a history of failure.
5. If the design calls for a concrete or asphalt overlay screed, confirm with the Main Contractor or structural Engineer that the substrate structure can sustain the total design weight.

5.1.2 Using Figure 2 and Table 6

The System Selection Flow Chart in Figure 2 provides a logical selection process for Designers, Specifiers and other users of this Code of Practice to help make design decisions to determine the appropriate torch-on membrane system for any project.

For "simple" design situations, the pathway is clear and direct, and the user should be able to determine the type of torch-on membrane system from Figure 2 in conjunction with Table 6.

For "complex" design situations, Figure 2 provides options at all stages, with reference to input from construction specialists or from the membrane Supplier who can provide guidance on the appropriate system.

Figure 2 is cross-referenced with Table 6, which outlines all currently available torch-on membrane components supplied to the New Zealand market, including special purpose cap sheets for a wide variety of end uses. Multi-layer membrane systems should be built-up by referring to Table 6.

5.2 Substrate Requirements

5.2.0 General

The substrate onto which the torch-on membrane system is to be laid must be sufficiently rigid in combination with the structure underneath (if a separate building element), dense and dimensionally stable to support the membrane system, insulation, surface protection, landscape and any plant or other item. It must also be designed to incorporate the required falls, drains, sumps and outlets to ensure sufficient drainage, and have sufficient movement/expansion joints in the substrate and structure.

The substrate selection and substrate structure design is the responsibility of the Designer. It is the responsibility of the Main Contractor to ensure that the designed falls are installed.

5.2.1 New Concrete Substrates

Except for topping screeds, new concrete substrates are generally structural building elements in their own right. They must be designed and built to the Engineer's recommendations and specifications, the Building Code and requisite standards.

Where a concrete roof slab is the substrate, curing agents must not be used. If used, any such curing agents must be removed by an abrasion method to ensure complete removal. Failure to do so can result in the failure of the adhesion of the torch-on membrane to the substrate surface.

Concrete substrates must be laid to falls and incorporate coves to upstands and rounded corners, drainage outlets at low points and integral expansion joints. They must be finished with a wooden float or lightly broomed to provide an even open surface. The recommended concrete surface finish is either U2 woodfloat or U3 steel trowel to NZS 3114. Steel floated finishes may require captive blasting, etching or grinding to permit penetration of the bitumen primer.

Under normal circumstances, there should be a minimum 28-day curing period of the concrete surface before torch-on membranes are installed.

5.2.2 Existing Concrete Substrates

Existing concrete substrates must be prepared and cleaned as per the Supplier's recommendations. If they are moss and/or mould infested, apply a killer solution, leave for 3 days and water-blast clean.

Grind off any nibs, flush out any hollows and/or imperfections. Skim over (if required) to improve falls and provide satisfactory surface. Install plaster fillets to upstands and chamfer all corners. Unsatisfactory concrete surfaces must be mechanically repaired to a suitable standard for membrane application.

Ensure the outlet(s) is/are at the lowest point and adequate in number. Saw cut any movement cracks and fill with a pliable sealant. Provide expansion joints on large roofs.

5.2.3 Cementitious Screeds

Where a reinforced concrete roof is to be overlaid with a concrete or plaster screed to provide falls, the screed should be laid and finished in accordance with NZS 3114.

The structure should be sound and may need an Engineer to certify the additional weight. The existing concrete is to be prepared and cleaned to ensure good adhesion of the new screed.

The new screed surface is to incorporate the required falls, be wood-floated to provide an even surface free of hollows, ridges or nibs. The thickness of the screed will determine the curing period required before application of the torch-on membrane system.

5.2.4 Plywood

5.2.4.0 General

Plywood consists of thin layers of timber bonded together. The number of layers, the direction of grain of each layer and the formation design, determines the sheet thickness and the potential uses for the plywood sheet.

Plywood must be branded to comply with the joint Australian/New Zealand Standard.

AS/NZS 2269:2004 and the Building Code requirements.

The top surface of the plywood should be sanded and plugged, to a minimum standard of C-D.

5.2.4.1 Treatment

Plywood substrate for the installation of a reinforced torch-on modified bituminous membrane must be treated (CCA) H3.2 grade.

LOSP-treated (light organic solvent preservative) or CuN treated (copper nitrate) plywood should not be used as it will cause membrane adhesion problems.

5.2.4.2 Moisture Content

The moisture content of plywood prior to priming must not be higher than 20%. During winter, pre-priming of the top surface and edges is prudent. Otherwise, plywood may be primed on the same day as installation.

5.2.4.3 Deflection Limits for Plywood Substrates

In general, the provisions of NZS 3604 apply where the deflection in the plywood is determined by the supporting structures and the centre spacing of the joists/rafters and noggins (blockings), the slope of the structure and the thickness of the plywood. The minimum dimensions are given in Table 7.

Table 7 – Plywood Design Chart: Minimum Plywood Thickness

Multiple Torch-on Membrane Layers	Roof Support 600mm x 600mm maximum	Deck Support 400mm x 400mm maximum
Minimum Plywood Thickness	17mm	20mm

Roofs or decks with support spacing greater than Table 7 in any direction are outside the scope of this Code of Practice. Refer to the Designer or Supplier for specific design.

5.2.4.4 Plywood Layout

Plywood must be installed across the joists, in a brick-like pattern, and with the face grain of the plywood all in same direction. All edges of the sheets must be fully supported.

5.2.4.5 Fixings

There must be solid blocking under all edges of the plywood substrate.

The plywood must be glued and mechanically fixed with counter-sunk Grade 316 stainless steel 10 gauge screws at a length approximately 3 times that of the thickness of the plywood.

Screw spacing must be at 150mm centres at the perimeter of the sheet and 300mm through the body of the sheet.

All sheets must be fixed from the centre out to reduce bowing.

5.2.4.6 Corners

All leading edges of plywood to be chamfered with minimum 5mm radiused corners (as per E2/AS1) where the membrane is to be flashed. All internal corners are to have timber fillets, to be minimum 20 x 20mm and H3.2 treated.

5.3 Insulation Boards and Systems

5.3.0 General

The use of insulation boards directly under a bituminous membrane is not common in New Zealand, but the practice is increasing to meet the demand for improved thermal performance within structures. Insulation is generally installed in new buildings in New Zealand within the roof space, either immediately above the ceiling with an air space to the roof (commonly called a cold roof), or within the roof structure (e.g. between timber rafters) or on top of the roof structure (commonly called a warm roof).

This Code of Practice specifically covers insulation boards where the insulation is immediately beneath the membrane as the torch-on membrane is directly fixed to the insulation boards, or when the insulation boards are fixed over the top of the membrane and overlaid with pavers or ballast, commonly called an inverted roof. When insulation is incorporated in the roof structure design, the Designer should ensure that the dew point is to the outside of the membrane system.

5.3.1 Types of Insulation Boards

The selection of the type of insulation board is dependent on design, location and the use of the roof. Soft type insulation material is not recommended, as it does not offer a sufficiently rigid or stable substrate for torch-on membranes. Some boards are tapered for drainage falls.

The most common types of thermal insulation boards are:

- Extruded Polystyrene foam (XPS) – extruded closed cellular foam with uniform fine air cells that are not inter-connected and therefore is water impermeable and dimensionally stable
- Polyurethane Foam – insulation boards of rigid urethane, polyurethane or polyisocyanurate foam with or without a fabric facing
- Cellular Foamed Glass – these insulation boards should have a density between 170 to 200kg/m3. Some have a bitumen-reinforced fabric facing
- Compressed Cork – consists of granulated cork and natural gum that is compressed into slabs (boards) at a minimum density of 110kg/m^2
- Proprietary products – where bituminous membranes are adhered to the insulation boards as part of the manufacturing process. The advantage of this product is the insulation board and base sheet are installed in a single application

All insulation boards should be installed in fine weather, in stages and with the installation of the bituminous base sheet to prevent the entrapment of moisture.

5.3.2 Adhesion of Insulation Boards

Insulation boards are adhered to the substrate or over a vapour barrier membrane by any of the following methods:

- Cold adhesion
- Bedded-in, melted down, rusticated (round indentation profile face)
- Self-adhesive vapour barrier sheet, and/or
- Mechanical fixing

5.3.3 Mechanical Fixing

The design and location of the roof must be taken into consideration when assessing wind uplift resistance of the combined roof torch-on membrane system to determine whether to mechanically attach the insulation boards using large (minimum 30mm) flat head fasteners. Purpose-selected fixings must be used.

5.3.4 Vapour Barrier

Where there is a requirement to control interstitial condensation within the roof structure and/or to permit moisture vapour from the substrate to dissipate, a vented vapour barrier membrane must be installed immediately above the substrate.

5.3.5 Existing Roof Torch-on Membranes

Torch-on membranes are suitable for re-surfacing over existing bituminous roof torch-on membranes and structures. It is up to the Designer, Owner, Supplier and/or Applicator to decide whether to remove existing components or to overlay them.

Issues to be considered include (but are not limited to):

- Selection of the new torch-on membrane system
- Compatibility of the proposed system with existing
- The type and condition of the existing surface
- The type and condition of the existing substrate

Overlaying has the following advantages:

- The interior is at minimal risk of water ingress through the works
- Waste removal and disposal cost is minimised
- Contract period can be minimised

Overlaying also has the following disadvantages:

- Roof loading may exceed the capacity of the structure
- Any entrapped moisture due to past water ingress must be dissipated effectively
- Details may be compromised by increased roof finish height
- Options for attachment of the new system may be restricted
- There is a need to verify the compatibility of the existing material with the new material that is proposed to be used
- Existing falls must be accepted

Removal of the existing system provides maximum scope for correcting deficiencies in the existing design and thermal upgrading. It also widens the choice of attachment methods.

5.4 Design Detailing

Figures 3 to 39 in section 7 provide generic construction details.

5.4.0 General

While the Designer has overall control of design detailing, there are some fundamental principles of design for torch-on membrane systems to be taken into account:

- Torch-on membrane surfaces must have a positive slope or fall to effectively drain water
- The torch-on membrane system must be fully supported on a suitable substrate, which itself must be fully supported by the structure
- Product specific design and installation instructions must always be obtained from the Supplier, and where practical, the membrane Applicator should provide advice before the final choice is made and drawings are completed
- Roof spaces and habitable spaces must be well vented to ensure all moisture and water vapour is removed
- The specification/design must comply with all relevant aspects of the Building Code
- All outlets, droppers or overflows from the torch-on membrane system are to be supplied and installed by the torch-on membrane Applicator
- All end-laps must be at least 100mm, we recommend 150mm
- All side-laps must be at least 80mm, we recommend 100mm, or as allowed by the membrane selvedge
- All membrane upstands must be at least 150mm or sufficient to provide a minimum 115mm cover behind the cladding system
- Full sheets must be used where possible
- The number of joints/laps must be kept to a minimum
- All flashings must be lapped over the under-layer
- Double or triple layer systems must have staggered laps, and
- Membranes for gutters should be laid longitudinally. The girth (overall width including under-laps to other roofing) of a gutter membrane should be designed as a module of the 1m-roll width i.e. .5m, 1m, 1.5m, 2m and any joints should be along the length of the gutter. In a double-layer gutter membrane the laps should be staggered to reduce unintended high points..

5.4.1 Ventilation

Ventilation in this Code of Practice covers:

- Cavity ventilation of the roof cavity under a torch-on membrane substrate. Closed-in construction spaces under torch-on membrane roofs and decks substrate must have adequate ventilation to prevent the accumulation of moisture under the substrate. Such ventilation systems are the responsibility of the Designer to design and the Builder to construct.
- Substrate ventilation of the membrane-to-substrate interface. Ventilation between the torch-on membrane and the substrate may be required (where moisture is present in the building materials at the time of installation of the torch-on membrane system) to minimise the risk of bubbles, blisters or wrinkling appearing on the surface of the torch-on membrane and to allow that moisture to dissipate.

6. Site Practice

6.0 General

This Code of Practice recognises the crucial role of workmanship in the installation of a torch-on membrane system in order that it can perform as required for its full service life. Similarly, materials delivery, storage, handling, condition/quality and control of the installation procedures are also of great importance.

The following sections cover some of the on-site issues that may face the Applicator.

6.1 Administration/Supervision

The Applicator is responsible for the quality control and the installation of the torch-on membrane system.

The Applicator is to provide the project administration and supervision for the membrane system component of work, plus co-ordinate all pre- and post-work by other trades with the Main Contractor or Property Owner (whichever is applicable), to ensure that the work proceeds satisfactorily, provides adequate building protection and minimises disruption to the normal building operations.

The Designer, Main Contractor and/or the Property Owner in consultation with the Applicator must monitor progress of the membrane work to ensure compliance with the approved consent documents that will include the project specifications and drawings in order to minimise potential problems and to provide a resolution when and as required.

This Code of Practice recommends a pre-inspection and/or a pre-job meeting of all parties involved with the torch-on membrane system to identify any areas of concern. It is important for a successful installation to resolve and clarify any issues or project requirements, work programme and issues with other trades, the project documentation required, product storage, and site health and safety matters.

6.2 Project Commencement

Before commencing work, the membrane Applicator must determine:

- That all the building consents have been issued and the specifications and detailed drawings are workable and suitable for the project
- That there is nothing that will compromise the Applicator's required responsibility under this Code of Practice and the Building Code
- That no existing conditions at the site prevent the Applicator from performing in a professional and safe manner
- That the product to be installed is as per the consent documents

6.3 Acceptable information

The Main Contractor, Property Owner or Applicator's company will provide to the installation personnel, the following documents in an accessible location on-site:

- Consented project drawings and specifications
- Supplier's product technical information sheets
- Product material safety data sheets (MSDS)
- The current health and safety documents and Working at Heights guidelines
- Any other relevant project documents

6.4 Handling of Materials

The correct way to administer, handle and store torch-on membrane materials prior to use includes (but is not limited to):

- Unload, crane and handle all materials with care
- Check all materials and discard damaged or suspect rolls

- All materials must be clearly labelled. Return any unlabelled materials and request new clearly labelled materials from the Supplier
- Store all membranes on a flat surface, with rolls in the vertical position. Do not store any other materials on top
- Materials must be stored in a dry and protected environment, and not be lifted onto the roof until immediately before they are required
- Rotate all materials such as adhesives and/or sealants, which may have a limited shelf life. Store such materials in a cool place prior to use and discard any materials, which have passed their use-by date
- When placing materials onto the roof deck, always place them directly above a major structural support until ready for use
- If possible, when lifting materials onto the roof spread their landing location to reduce point loadings. If this is not possible, spread as soon as practicable after lifting is completed
- Where required, relax the rolls for at least 20 minutes prior to use to eliminate any packaging, transit and/or handling stress
- Protect from frost
- Protect from sun heat
- Protect membrane already laid during installation

6.5 Working Conditions

Site and project specific working conditions are critical to a successful application of a torch-on membrane system. Laying should not take place in frost, rain, snow, high winds, on wet surfaces or in extremes of temperature. The Applicator must check the local existing and forecast weather conditions before commencing, and be prepared at all times to protect any un-completed work from possible changes in weather conditions.

If the work must proceed irrespective of any adverse weather conditions, a temporary roof with sufficient working headroom should be installed over the working area.

6.6 Scheduling of Work

As the membrane system will invariably be an integral component of the waterproofing system of the building, all work must be scheduled through the duration of the entire project as well as within any day to minimise the risk of the work not being able to be completed.

Be aware of any potential adverse weather patterns, or possible water or moisture ingress from other trades.

For any re-roofing work that requires the removal of an existing membrane, limit such removal to an area that will be completely replaced with a new waterproof membrane that same day.

The installation of decorative cap sheets in a double-layer or triple-layer membrane system can be delayed until the end of the works to ensure the minimum of damage to the final surface.

6.7 Care of Adjacent Surfaces

The installation work should be planned and carried out in a manner that ensures adjacent surfaces are protected from damage.

All damage of adjacent surfaces or any work by other trades must be notified to the appropriate management or personnel, and agreed corrective work carried out.

Co-ordinate all work operations so that adequate interior protection is provided to prevent damage and to minimise disruption to the normal building operations.

All torch-on membrane systems are susceptible to damage by other trade activities during and after installation. These other trades have a duty of care of adjacent surfaces, and any damage to the torch-on membrane system or substrates must be notified and arrangements put in place for rectification work to be carried out.

Where further construction work or the storage of materials is planned to proceed, the installed membrane must be overlaid for protection.

6.8 Fire Safety and Prevention

The installation of a torch-on membrane system is predominantly achieved by the use of a gas torch with a naked flame to heat the bituminous content of a sheet, which then adheres to the substrate (or layer immediately under), and similarly to create waterproof overlapping welds.

Fire prevention in the first instance is the responsibility of the Applicator, where current industry best practice includes (but is not limited to):

- Ensuring fire extinguishers are on site
- Provision of insurance cover commensurate with the nature and size of the works, including specific clauses for on-site torch work
- The adoption of working procedures that ensure the safety of all personnel on site
- Taking adequate care where flame is directed in carrying out work to flashings, confined spaces or around combustible materials
- Applicators must cease all torch-work in areas of concern at an appropriate time prior to leaving the site to ensure continued site safety
- Observing fire and safety precautions as per the recommended site procedure requirements, specific requirements from OSH, the territorial authority, insurer(s) or this Code of Practice

Cold adhesive bonding of the membrane, thermal self-adhesive membrane, or similar type membrane systems must be used in situations of potential fire concern.

6.9 Workmanship

All work performed by the Applicator or their staff must be carried out by competent experienced personnel and assistants, equipped with the necessary tools and plant to carry out the work.

All installation work must be in accordance with the project specifications and detailed drawings as approved by the BCA in issuing the building consent. Any departure from these requirements must be approved in writing by the Designer, Main Contractor, Owner, BCA and/or the Supplier of the membrane material. Contact the approving BCA prior to commencement of work to verify if the proposed departure requires an amendment to the issued building consent.

Installation procedures must be in accordance with the Supplier's product data specifications, application manual or any other technical document or instructions provided by the Supplier and approved by the BCA.

All work carried out should be in accordance with the relevant sections of this Code of Practice to produce the required standard for a waterproof membrane finish that will meet the provisions of the Building Code. The installation of the system to this Code of Practice does not automatically mean compliance with the Building Code (see Section 3).

6.10 Training

The long-term performance of the torch-on membrane system is highly dependent on the procedures adopted and standard of workmanship in the preparation, installation and finish of the membrane. Training of all on-site personnel is very important to obtain the required level of competency.

The training can be achieved by any of the following, or a recognised alternative:

- On-site training and supervision by a qualified and experienced Applicator
- In-house training seminars at the Applicator's premises
- Training seminars provided by the Supplier or membrane Manufacturers
- Attending training courses by recognised and accredited providers

A future requirement of the Building Act 2004, is that all tradespeople involved in “critical works”, which in this situation involves all trades to do with the weatherproofing of any building element, will be required to become or be supervised by a Licensed Building Practitioner (LBP) by 2009.

Note that the Department is yet to specify the generic level and/or type of training required, and that training seminars conducted by Suppliers may in themselves not be sufficient.

6.11 Health and Safety

It is the responsibility of Applicators to be conversant with, and to carry out the required safety procedures for their immediate surroundings and work practices. The requirements for good on-site safety and procedures include (but are not limited to):

- All applicable and appropriate requirements under the Health and Safety in Employment Act 1992
- Applicators must wear protective clothing including a hat and suitable footwear. In particular, heat resistant gloves must be worn to reduce the risk of heated bitumen coming into contact with skin
- Working with a gas torch is hazardous and requires care both for the Applicator, other associated personnel, and other persons on the work site
- Regular checks of all gas equipment to ensure that it is in good working order and safe for use. Thoroughly train all personnel in the proper use and maintenance of this equipment
- As torch-work can create the risk of fires, including smouldering fires, the Applicator must be trained in fire prevention and the proper extinguishing of fires. Code compliant fire extinguishing equipment must kept close to the membrane installation area and be in good working order.
- First aid equipment must be provided on site and work personnel trained in first-aid procedures
- Experience and training for working at height including understanding restraint procedures. Most torch-on membranes are applied to either roofs or decks, which will usually be 2.5m or more above the ground. The Health and Safety Act 1992, requires that all work carried out in such situations provides sufficient safety and protection to workers to avoid falls. Refer to ACC or OSH for more information.

7. Installation

This section contains several lists. In general:

- Bullet-point lists are not in order of importance in that any or all may be relevant to a particular project
- Numbered lists are generally in a process order, but some items may not apply to a specific project.

7.0 General

All work must be carried out by an Applicator and installed in accordance with the requirements of the building consent, contract documentation and the Supplier's installation manual, having regard to the membrane system selected:

- Workmanship and application experience
- Site conditions and current industry best practice
- Selection of membrane and system
- Torch-on membrane layout
- Fixing, adhesion method and detailing
- Site safety
- Co-ordination with the Main Contractor with regard to penetrations and other trades
- Site-specific conditions

7.1 Pre-Inspection

Before commencing any work on site, a project pre-installation meeting must be carried out to discuss the overall project in general and the specific working conditions.

Applicators should make themselves aware of:

- Any normal and/or special project conditions or conditions of contract relating to the torch-on membrane system
- The overall project programme and the proposed membrane installation timing within the programme
- That suitable and sufficient storage is available for materials and plant
- That adequate water, power, lighting and other required facilities are available on site
- That suitable cranage is available for the movement of materials from storage to any roof
- That there is suitable provision for access to the work location
- That all site health and safety requirements are addressed in regard to the membrane work
- That the scheduling of work of other trades has been co-ordinated by the Main Contractor, and the name of the person who is responsible for such co-ordination
- That the membrane will be protected from use by other trades, both while installation work is in progress and after completion. Once the installation is completed, the Main Contractor must assume responsibility for protection of the membrane system.
- That there are facilities for the daily removal of rubbish, surplus material and plant

7.1.1 Overall Project Pre-Inspection

Before commencement of work on site, ensure that the overall building project has sufficiently progressed to be ready for the application of the torch-on membrane system. It is recommended that a pre-inspection and/or a meeting of all parties involved in the roof/deck part of the project be held to identify any areas of concern.

Specifically, obtain confirmation in writing from the Main Contractor that the conditions of contract and building consent documentation relating to the installation of the substrate have been met.

Similarly, where possible, obtain confirmation from the BCA or Main Contractor that that the substrate has been constructed and inspected as required by the building consent documentation.

7.1.2 Working Conditions Pre-Inspection

The surface to be covered with the torch-on membrane system itself must be acceptable before application commences. There are many potential factors that may reduce the effectiveness of a torch-on membrane system.

The Applicator must inspect the substrate and notify any such design or construction faults, or damage of the substrate in writing to the Main Contractor/project manager, and all fault(s) must be fully rectified before the Applicator commences work in that area.

To negate the common faults and/or failure, check that (listed in no particular order and not limited to):

- The roof has sufficient substrate strength to accept the dead load of stacked or stored membrane materials prior to installation
- That the substrate is both surface dry and that the moisture content of the substrate is low enough to commence installation
- That the substrate surface is both clean and suitable for the torch-on membrane system to be applied
- That adequate provision in the construction details has been made for local wind-load conditions
- That falls, drainage and discharge meet the requirements of the consent documentation and the Building Code
- That expansion joints and their construction and finish meet the requirements of this Code of Practice
- That allowance has been made for all penetrations, fixtures and attachments
- That all flashing details are sufficient and meet the requirements of the consent documentation and the Building Code
- That all roof openings or protrusions such as pipes, sleeves, ducts, vents, skylights have been constructed in accordance with the consent documentation before application of the torch-on membrane system
- That any ventilation requirements, including roof cavities, have been designed and specified by a suitably qualified Designer, for example an HVAC (heating, ventilation and air-conditioning) Engineer

7.2 The Substrate, the Substrate Surface, Surface Preparation

7.2.0 General

A critical factor in the successful application of a torch-on membrane system, apart from the membrane system itself, is the substrate. This includes the structural support that is offered, the surface to which the membrane is fixed and the preparation of the surface.

7.2.1 The Substrate

The substrate is the structural element upon which the torch-on membrane system is to be laid. It must be sufficiently designed to withstand point and working loads, and to have sufficient falls and water-discharge and overflow mechanisms for the expected local weather conditions.

The substrate must have an acceptable moisture content compatible with the water vapour transmission rate of the membrane system. For a fully bonded torch-on membrane system, the maximum moisture content for plywood substrates is 20% and for concrete substrates the maximum moisture content is 75% relative humidity.

The substrate surface preparation is critical to the successful installation and performance of the torch-on membrane system, as the service life of the membrane is dependent on the quality of the adhesion between the substrate surface and the membrane itself.

7.2.2 The Substrate Surface

Torch-on membranes require a surface that is smooth, with no nibs or hollows but with the required falls toward the water outlet system.

If the substrate is concrete, it is likely that some curing compounds or release agents may interfere with the adhesion of the torch-on membrane system. The Main Contractor must be advised at the pre-installation meeting if a curing compound or release agent has been used. Its type/name must be disclosed prior to installation to the Applicator who will advise if it requires complete removal by an appropriate means before the Applicator commences work on site.

7.2.3 Surface Preparation

When the substrate surface is accepted by the Applicator as suitable to commence work, the substrate surface should be prepared as required by the Supplier of the torch-on membrane system to be used.

The surface must generally be dry, clean, free of any contaminants, concrete splashes or nibs, dust, holes, nails or bolts, or any other protrusions not included in the building plans.

The substrate must be primed with the Supplier's recommended bitumen primer to ensure the satisfactory adhesion of the torch-on membrane system to the substrate.

Where there is a delay between priming of the substrate and installation of the membrane, the existing primer may require cleaning and re-priming prior to proceeding with installation of the membrane.

With adhesive-bonded systems, the adhesive is generally self-priming.

7.3 Installation Procedure

All projects differ, and the torch-on membrane system components themselves each have specific requirements. Thus, the required installation procedure may differ for each project.

The installation of modified reinforced bitumen membranes can be carried out by a range of methods:

- By the application of heat, usually a portable gas torch, to the underside of the membrane sheet as it is rolled out. This softens the bitumen, which then bonds to the substrate or the membrane layer beneath.
- By the application of a thixatropic liquid bitumen bonding compound to the substrate, and the membrane sheet laid on to it
- By the use of a membrane with adhesive on the sheet when delivered to site, the protective layer "peeled off" and the membrane laid on the substrate, hence "peel and stick". Some thermal type membranes require heat to be applied over the top for full bonding.

The material set out in this section is not intended to be an installation manual; rather it illustrates generic installation principles based on current industry best practice. For example, the phrase "membrane system" where used in Figures 3 to 39 may be a single or a multiple-layered system. Some figures may contain several installation principles, and for some principles, alternative methods are shown. Some figures may be similar to another but show an alternative flashing method e.g. an over-flashing rather than an under-flashing. The only dimensions shown are those that are critical to the satisfactory installation of the torch-on membrane system. It should also be noted also that not all figures are to scale.

Building consent documentation and/or Supplier's details always take precedence over generic construction figures.

Final construction details are the responsibility of the Designer and/or Supplier. Applicators must adhere to the consented construction drawings and the Supplier's written installation instructions and recommended procedures for the selected membrane system.

In general:

- All flashings and upstand dimensions shall follow the figures in this Code of Practice
- All fillets to internal corners are 20 x 20mm minimum, and timber fillets are treated to H3.2 minimum
- All external corners are chamfered or arrised 5mm minimum
- Where a two-layered membrane system is specified, the laps of the cap sheet must be offset to the laps of the base sheet. Similarly with three or more layered systems.
- If a multiple-layered system, torch on the upper sheets so that they are fully bonded to the immediate under layer
- All flashings and sheet edges with a mineral finish will require preparation to ensure welds are bitumen to bitumen unless a cold adhesive compound is used
- Matching granules of the mineral membrane may be broadcast into the heated bitumen bleed seam to improve the finished appearance
- Large roofs on a plywood substrate may require a bond-breaker over construction junctions. The bond breaker must be of a pliable material of sufficient dimension to allow the membrane to accommodate structural movement. Location of the construction junctions is the responsibility of the Designer
- LOSP-treated (light organic solvent preservative) or CuN treated (copper nitrate) plywood should not be used as it will cause membrane adhesion problems.
- Ensure good heat control during the whole process for a good watertight installation, applying sufficient and even heat so that bitumen starts to flow. Excessive heat will damage the integrity of the membrane while poor heat control will result in unsatisfactory bonding to the substrate or immediate layer below, and suspect laps or flashing welds with the potential for leaks.

7.3.1 Daily Project Pre-Check

Notwithstanding the overall project and substrate checks that have been made, immediately prior to commencing work each day Applicators should:

- Check the weather forecast and only work in suitable weather conditions. Ensure the weather conditions are and will remain appropriate for application of the torch-on membrane system
- Check that in the immediate working area all substrate surfaces are clean and dry
- Ensure that other trades are aware that you will be commencing work, and that there are no issues arising with co-ordination of work with other trades
- Carry out all work in fine weather to avoid trapping-in moisture

7.3.2 Typical Installation Steps

A typical installation includes some or all of the following steps. They are listed in an approximate order of work; however, a particular project may require or the Applicator may choose to do certain tasks in a different order. In any event, plan the entire work programme before commencement, and generally perform all detail work (gutters, edges, parapets, penetrations, etc) before full sheet application.

Installation work includes:

1. Install all droppers, parapet outlets, scuppers, sumps, overflows etc in substrate recesses if practical, and bed-in to an under-flashing membrane. Use proprietary components where possible with stainless steel or other durable fixings.

   The membrane must be flashed down into the drainage outlet, and heat-welded to the sides to prevent water moisture from tracking under the membrane and back into the structure.

   In general, drainage from the membrane surface should be via preformed gutters, channels or scuppers into rainwater heads and droppers. Ensure that they are positioned at the lowest point to give effective drainage.

   See Figures 3, 4, 5, 6, 7.

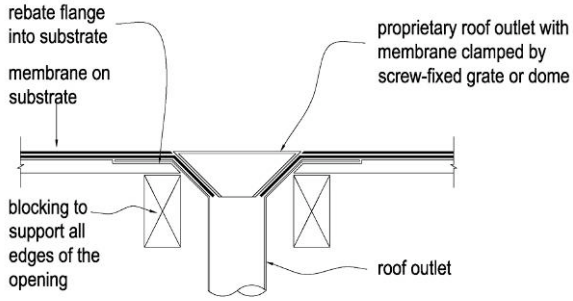


Figure 3 – Typical roof/deck gutter outlet with rebated gutter flange

Note - The figure is not to scale, and "membrane system" may mean a single layer or multiple layer system depending on its application.

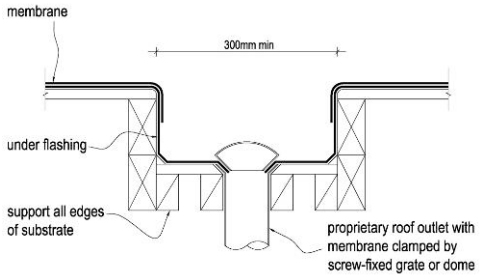


Figure 4 – Central gutter outlet with proprietary dome outlet

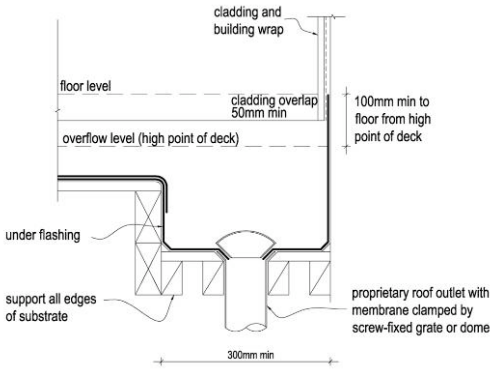


Figure 5 – Perimeter gutter outlet with proprietary dome outlet

Note - The figures are not to scale, and "membrane system" may mean a single layer or multiple layer system depending on its application.

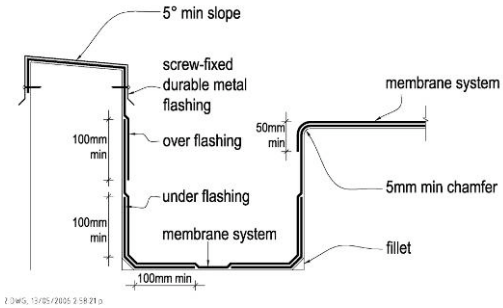


Figure 6 – Internal gutter to parapet, with underflashings

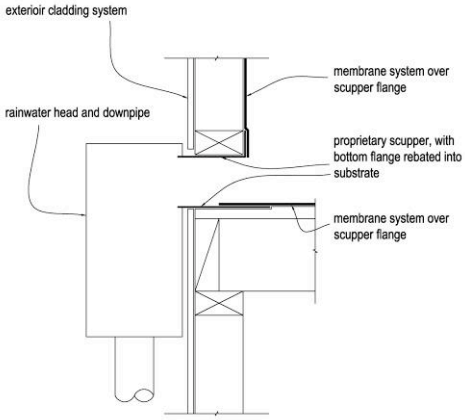


Figure 7 – Proprietary scupper and rainwater head through parapet wall

Note - The figures are not to scale, and "membrane system" may mean a single layer or multiple layer system depending on its application.

2. Install all under-flashings to upstands, and internal and external corners.

   See Figures 8, 9, 10.

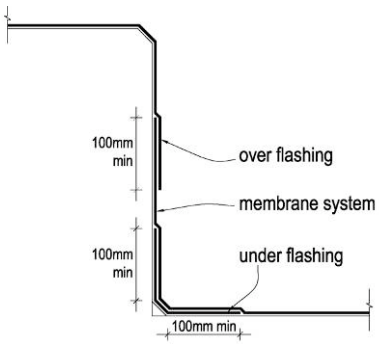


Figure 8 – Internal and external corners with underflashing, either in plan or section

Note - The figure is not to scale, and "membrane system" may mean a single layer or multiple layer system depending on its application.

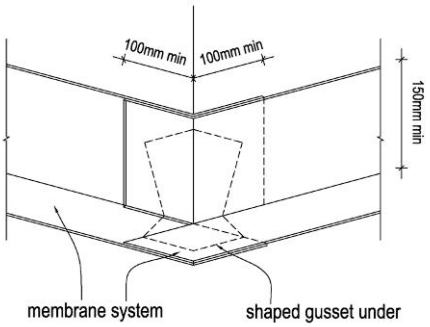


Figure 9 – Underflashing of external corner with gusset

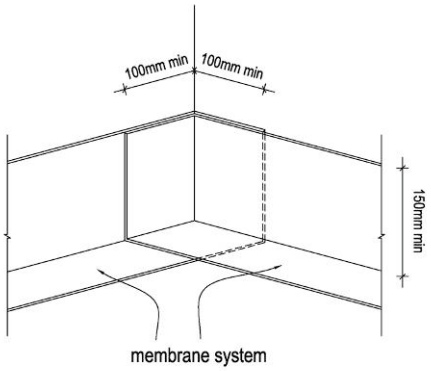


Figure 10 – Underflashing of internal corner

Note - The figures are not to scale, and "membrane system" may mean a single layer or multiple layer system depending on its application.

3. Install modified bitumen membrane to gutter (if applicable) including stop-ends, into droppers, parapet outlets, overflows, fascias, drip edges, verges, barge boards and all junctions where a double layer is required.

   There are many methods of creating a drip edge at the fascia/barge/verge or into a proprietary gutter. The preference is to create this out of the membrane to continue the weatherproof system. Where falls are slight, i.e. decks, it is advisable to rout a rebate at the leading edge, so an under-flashing can be installed flush with the deck surface and the deck membrane laid over.

   Where a metal drip flashing is incorporated, it must be designed for the purpose, be non-rusting (or suitably protected), at least 0.9mm aluminium or .55G mild steel, and mechanically fastened every 150mm into a recessed channel by screwing into solid timber.

   See Figures 11, 12, 13, 14, 15, 16.

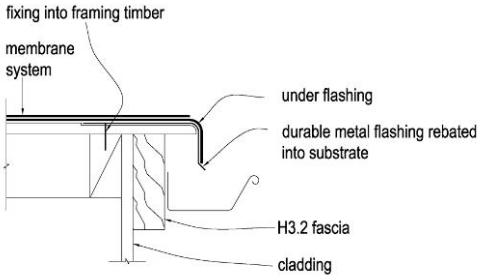


Figure 11 – Metal drip edge, rebated and underflashed

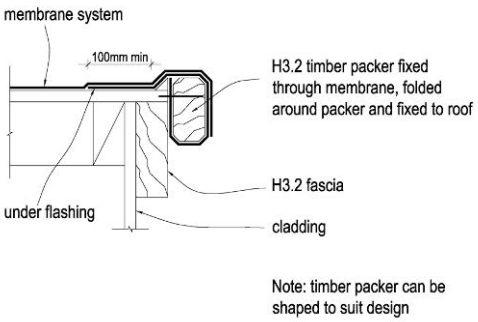


Figure 12 – Verge with underflashing around shaped timber packer

Note - The figures are not to scale, and "membrane system" may mean a single layer or multiple layer system depending on its application.

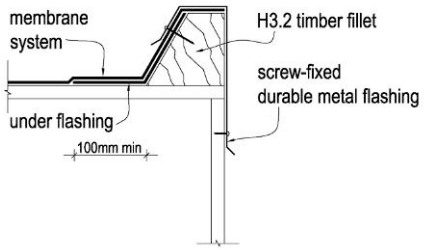


Figure 13 – Verge with metal overflashing and membrane underflashing

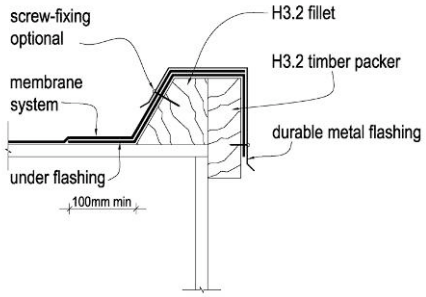


Figure 14 – Verge with metal overflashing, membrane underflashing & expressed timber trim

Note - The figures are not to scale, and "membrane system" may mean a single layer or multiple layer system depending on its application.

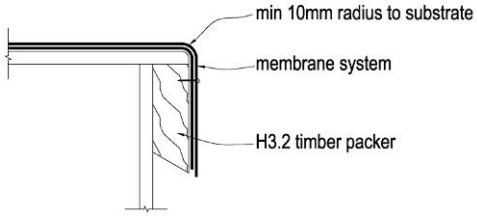


Figure 15 – Welted barge

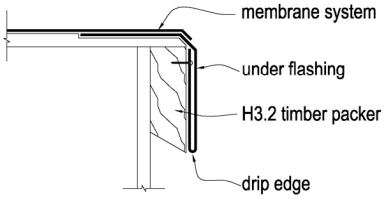


Figure 16 – Welted barge with folded under-flashing

Note - The figures are not to scale, and "membrane system" may mean a single layer or multiple layer system depending on its application.

4. Plan the layout pattern of the full membrane sheets, especially if the design calls for a specific pattern for aesthetic reasons. Ensure that the full-sheet layout is compatible with all junctions of detail work, expansion joints, vents and/or penetrations (ensure that they occur mid-sheet rather than at a lap), plinths, etc.

5. Where it is not possible to run the membrane up and over a parapet or into a chase, a compression plate (sometimes called a "termination bar") must be used as a mechanical fixing. Fix the membrane around the roof perimeter, up parapets and/or walls and other susceptible areas as required.

   There are also situations that require all or part of a modified bitumen membrane system to be mechanically fixed, most notably being in high-wind situations or areas. NZS 3604:1999, section 5, shows the wind zone maps, and Table 5.1 shows the wind speeds. If a project is in the VH (very high) or SED (specific engineering design) zones, mechanical fixing should be used.

   While NZS 3604 is for non-specific design situations, mechanical fixing will always require specific design by the Designer in conjunction with the Supplier and/or the Applicator. Thus the wind zone maps are to be used as a guide only. If in doubt, discuss with the Supplier.

   See Figure 17.

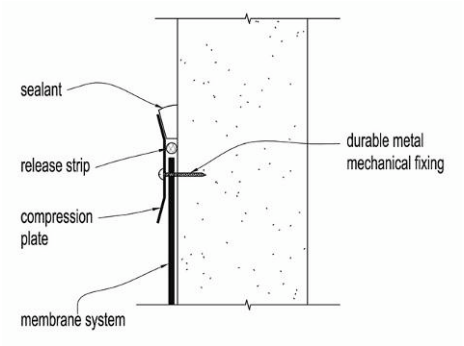


Figure 17 – Mechanical fixing with termination bar
Note - The figure is not to scale, and "membrane system" may mean a single layer or multiple layer system depending on its application.

6. Unless a ventilated sheet system is required, install the torch-on membrane either by selecting a self-adhesive membrane, in a cold bed of adhesive or by torching down to achieve a full or partial bond as required.

7. Burn-off the backing film to the under-side of the membrane during the modified bitumen process or before laying the membrane into a liquid bedding compound.

8. Continue all membranes and form up the wall or parapet, with fillets, to the prescribed height.

   Inadequate waterproofing of parapet caps, corners and roof-to-parapet junction upstands provide a series of potential ingress routes where water can seep in and around, and eventually, behind the membrane. All parapets must be capped.

   See Figure 18.

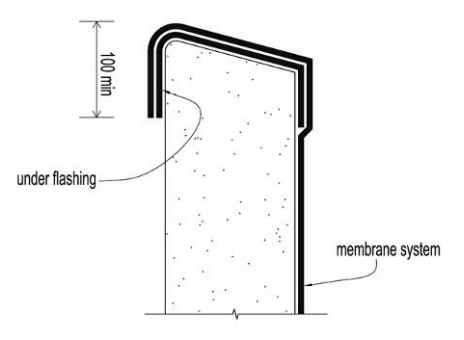


Figure 18 - Typical parapet capping
Note - The figure is not to scale, and "membrane system" may mean a single layer or multiple layer system depending on its application.

9. Where the membrane is terminated part-way up a wall, flash with a termination bar or into a sealed chase.

   See Figure 19.

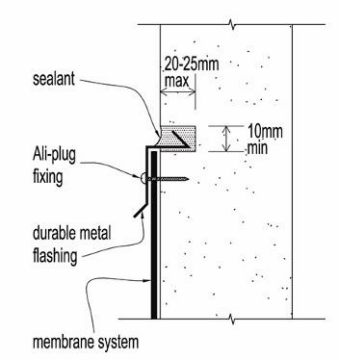


Figure 19 – Termination into concrete or masonry wall with metal overflashing
Note - The figure is not to scale, and "membrane system" may mean a single layer or multiple layer system depending on its application.

10. Turn the membrane down gutter sidewalls.

11. Turn the membrane down and weld to fascias or into spouting.

12. Under-flash and heat-weld all wall upstands, parapet walls, skylights and all changes of direction.

13. Install bond-breakers over plywood sheet joints and other construction junctions as required.

    See Figure 20.

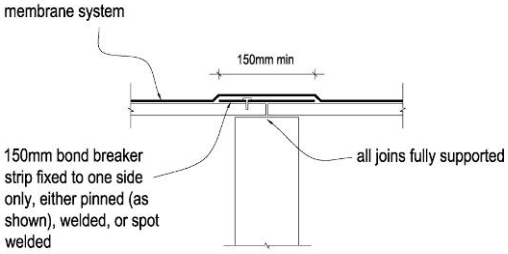
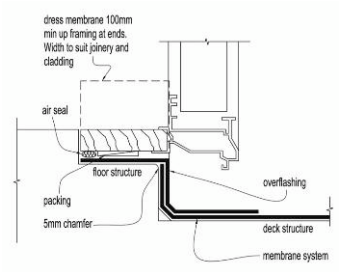


Figure 20 – Bond-breaker over plywood sheet joint
Note - The figure is not to scale, and "membrane system" may mean a single layer or multiple layer system depending on its application.

14. Flash under doorsills. The membrane flashing must be installed prior to the placing and fixing of doors or similar type windows. Double flashings must be installed over the fillet, up the raised base plate and over, including the upstand flashing to the stiles.

    It is also recommended that a proprietary metal flashing with stop-ends and a back upstand be installed prior to the fixing of the door with no mechanical fastening into the sill.

    See Figures 21, 22.



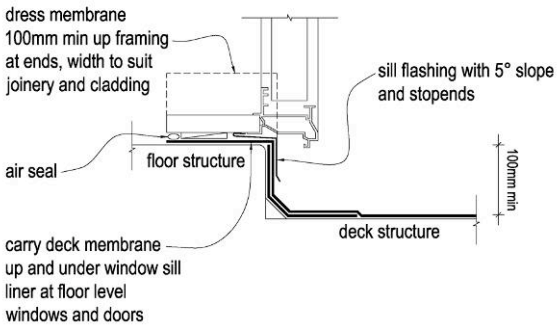


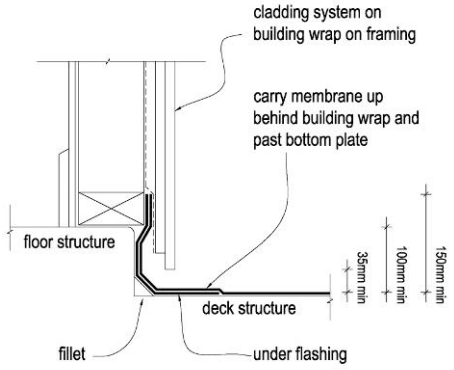
Figure 21 – Level-entry door sill

Figure 22 – Direct-fixed door sill, with metal flashing

Note - The figures are not to scale, and "membrane system" may mean a single layer or multiple layer system depending on its application.

15. Flash up walls behind wall claddings, ensuring full support between studs if the wall is timber. If at a cladding transition, use a durable metal flashing. Note the minimum overlap dimensions.

See Figures 23, 24, 25.



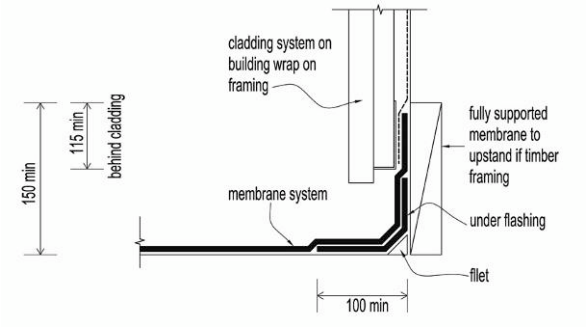


Figure 23 - Wall/floor/deck junction, with underflashing

Figure 24 - Wall/deck junction with underflashing (and full backing support if a timber wall)

Note - The figures are not to scale, and "membrane system" may mean a single layer or multiple layer system depending on its application.

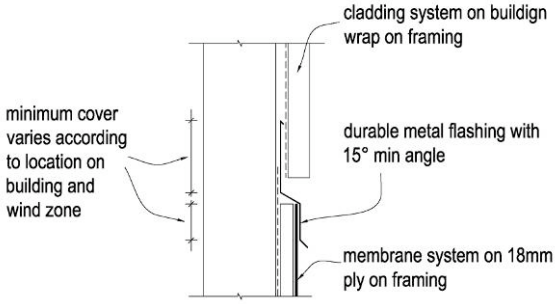


Figure 25 – Termination under and behind existing wall cladding

Note - The figure is not to scale, and "membrane system" may mean a single layer or multiple layer system depending on its application.

16. Install venting systems at recommended or specified locations, as per the Supplier's installation procedure.

See Figures 26, 27, 28.

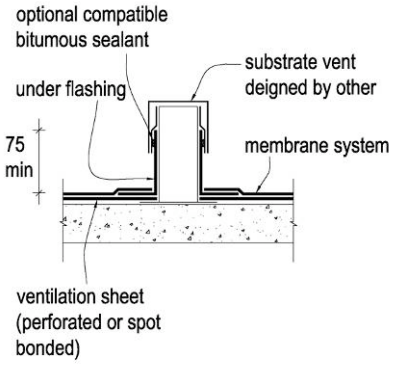


Figure 26 – Substrate vent

Note - The figure is not to scale, and "membrane system" may mean a single layer or multiple layer system depending on its application.

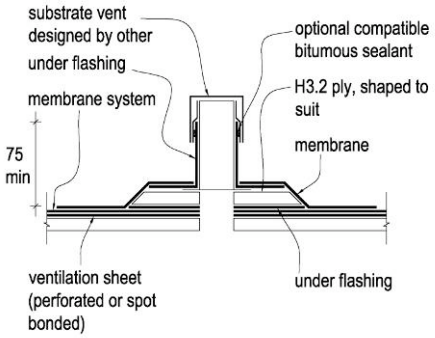


Figure 27 – Roof-cavity vent on timber plinth

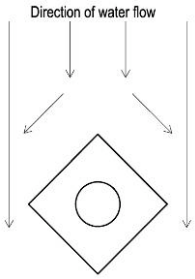


Figure 28 – Orientation of plinth to allow for water flow

Note - The figures are not to scale, and "membrane system" may mean a single layer or multiple layer system depending on its application.

17. Install flashings to all pipes, vents or other penetrations. A proprietary sleeve should be installed for pipes to pass through, which allows for replacement of the pipe if required at a later date with less impact on the membrane system.

All penetrations must be flashed all round and collared or capped to produce a complete watertight seal, and be angled or curved downward so that the opening is facing down to prevent water ingress.

If the pipe is to be directly flashed around, use a proprietary flashing boot and cap, which will increase the watertightness and reduce direct flame and/or heat from the pipe itself.

To improve the effectiveness of preventing water ingress at penetrations on relatively horizontal plywood substrates, it is recommended that a purpose shaped plywood base be installed around or under the penetration, then flashed over with the membrane, including the collar if a proprietary accessory is used.

See Figures 29, 30, 31.

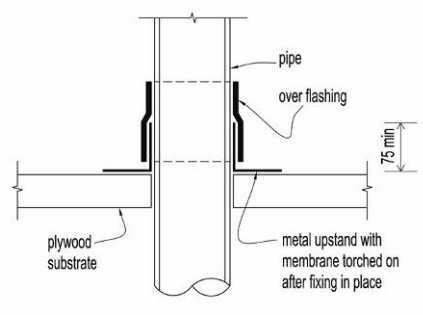


Figure 29 – Typical vertical pipe penetration with proprietary over- and under-sleeve (membrane omitted for clarity)

Note - The figure(s) is/are not to scale, and "membrane system" may mean a single layer or multiple layer system depending on its application.

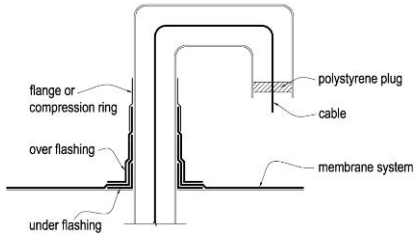


Figure 30 – Typical vertical pipe penetration

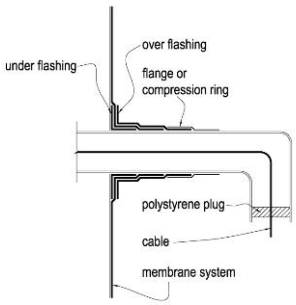


Figure 31 – Typical horizontal pipe penetration

Note - The figures are not to scale, and "membrane system" may mean a single layer or multiple layer system depending on its application.

18. Install under-flashing then the roof membrane to a pitch roof ridge, including an over-flashing. Flash to adjacent surfaces including up and under other types of roofing.

    See Figures 32, 33, 34.

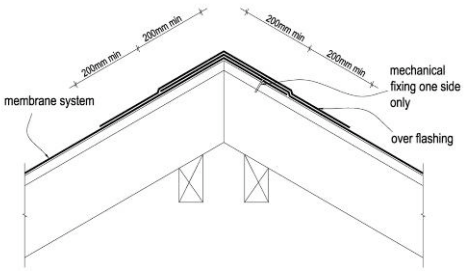


Figure 32 – Roof ridge with overflashing

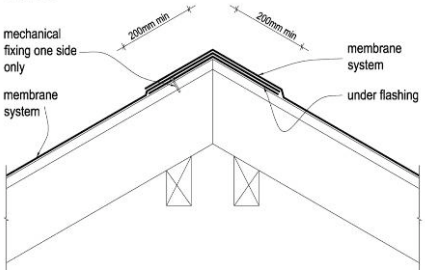


Figure 33 – Roof ridge with underflashing

Note - The figures are not to scale, and "membrane system" may mean a single layer or multiple layer system depending on its application.

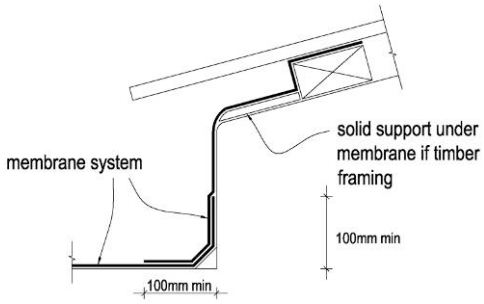


Figure 34 – Membrane up wall and under roofing, with solid support
Note - The figure is not to scale, and "membrane system" may mean a single layer or multiple layer system depending on its application.

19. Where expansion joints are detailed, a proprietary capping should be used. A common cause of premature membrane failure is the lack of properly designed, constructed or flashed construction or expansion joints. It is the responsibility of the Designer to ensure that they are correctly spaced and designed. If not detailed, the Applicator must advise the Main Contractor and require the information to be provided.

    All expansion joints will end up against a parapet wall or fascia, requiring a saddle- or stop-end flashing of some description. These are very site and construction specific, so no drawings of this nature have been included in this Code of Practice.

    See Figures 35, 36, 37, 38, 39.

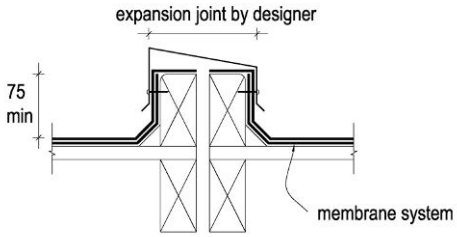


Figure 35 – Metal expansion joint cap, double-sloped, fixed both sides

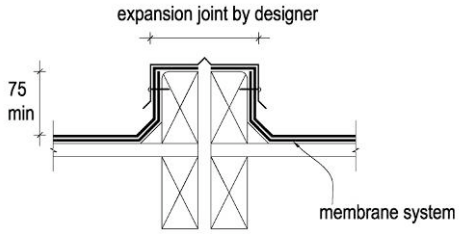


Figure 36 – Metal expansion joint cap, centre-peaked, fixed both sides

Note - The figures are not to scale, and "membrane system" may mean a single layer or multiple layer system depending on its application.

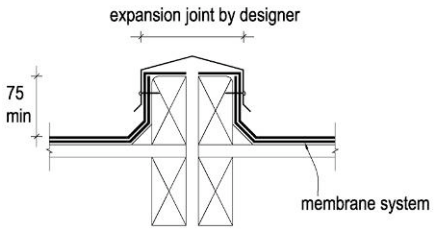


Figure 37 – Metal expansion joint cap, single-sloped, fixed one side

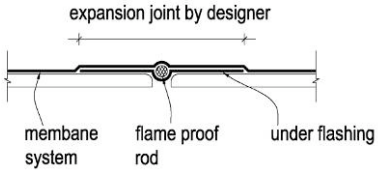


Figure 38 – Flush expansion joint

Note - The figures are not to scale, and "membrane system" may mean a single layer or multiple layer system depending on its application.

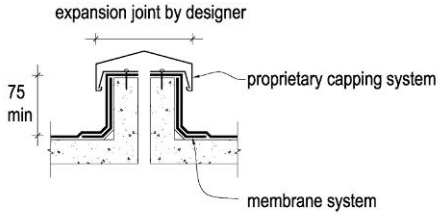


Figure 39 – Proprietary expansion cap with underflashing

Note - The figure is not to scale, and "membrane system" may mean a single layer or multiple layer system depending on its application.

20. Complete all upstands, downturns, pipes etc with an over-flashing.
21. In general, install additional layered flashings to all other junctions (not covered specifically above) such as plinths, air-conditioning unit runners, water-tank feet, balustrade feet or posts, for example by heat forming and welding.
22. After all the detail work has been completed, lay the full membrane sheets. Chalk a line where necessary to position and align the sheets prior to installation to ensure a good layout and correct and even over-lap welds. All adjacent end laps must be staggered.
23. All laps must be parallel or perpendicular to the slope of the roof so that the flow of water is over the lap and never against or into the exposed lap edge.
24. Overlap all membrane sheets by 100mm minimum at sides, and 150mm at the ends of rolls. All overlaps must be heat-welded including flashings to achieve a waterproof joint.
25. Always start at the lowest point of the area to be laid and work up the slope to the highest point.
26. At completion, check all welds for total bond and if practical carry out a water test.
27. Clear off all excess materials and plant, leaving the site clean and tidy.
28. If the modified bitumen membrane is a plain finish, apply the recommended film-build/number of coats of protective coating.
29. Complete the appropriate quality control sheet as the job progresses. Sign off at completion with the Main Contractor and file accordingly.

7.4 Muliple-layered Systems

To provide additional protection and long-term waterproofing, a multiple layered membrane system may be specified.

In a two-layered system, each sheet must be fully waterproof in it's own right, thus the following sheets cannot be considered to form part of the two-layered system:

- A thixatropic bedding compound
- A perforated vent sheet
- A mechanically-fixed sheet

7.5 Coating and Protection

Mineral-finish membranes provide inherent UV protection provided that the mineral granules themselves remain firmly embedded in the membrane and do not normally require coating.

Plain-finish bituminous membranes as supplied from the Supplier must be coated to provide various properties or combinations thereof as required, including to:

- Provide UV protection
- Reduce heat absorption
- Provide wider colour selection
- Enable a specific design appearance or colour, with a light reflectance value of greater than 40
- Enable the collection of potable water

After installation, the membrane must be left for a suitable period as recommended by the Supplier to allow for the release of any installation tension and for any oxidisation of the outermost face to occur. Following this, the modified bitumen membrane system must be checked and any maintenance or repair work carried out. Then the membrane should be cleaned ready for any final coating.

Membranes are to be coated in accordance with the Supplier's recommendations.

Low slope structures must be coated with suitable immersion-resistant type paint.

Mineral-finish membranes may also be coated.

Coatings must be kept clean and free of algae infestation. Coatings may require re-coating every 5 to 7 years, depending on the local conditions and the Supplier's recommendation.

7.6 Over-Surfacing

There are times when the modified bitumen membrane system is over-surfaced for various purposes that can involve a wide range of other systems or materials. This section covers the majority of these situations, and addresses the general membrane installation and protection requirements. Refer to the building consent documentation and/or the Supplier's recommendations.

7.6.1 Roof Gardens

Roof garden systems themselves (e.g. drainage procedures, filtration cloth, composition of scorias/soil/etc) require specialist design, and are outside the scope of this Code of Practice. However, for the membrane system itself, and in general:

- For all roof gardens, the minimum modified bitumen membrane system must be a double-layered system to ensure watertightness. The top layer should be a membrane specifically designed for roof gardens that incorporates a root-resistant additive to resist root attack
- Ensure all drainage outlets are mechanically fixed, and that leaf guards are installed and wrapped in geo-textile
- Roof garden membranes to both the floors and walls must be protected from mechanical damage e.g. from spade/shovel strike
- A free-draining/protective layer should be installed between the membrane and the body of the garden

7.6.2 Insulated Roof

Insulated roofs themselves require specialist design, and are outside the scope of this Code of Practice. Detailed instructions must be obtained from the Designer and/or Supplier. However, for the membrane system itself, and in general:

- Foam panels can be tapered to provide falls of uniform thickness if the substrate has been designed to provide a fall
- The panels should be installed in an interlocking brick-like pattern
- The panels can be directly fixed to the substrate by a mechanical fixing method or if over a vapour base sheet by a cold adhesive bed or with bituminous membranes designed for the purpose
- Any modified bitumen membrane system over foam panels must be a double layer, the first being a self-adhesive or cold-fix type to avoid the use of flame and the cap sheet torched-on. All laps must be heat-welded
- Some proprietary systems are available where a bituminous membrane is pre-attached to the foam insulation. These would be laid as per the Supplier's instructions with overlaps heat-welded, and then a cap sheet applied
- Roofs that involve foam insulation immediately under the membrane should be non-trafficable, other than for maintenance purposes

7.6.3 Inverted Roof

An inverted roof is where insulation is placed above the modified bitumen membrane system and then protected by another material. This work is carried out by other trades and it is the responsibility of the Main Contractor to ensure that adequate protection of the membrane system is in place before the application of the other material.

Concrete screeds must only be placed over a bituminous modified bitumen membrane system that has been protected with polythene sheet, foam panels, XPS, HDEPS or other suitable protection materials that act as a slip membrane to reduce tension on the modified bitumen membrane.

7.6.4 Ballast

Cap sheets are supplied with mineral granules bedded into the bitumen or sand-faced. If further ballast is required, for instance where a specific colour is required, it should be laid over a protection drainage sheet/pad or geo-textile.

7.6.5 Direct Tiling

Do not direct tile in a thin-bed adhesive over a torch-on membrane system. See section 7.5.6.

7.6.6 Tiling Over Screed

If a tile decking over a screed is specified, the membrane must be protected with a suitable release layer such as heavy gauge polyethylene. Then a minimum 30mm concrete reinforced screed is installed and left to cure before the tiles are laid. The screed and the tiles must incorporate expansion joints at maximum 3m x 3m grid centres and at the perimeter of the deck.

7.6.7 Pavers

Pavers are usually installed by a following trade, usually on proprietary paving support pads, which protect the membrane and allow drainage. Ensure that the support pads themselves and their spacing are such that they can sufficiently spread the load of the pavers and the expected traffic load. See section 7.5.8.

7.6.8 Raised/Removable Surfaces

Proprietary systems or supports (sometimes called a "chair") exist which can provide raised or removable surfaces over a torch-on membrane system, or they can be custom-designed.

Such systems are or should be designed to allow water to pass through and are not part of the waterproofing system. Instead, they provide a protection layer by eliminating any direct traffic to the membrane. Thus, the raised surface could be designed to finish level with the internal finished floor level as any water that does fall through will be dealt with by the torch-on membrane system itself, which must be 100mm below the internal finished floor level as required by E2/AS1.

There is a range of proprietary systems, but the key principles offered should be:

- That the finished surface of the pavers will allow water to pass through, usually a 5mm gap between pavers
- That the finished surface is well-supported, such that it will not deflect under the expected normal traffic loads
- That the support mechanisms will not damage the torch-on membrane system, either by having a great enough number of individual supports or by the use of a support system that sufficiently spreads the load so that there are no unacceptable point loads
- That any support component will not penetrate the torch-on membrane, unless specifically designed and detailed to do so
- That there is a 12mm minimum gap between the pavers at the edge and any adjoining wall or balustrade

7.7 Resurfacing

When an existing roof membrane system has deteriorated beyond repair or the substrate is suspect and it is not advisable to overlay it, then the existing membrane must be removed and a new torch-on membrane system installed.

Removing an existing roof membrane exposes the building to potential inclement weather and therefore must only commence and/or proceed with sufficient long term fine weather forecast for the completion of the project. If this is not possible, install a temporary weatherproof protection system over the working area as required.

Depending on the size of the project, it is recommended that the removal of the existing membrane and installation of the new membrane be completed in stages, sealing all leading or exposed edges at the end of each day. Avoid removing large sections that cannot be protected from the weather or resurfaced that day.

The work should be planned to cause the least possible damage from water or other building material ingress or disruption to the building occupiers, operations or activities.

The work procedure to be followed is:

1. All existing membranes including flashings are to be removed back to the substrate
2. The substrate is to be checked, repaired and prepared for resurfacing. Any ponding areas are to be made flush before laying any new membrane
3. If the substrate is plywood, check and remove any faulty plywood and/or supporting timber. Replace with treated timber and CCA treated plywood (H3.2 grade), see section 5.2.4.1
4. All existing metal flashings that are faulty are to be removed and replaced
5. Check the falls and recreate where required to ensure that surface water will drain to the outlets
6. In general, thoroughly prepare the surface, then prime with an approved bitumen primer before installing the new membrane
7. Use Figure 2 and Table 6 to select the correct torch-on membrane system for the project, giving consideration to venting the substrate
8. Install as per section 7.3

7.8 Accessories

Accessories (often called ancillary products) should be sourced from the membrane Supplier with the membrane to create a complete system. Other than box sumps in gutters that can be preformed in the substrate, all other accessories are purpose-designed and constructed from non-ferrous metal or a composite material e.g. thermoplastic, rubber or similar.

Such accessories or ancillary products should be a single component.

Where practical, the flanges of all accessories (other than air vents) should be fitted, mechanically fixed and recessed into the substrate to create a level surface for the membrane to cover over, unless under-flashed to sandwich the flange between.

Typical roof accessories should be rebated into substrates where possible, and include:-

- Box sumps – placed in gutter and roofs at low points. Preformed in square or rectangular shapes, with one large drain. Some models also incorporate overflows.
- Scuppers – often referred to as parapet box outlets. Preformed with flanges and a pipe tongue to go through the parapet into an external rainwater head or a downpipe.
- Overflows – a variety of preformed models and shapes are available. They should be installed at a height to allow excess water to be drained away safely rather than flow into the building structure. They are very often standpipes with the top level set well below the highest flashing or upstand level.
- Drains – a range of purpose-designed drains installed in the roof substrate allow surface water to drain away. The most common are often referred to as a “dropper”, preformed with a flange, a clamp ring and a non-return tongue that fits into the downpipe.
- Drain grilles – often referred to as leaf guards, purpose-designed and manufactured from non-ferrous metal or a composite material, either loose fitted or held in place by a flange
- Air-vents – cone type (mushroom shaped) or low profile, both with caps to allow moisture vapour to dissipate whilst preventing rainwater entry

Other accessories supplied for use over torch-on membranes include:

- Paver supports, duckboards, support pads – purpose-designed, preformed out of thermoplastic rubber to provide support for concrete pavers or timber framing for catwalks or duck boarding. These pads provide protection to the membrane and permit water drainage.
- Walkway matting - often produced out of recycled rubber granules, the matting provides protection to the membranes from maintenance traffic and incorporates other features, such as sound deadening acoustic and anti-slip properties
- Protection/Drainage mats – a range of products available from profiled HDPE protection sheets to purposely designed drainage cores incorporating geo-textile

7.9 Post-Installation Work

The Applicator must clear from the worksite all installation debris, cut-offs, scraps, and protective wrappings on a daily basis.

During the course of regular in-service maintenance, the whole roof or deck should be systematically checked and a note made of any items requiring attention. The following checklist (as a minimum) should be used:

- Surface protection – check that the surface protection layer is in place and complete. Note any wind scour, displacement of ballast, cracked or damaged pavers
- Flashings – check that flashings are intact and fully secured with pointing or sealing complete
- Upstands – check that upstands are intact, fully adhered, and adequately protected. Note any areas of distortion or stress and any blistering
- Penetrations – inspect the torch-on membrane around each penetration. Ensure that flashings and upstands are intact
- Edge trims – check for signs of movement, displacement, or stress, particularly at the joint between torch-on membrane roofing and metal trims

- General area – examine the whole of the general roof area and note any areas of stress, any signs of blistering, or any indications that the roofing is detached from the substrate. Record the extent and type of any defects
- Check lap joints for integrity
- Drainage – inspect all gutters and rainwater outlets and discharge points. Ensure they are clean and that water discharge from the roof is uninterrupted. Carefully examine the junction between the torch-on membrane roofing and rainwater outlets. Note any apparent defects or signs of silting or ponding
- Inside the building – check inside the building for any staining or indication of damp penetration or condensation, which could be related to the roofing

Completed torch-on membrane roofs must not be used for storage of materials unless fully protected by rigid durable sheet material, and no work by other trades may be carried on or over an unprotected torch-on membrane.

7.10 Testing

The roof should have the drainage outlets temporarily blocked and the roof flooded to check the integrity of the torch-on membrane system. On large roofs, sand bagging may be required to prevent the spread of water or to contain it to allow 50mm depth to be achieved across the area being tested. The flood test must be for a duration of not less than 48 hours.

Once the membrane system has been checked and tested, the roof can be handed over to the Main Contractor and written acceptance of the torch-on membrane system obtained as installed.

7.11 Post-Installation Penetrations

A major reason for future leaks in a torch-on membrane system is penetration of the membrane by other following trades during the construction project or at a later date.

Although the size of the penetration is important e.g. a skylight compared to a TV cable, the most critical aspects are the skills of the tradesperson, how the penetration is detailed and how the work is carried out.

Unless the work is of a major nature, such post-installation penetrations will usually be minor and often not consented. However, this does not reduce the requirement that such work be carried out to the same standard as the original installation. It will usually require more attention to detail for a successful integration of the new work with the existing. It is highly recommended that the original Applicator, Designer and/or Supplier are consulted to ensure that total waterproofing integrity is maintained.

8. Maintenance

8.0 General

A torch-on membrane system, which has been designed and installed in accordance with this Code of Practice, should give trouble free service for many years, provided it is properly maintained.

Similarly, Building Owners would expect their roofing system to remain durable. In New Zealand, the Building Code requires that roof claddings, with normal maintenance, are waterproof for at least 15 years.

The serviceable life of torch-on membrane roofing systems depends on:

- The underlying building design and construction
- The stability of the substrate
- The type, grade and formulation of the torch-on membrane system installed
- The thickness of the finished application
- The standard of installation by the Applicator
- The level of UV exposure and/or protection
- Activities that occur on and over the torch-on membrane
- Attention to maintenance requirements

Preventive maintenance by regular inspection checks is highly recommended, rather than waiting for either catastrophic failure to occur or systematic failure to become evident.

The frequency of inspections will depend upon local conditions, use of or activities on the membrane, close proximity of trees, degree of atmospheric pollution, etc.

It is recommended that the Designer, Supplier and/or Applicator notify the Building Owner in the writing of the contract liability conditions and maintenance requirements of the torch-on membrane system.

All references to Building Owner or Property Owner and their responsibilities, also apply to the property management company, the lessee or the tenant.

Prudent risk management of the building as a whole suggests that regular inspection and maintenance of the torch-on membrane is an important part of avoiding future problems.

Further, to ensure the best and regular care, such work should form part of any maintenance contract. Ideally the regular inspection should be carried out by the Supplier and an approved Applicator.

8.1 Defects Liability

Post practical completion maintenance defects liability requirements are covered either in the original contract documents for the construction of the building, the resurfacing tender documents or any other written commercial obligations. The obligations extend to the end of the Defects Liability Period, the length of which will have been stated in the contract.

The Property Owner should read these documents and be aware of the maintenance defects liabilities.

8.2 Preventive Maintenance

The long-term performance of the torch-on membrane system installed on any building is reliant on the property owner implementing a good housekeeping or preventive maintenance programme.

The roof should be inspected periodically to determine its condition and any areas of concern identified, including moisture ingress to the interior noted. Any problems must be reported to the membrane Applicator or the Supplier, so that prompt remedial work can be carried out.

The following are some of the requirements. Others are covered under various headings throughout this Code of Practice, or in an inspection checklist provided by the Main Contractor.

8.2.1 Checking
During and after other trades' work is carried out on the building (for example the installation of a TV aerial or air conditioning unit), a check should take place to ensure there is no damage to the membrane or any potential water entry created. Call on the service of the membrane installer if required.

8.2.2 Clearing
Check gutters, sumps, drains, overflows and corners for accumulated rubbish, leaves, branches, silt and plant-growth and remove anything that can cause blockage.

8.2.3 Cleaning
It is recommended that the membrane surface be washed down yearly at low pressure, to not only clean the surface but also enable thorough inspection of the roof membrane.

8.2.4 Treating
Should any moss, mould or lichen infestation appear, treat with a recommended (by membrane Supplier) solution and wash down at low pressure.

8.2.5 Inspecting
The complete membrane surface, including gutters, sumps, drains, flashings, penetrations and upstands must be thoroughly inspected at least yearly, any areas of concern noted and rectification work carried out.

8.2.6 Recoating
To ensure a coated torch-on reinforced bituminous membrane performs as required, it may be necessary to clean, prepare and recoat every 5 to 7 years or at signs that the existing coating is deteriorating. To extend the performance of the membrane beyond 15 years, the Applicator should be engaged to check, carry out any repairs that may be required and recoat.

8.3 Notification of Remedial Work
The Property Owner is advised to notify the membrane Applicator or Supplier if they become aware of:

- Faults found in the membrane
- Mechanical damage caused to the membrane.
- Subsequent installation work, such as TV aerial, vents, air conditioning unit, etc
- Building alterations or extensions

Prompt notification is vital to not only rectify a problem, but to reduce any subsequent water ingress problems.

8.4 Maintenance Servicing
During the course of regular maintenance inspections the complete roof surface should be systematically checked and any areas requiring attention should be noted. The following checklist could be used:

1. General surface – Examine the whole of the general roof area and note any areas of stress, bubbling or blistering, de-lamination from the substrate or within the torch-on membrane system and note the extent and type of defects.
2. Surface condition – Check for accumulated rubbish, silt, leaves, branches and plant growth, including moss, mould or lichen infestation and the overall condition of the membrane.
3. Overlap welds – Check all overlap welds in the membrane and flashing to ensure they are fully bonded to the membrane, watertight and functioning as required.

4. Surface protection – Check that the surface protection layer is in satisfactory condition. i.e. no bare patches of mineral chip or peeling and badly oxidising paint film.
5. Flashings – Check all flashing are intact, fully adhered, not ruptured and functioning as required. Note any bad rippling, distortion or stress areas.
6. Upstands – Check all upstands are intact, fully adhered, adequately protected and functioning as required. Note any areas of distortion or stress.
7. Penetrations – Inspect the membrane around each penetration to ensure that the flashings are intact, not ruptured, adhering and performing as required.
8. Edge trim – Check for suspect movement or stress areas, ruptures, de-lamination or displacement at junction places or adjacent surfaces.
9. Abutting construction – Check parapet wall and other adjacent structures flashing and/or linings for damage, rippling, distortion or areas of distress and cracking.
10. Expansion joints – Check movement or expansion joint upstands, flashing or capping to ensure they are functioning as required.
11. Roof fixtures – Check all roof fixtures and fittings, flashings, collars etc are sound, not loose or suspect.
12. Substrate – Check for depressions and ponding created by deflection in substrate and investigate the cause.
13. Drainage – Check all gutters, sumps, outlets and rainwater discharge points to ensure they are clear of rubbish and clean. Inspect all welds and flashings, note any rippling, distortion or stress areas.
14. Sealants – Inspect all sealants to ensure they are not faulty and are performing as required. Note any areas of concern.
15. Inside building – Check the interior of the building for any staining or dampness signs that would indicate moisture ingress or condensation.

The inspection must be thorough, any areas of concern recorded and the installation Applicator or membrane Supplier advised promptly. It is recommended that an experienced membrane Applicator be used as they will know how to carry out a thorough inspection and the potential problem areas to look for.

The original Applicator should be engaged to carry out the required repair work.

8.5 Repair procedures

Repairs should only be carried out after the type and extent of any defects have been noted and their underlying cause identified. The intention of repair work should be to restore the roofing to its original condition and ensure its continuing performance. All repairs should therefore be carried out using materials, accessories and standards of workmanship etc, compatible with the original installation.

The Applicator carrying out any repair, recoating or resurfacing of the modified bitumen reinforced bituminous membrane must do so in a manner that causes the least inconvenience to the occupiers or normal operations within the building.

8.6 Recoating

Recoating of any torch-on membrane system must only be carried out with compatible materials, thus the original Designer, Supplier and Applicator should be consulted before any work is carried out.

The recoating work will require the following:

- Remove all accumulated rubbish or plant growth
- Apply a recommended moss, mould and lichen treatment solution, leave for the required duration
- Scrub, wash or water blast clean at low pressure to a sound surface.

- Repair the membrane installation as required.
- Prime/touch up any areas of damaged coating.
- Apply required number of coats of protective coating.

8.7 Re-Surfacing

Once the original torch-on reinforced bituminous membrane has reached its economic lifespan and repairs and recoating are no longer an option, then consideration is required to either remove and replace the membrane, or overlay with a compatible material.

Removal of the existing membrane and its replacement is covered in section 7.6.

Overlaying or resurfacing the existing membrane with a compatible bituminous torch-on membrane system requires suitable preparation. Consult the membrane Supplier or an approved Applicator. Suspect trapped moisture in the original membrane or substrate will require venting, either by the installation of air-vents, a vent sheet in a double layer system, or both. A sound, well-adhered existing membrane may be resurfaced with a suitable single layer reinforced bituminous membrane.

Irrespective of which torch-on membrane system is proposed, thorough surface cleaning and preparation is vital to ensure good adhesion and long-term performance of the new membrane. The following is required:

- Apply a suitable moss, mould and lichen solution to the complete membrane surface and leave for the prescribed period
- Water-blast clean and leave to dry
- Repair the existing membrane to render it weathertight
- Heat and remove any degraded material to restore a sound surface.
- Heat and remove the existing mineral finish, or heat to bring-up the bitumen and press mineral down into the membrane. Alternately overlay with a bitumen compound. Either system must provide a suitable surface for good adhesion of the new membrane.
- Install a vent sheet, air-vents or both if required
- Install cap-sheet of the selected finish
- Coat with a protective coating if required

All installation work should be carried out as covered in sections 6 and 7 of this Code and the membrane Supplier's written installation instructions.

MGNZ Members:

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