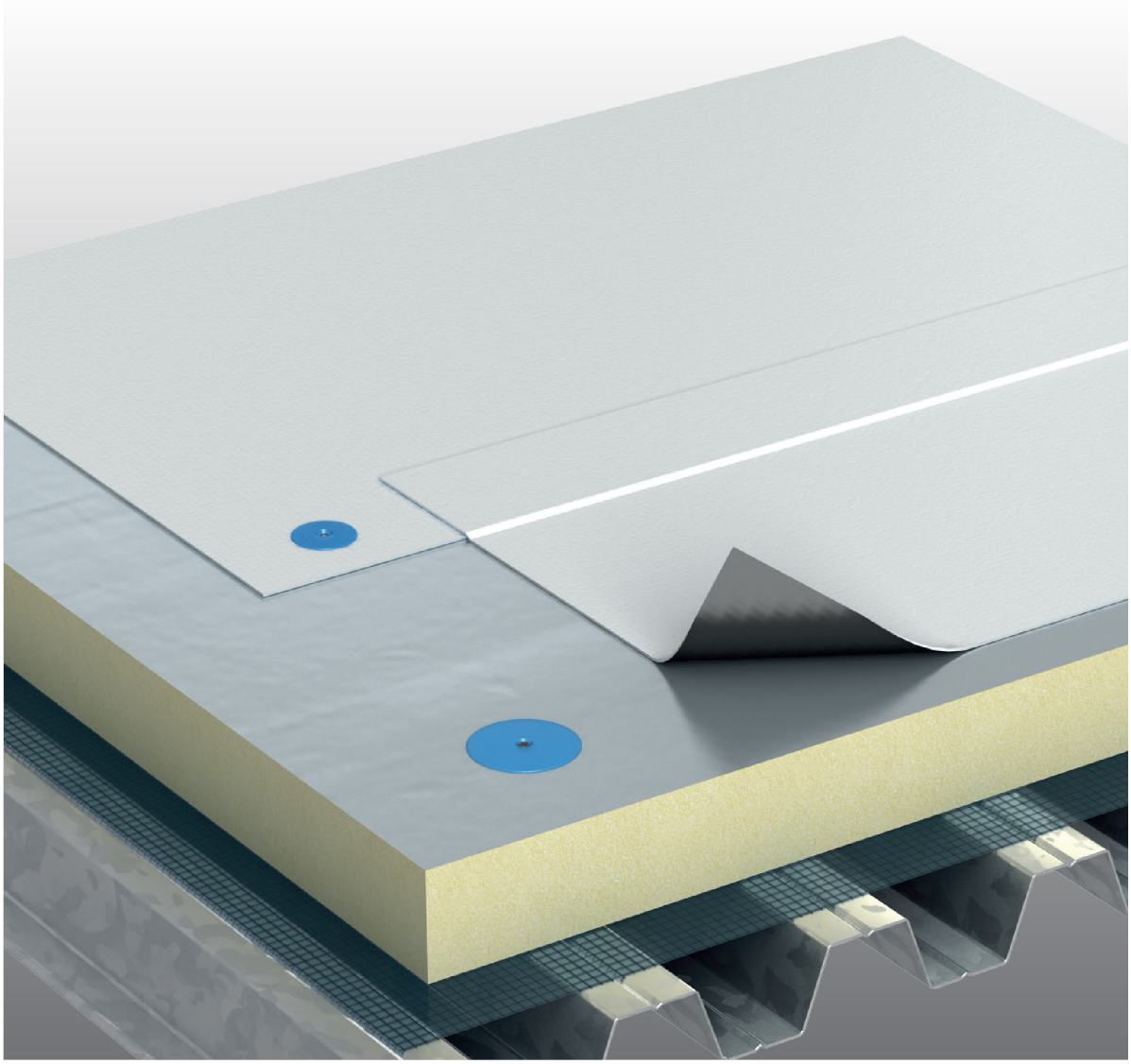
BMI EVERGUARD

Installation and welding guide for mechanically fixed applications



EverGuard TPO Single Ply Roofing System

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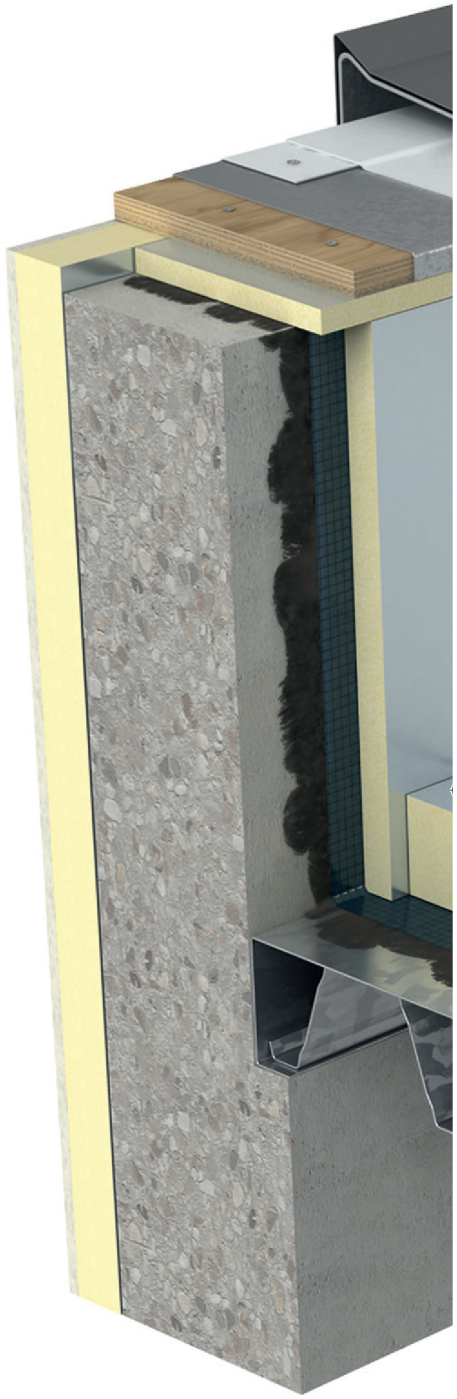
Thermoplastic Polyolefin (TPO) single ply roofing membrane, with knitted polyester reinforcement.

Mechanically fixed system application according to EN 13956.

EverGuard TPO Single Ply Roofing System Overview

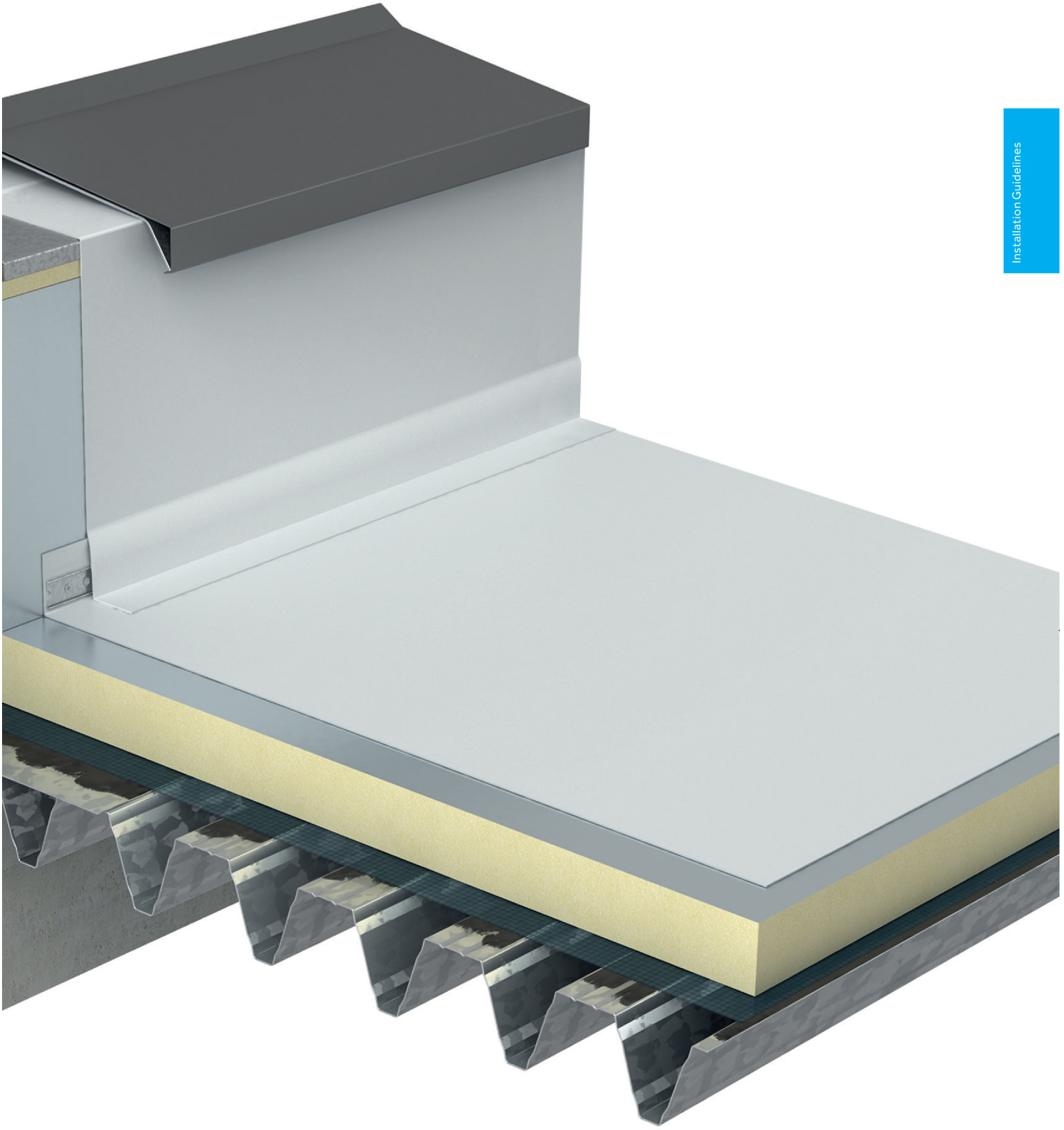


A complete roofing solution.

BMI EverGuard is a single ply flat roof system incorporating a thermoplastic polyolefin (TPO) waterproofing membrane, complete with insulation, vapour control layer, mechanical fixings and a range of accessories. Installed across more than 300 million square metres throughout the world, its multi-layered benefits have gone beyond product performance to deliver comprehensive system solutions.

Solutions underpinned by certifications, approvals and guarantees – and by our BMI RoofPro contractor programme, ensuring that those certified to install EverGuard are experts in building lasting layers of protection, performance and peace of mind into

- SINGLE-SOURCE SYSTEM
- EASIER INSTALL
- IMPROVED BUILD SPEED
- ROOFPRO CONTRACTOR PROGRAMME
- SYSTEM GUARANTEE



EverGuard TPO System Concept Solutions

BMI mechanically fixed systems with EverGuard TPO Membranes are ideal for roofs of all sizes and locations - one membrane for all climate zones.

The EverGuard TPO Membrane Roofing System is a quick and cost-effective system that can be installed practically all year round and ideally suited for all lightweight metal decked structures and buildings such as warehouses, supermarkets, distribution and logistics centres.

MECHANICALLY FIXED APPLICATION WITH EVERGUARD TPO

Advantages:

- Mechanically fixed roofs are the most cost efficient for exposed roofing applications.
- Fast installation speed achieved with mechanical fastening.
- Installation of mechanically fixed roofs is independent of weather conditions.
- The physical properties of the membrane provide high wind uplift values.
- Uncontaminated material can be recycled at end of life providing an environmental advantage.

Why EverGuard TPO Membrane?

- EverGuard TPO outperforms its competitors in excellent weldability, high wind uplift values, heat-aging and UV tests – the best predictors of TPO performance.
- An independent TPO study showed EverGuard TPO 1.5 mm membrane to demonstrate superior accelerated aging performance. Following accelerated heat aging at 135°C for 105 days, EverGuard 1.5 mm TPO showed no cracking.
- Factory Mutual Approved roof systems incorporating membrane, insulation, fasteners and vapour control layer are available.
- The welding characteristics make it easy to install and it is complemented by the most complete line of accessories.

Accessories

Field fabrication of TPO accessories is time consuming, costly, and inconsistent – and it can lead to unreliable details that compromise a watertight roofing system. EverGuard TPO prefabricated accessories deliver consistent quality and eliminate the worry and problems often associated with field fabrication. They can also boost productivity up to 200%, while reducing installed cost by up to 12%.

SYSTEM APPLICATIONS

The system roof concepts deal with support structures such as lightweight constructions consisting of trapezoidal metal sheet, concrete or plywood.

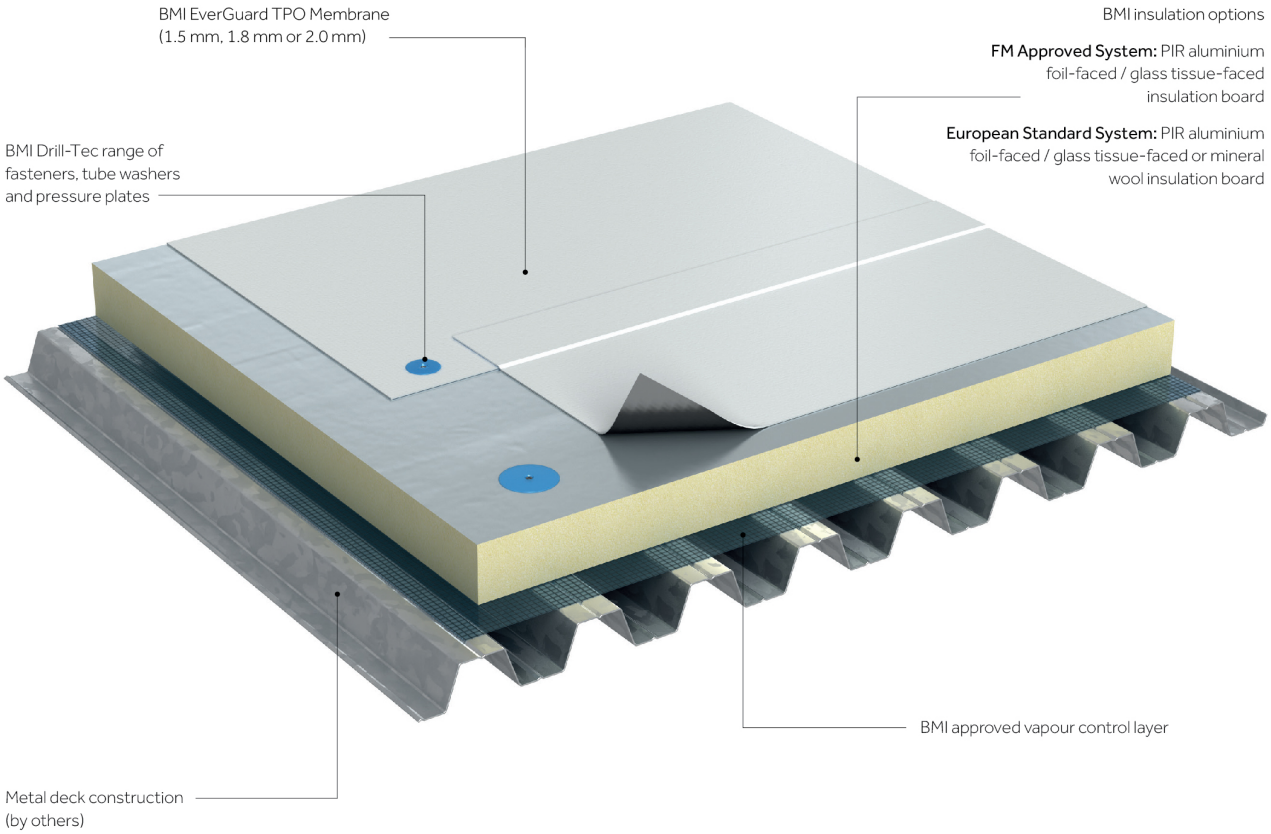
BMI EverGuard TPO System concept solutions consist of TPO membrane, insulation, VCL and fasteners, approved to FM and EU standards. These concept are supported by BMI guarantees that provide a high level of technical service and support.

EverGuard TPO prefabricated accessories can boost productivity by up to 200%, while reducing installed cost by up to 12%.

BMI EVERGUARD TPO ROOF SOLUTION ON TRAPEZOIDAL METAL DECK

BMI System recommendation

- BMI EverGuard TPO membrane
- BMI Drill-Tec fasteners
- BMI insulation - PIR or mineral wool
- BMI approved vapour control layer
- Metal deck construction (by others)



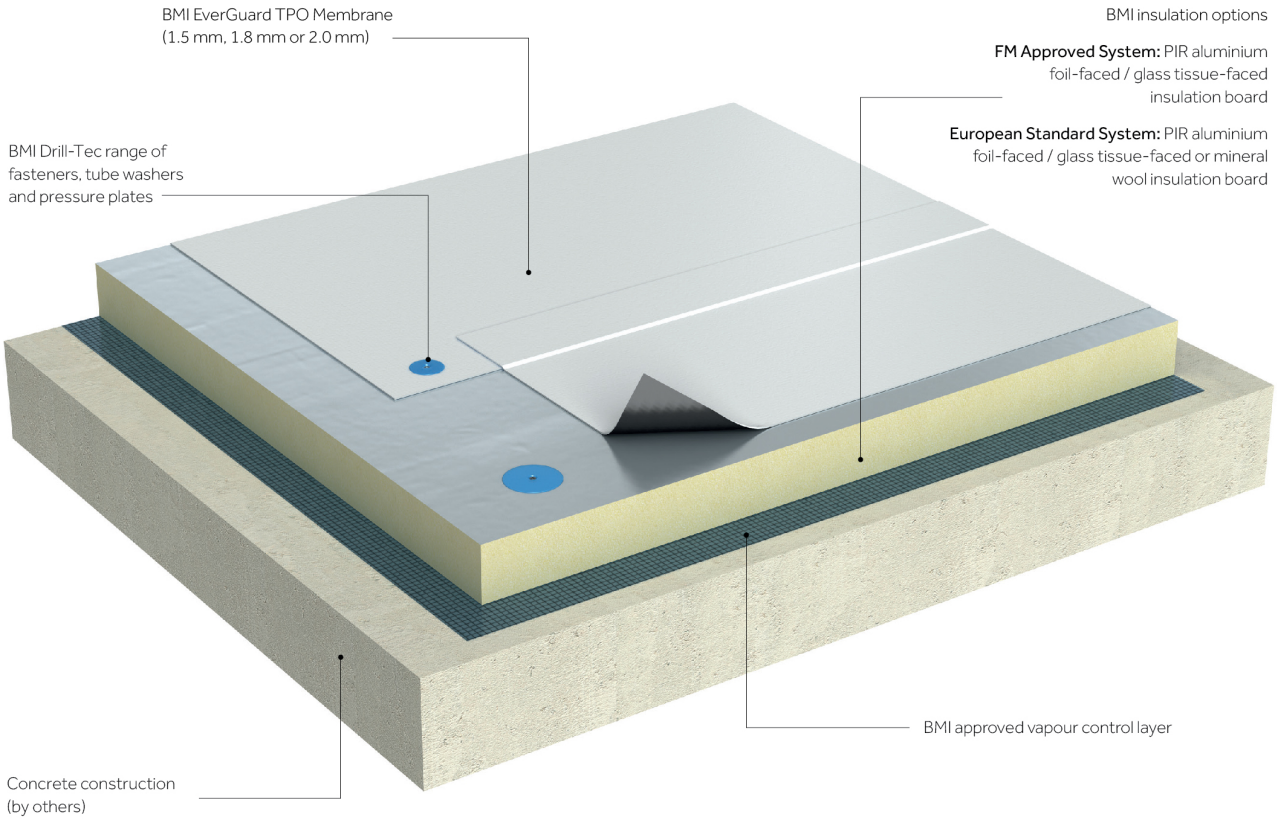
FM APPROVED

EverGuard TPO Single Ply Roof System also available to FM Approval specification, visit: **bmigroup.com/EverGuardFM**

BMI EVERGUARD TPO ROOF SOLUTION ON CONCRETE DECK

BMI System recommendation

- BMI EverGuard TPO membrane
- BMI Drill-Tec fasteners
- BMI insulation - PIR or mineral wool
- BMI approved vapour control layer
- Concrete construction (by others)



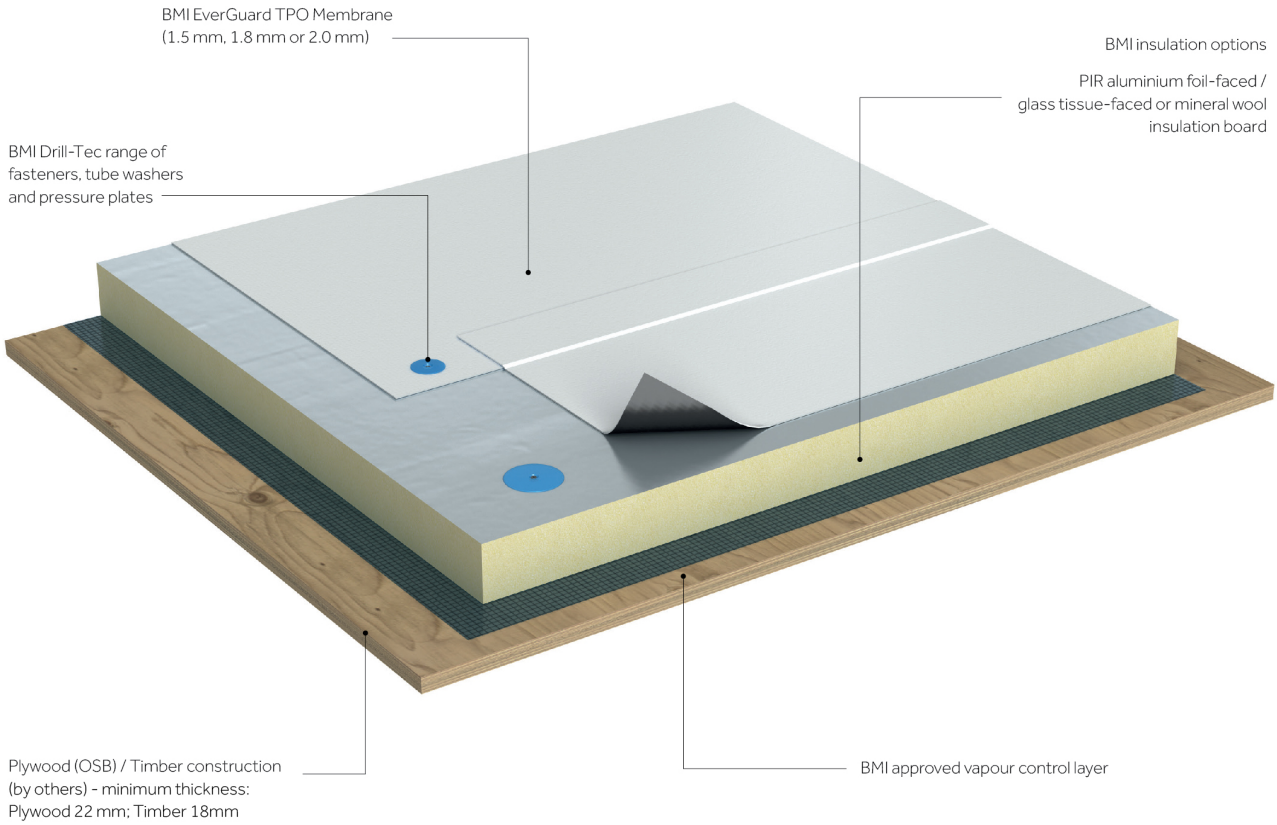
FM APPROVED

EverGuard TPO Single Ply Roof System also available to FM Approval specification, visit: **bmigroup.com/EverGuardFM**

BMI EVERGUARD TPO ROOF SOLUTION ON PLYWOOD (OSB) / TIMBER

BMI System recommendation

- BMI EverGuard TPO membrane
- BMI Drill-Tec fasteners
- BMI insulation - PIR or mineral wool
- BMI approved vapour control layer
- Plywood (OSB) / Timber construction (by others)



EverGuard TPO Introduction

This application manual contains basic rules and serves as guidance for roof waterproofing using EverGuard TPO membranes for new buildings and refurbishment projects. The basic rules in this document reflect the manufacturer's instructions and guidelines for roofers and construction site managers.

This document, including the section dedicated to the range of approved system concepts offered by BMI, is supported by a guarantee scheme, should be used as a tool for roofers and planners to guide them in selecting the correct roofing solution for the application.

For further information, detail or if you have any questions, please contact BMI Technical Support.

Adherence to the relevant technical rules, as published in standards and regulations, as well as to workers protection and safety regulations is obligatory. The handling instructions and notes on labels and safety data sheets for BMI accessory materials are to be observed. Drawings included in these instructions are not true to scale and are schematic.

DELIVERY AND STORAGE OF SYSTEM COMPONENTS

Rolls of EverGuard TPO Membrane should be delivered to site in original packaging with seals unbroken and labelled with manufacturers name, product brand name, and type. Rolls must be protected against moisture and frost until they are used.

All single ply materials, including accessories, stored outside must be raised above ground or roof level on pallets and covered with a tarpaulin or other waterproof and 'breathable' material. Rolls must be stored horizontally on a clean flat and dry level surface. Pallets should be distributed evenly across the roof deck to prevent undue or concentrated loading in any area. Pallets should not be stacked.

Do not remove any protective tarpaulins until immediately before single ply materials are to be installed. Extreme heat or cold conditions may require special storage requirements. Reference product data sheets for product storage requirements.

Do not use materials that are wet or damaged to the extent that they will no longer serve their intended purposes.

Rolls of EverGuard TPO Membrane should not be stored on the rooftop than will be used within five days. When prolonged inclement weather threatens, roofing materials should be supplied to the rooftop than can be used immediately. Moisture on the membranes may impair weldability.

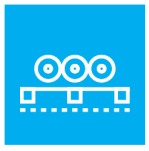
Insulation boards are supplied in shrink wrapped polythene which will provide limited protection during unloading and handling. All board packs are clearly marked with date/time of manufacture, board type and thickness for ease of identification.

Ideally, boards should be stored inside a building or undercover. If, however outside storage cannot be avoided, boards should be stored flat and off the ground. Full protection in the form of tarpaulins or heavy gauge waterproof sheets must be provided at all times whilst on site.

Boards that have been allowed to get wet must not be used.

Cover and protect all exposed materials at the end of each day's work.

PROTECT FROM FROST & MOISTURE



STORE MATERIALS OFF GROUND

DO NOT USE WET MATERIALS

STORE INSULATION UNDERCOVER

MAX 5 DAYS ROOFTOP STORAGE

Please refer to Appendix for BMI product storage guidelines for synthetic membranes.

Tools & Equipment

The following is intended as a basic list of tools and equipment and their operation necessary to install the EverGuard TPO Single Ply Roof System. Depending on the project, other tools and equipment may be required.

Additionally, these instructions are provided as recommended guidelines to follow to ensure proper performance of the equipment and successful installation of the EverGuard TPO Membrane. BMI does not endorse or recommend any particular brand of equipment.

AUTOMATIC WELDER

This is a self-propelled, electrically powered machine with attached air blower and heating unit with a 40 mm nozzle for TPO membranes. There are several models available, and proper operating instruction in the use of each model is the responsibility of the manufacturer/supplier of the machine.

Always read and/or ask the manufacturer of the equipment for the operating procedure.

The following should be either checked or the routine followed daily to ensure proper splicing.

Alignment – Check the machine set-up to ensure proper alignment of the heating nozzle and pressure wheels or moving parts to see they move properly or are free-spinning.

Air Intake – Make sure the air intake is open. Clean out the air intake for the blower unit regularly.

Repair – Check the machine for worn or broken parts which need to be replaced. Take care to protect the pressure wheel from notches or cuts to prevent incomplete sealing of the welded splice.

Power-up – Before the machine is connected to the power source, make sure it is switched off to prevent a power surge that could damage the unit. Turn on the unit and allow the blower/heater unit to reach the recommended temperature of approximately 480 °C. Always carry out a test weld on a sample piece of membrane each morning prior to welding.

Cleaning – Occasionally clean the heat nozzle with a wire brush to remove any build-up of membrane material.

HAND-HELD WELDER

These are used for detailing and making welds not accessible by automatic welders. The hand-held welder should be set to a temperature of approximately 400 °C. Test welds must be carried out.

Many of the care and operating notes for the automatic welders apply to the hand-held welders as well.

TOOL KIT

A typical tool kit should include the following:

- A 40mm seam roller
- A penny roller
- A seam probe
- Hot-air hand-held welder
- A 40mm flat nozzle
- A 20mm flat nozzle
- A 20mm angled nozzle
- A pair of scissors
- A wire brush

Product Range at a Glance

EverGuard TPO is a thermoplastic heat weldable reinforced waterproofing membrane for flat, curved and pitched roofs. EverGuard TPO accessories have been individually designed to ensure total compatibility and ease of application and play a vital role in achieving the total integrity of the EverGuard TPO waterproofing system.

SYSTEM COMPONENTS

Single Ply Membrane

- EverGuard TPO membrane.

Accessories

1 EverGuard TPO Coated Metal is a 0.6 mm hot dipped galvanised steel sheet coated with a layer of 0.6 mm non-reinforced TPO film for an overall thickness of 1.2 mm. The sheet is cut into appropriate widths and used to fabricate metal drip edges or other roof perimeter edging profiles. The coated metal can also be used to provide mechanical restraint at any changes in level, abutments or roof area perimeters.

2 EverGuard TPO Reinforced Strip is used in conjunction with coated metal drips and upstands.

3 EverGuard TPO Unreinforced Flashing is intended to be used in the formation of internal/external corners, field fabricated pipe flashings, sealant pockets and scuppers, when the use of pre-moulded accessories are not feasible.

4 EverGuard TPO Walkway Membrane is a weather resistant TPO membrane which is yellow and grey in colour and incorporates an aggressive, non-slip, interlocking herringbone tread pattern.

5 EverGuard TPO Prefabricated Corners aid speed of installation on site, and are used to reinforce internal and external corners with no stretching or cutting required.

6 EverGuard TPO Pipe Flashings are moulded preformed TPO pipe flashings designed to suit a range of pipe diameters, achieving a watertight seal. There are two types available, one for pipes venting at roof level and one for pipes that are continuous.

7 Fixation Bar is designed for securing and sealing membrane terminations at upstands in accordance with current BMI specifications. The 3 metre long bar incorporates pre-drilled holes at 150 mm centres.

8 Screw fasteners are manufactured from high grade carbon steel which are case hardened to achieve the properties essential for long term performance and have an organic corrosion resistant finish to meet UEAtc Part 2 requirements. The fasteners are also available in austenitic stainless steel offering exceptional corrosion resistance for extended warranty projects.

Tubular washers are precision moulded from high grade polypropylene and extensively tested to ensure resistance to the extreme temperatures and mechanical stresses encountered within the roofing system. They are blue in colour and are available with two washer diameters: A 45 mm diameter for fixing membranes and a 75 mm diameter for fixing rigid insulation boards.

Pressure plates are manufactured from high quality corrosion-resistant stainless steel and are for use where tube washers cannot be utilised or where the membrane is being fastened when insulation is not present, e.g., cold roof situations.

9 Manufactured out of TPO coated metal and unreinforced membrane, EverGuard Scuppers provide a compatible drainage channel through roof parapet walls, eliminating the need for additional flashings.

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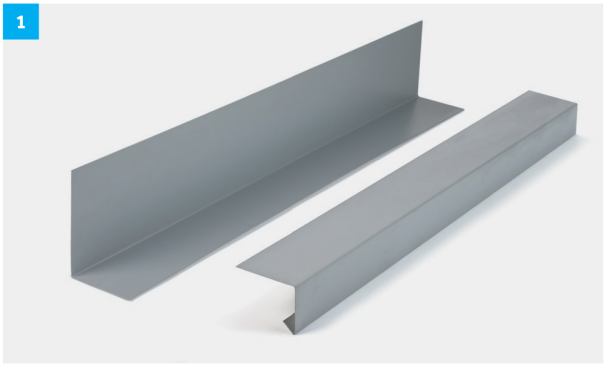

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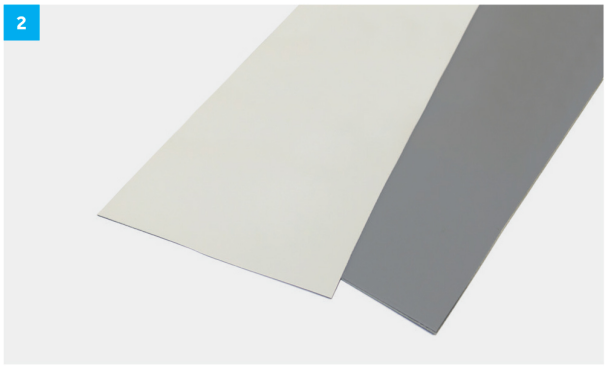

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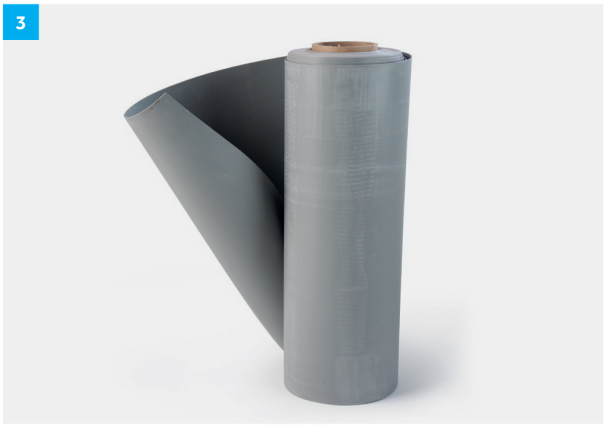

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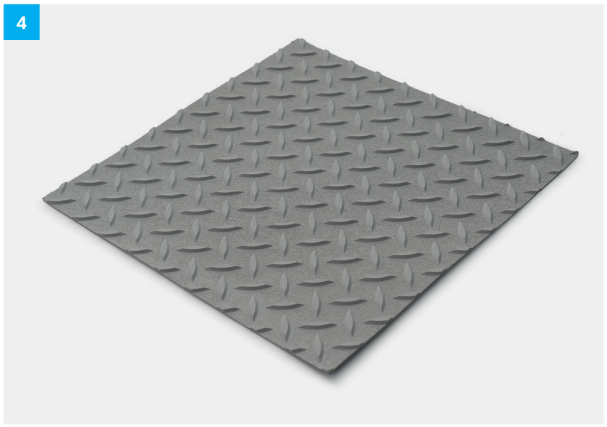

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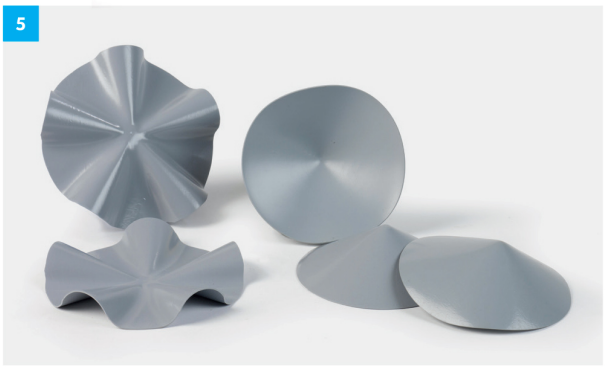

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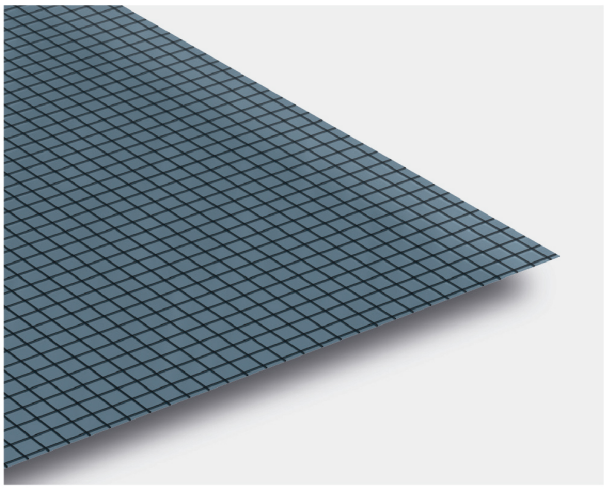
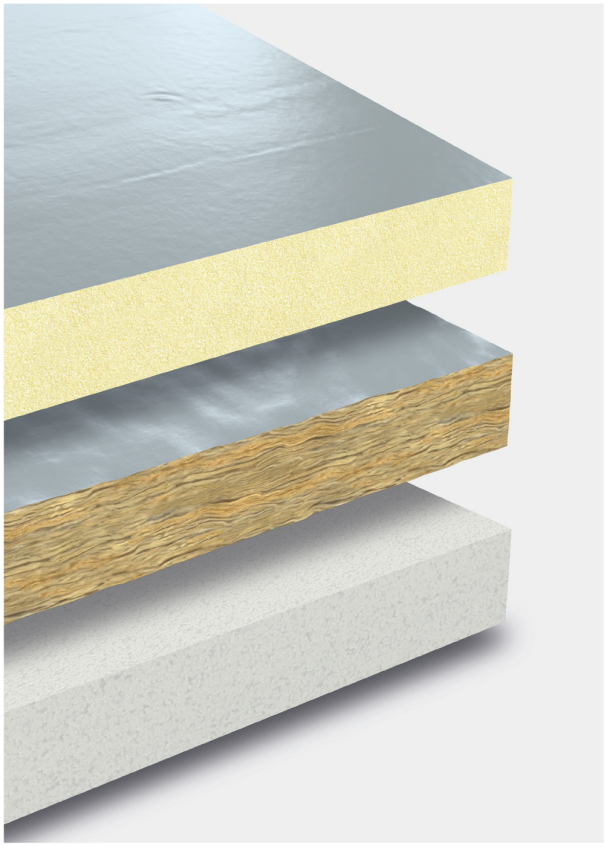
Product Range at a Glance





SYSTEM COMPONENTS (CONTINUED)

Vapour Control Layer

The presence of a vapour control layer helps to maintain the airtightness of the roof. The specification of the vapour control layer is dependent upon a number of factors, such as deck type, method of attachment of vcl and method of attachment of the insulation and waterproofing.

BMI supplies a range of high performance polyethylene and bituminous vapour control layers for use with its single ply roofing systems.

Loose Laid VCL

For mechanically fastened situations, the Monarflex range of reinforced polyethylene VCL's provide a quick and cost effective method of vapour control. These membranes are loose-laid with laps sealed with Monobond LT tape, and are secured to the roof deck through the mechanical fastening of the insulation board. Monarflex multi-layer VCL's are manufactured from virgin polyethylene with built-in reinforcement grids of HDPE making them highly resistant to tears and damage. Some also have a layer of aluminium foil for higher water vapour resistance performance. For further guidance and product information contact BMI Technical Support.

Lay Monarflex vapour control layer without folds or wrinkles allowing for minimum 100mm side and end laps. Seal all laps with Monobond LT double-sided sealant tape. Turn the vapour control layer up at all upstands, kerbs and penetrations etc. to maintain an air tight barrier.

Self-adhesive VCL

Witec SK vapour control layer with SD ≥ 200 m aluminium polyester composite foil with a glass fleece reinforcement. Self-adhesive compound on the underside and self-adhesive sealant. Seams must be bonded.

Insulation

Recommended insulation board types:

- PUR / PIR with foil or glass tissue facings;
- Mineral wool; or
- EPS (expanded polystyrene).

Install only as much insulation as can be covered by the completed roofing system by the end of the day. Surfaces shall be smooth, clean, dry and free from contaminants.

Fit insulation neatly at all perimeters and penetrations with gaps and steps not to exceed 6mm. Voids greater than 6mm must be filled with insulation. Stagger end joints between boards. When installing multiple layers, offset joints between layers.

Fasten the insulation where required with the recommended fastener assemblies.

On metal decks, boards shall be laid with long edges at 90° to the deck troughs with end joints fully supported on the crowns.

Protection, Separation & Levelling Layers

In many roof applications, the roofing membrane has to be separated from other incompatible elements or protected against mechanical damage. Where this is the case, a geotextile separation or protection fleece should be installed as part of the roof build up.

Separation layers

Separation layers are often used with single ply membranes when applied onto non-compatible substrates.

Geotextiles such as non-wovens made of polyester, polypropylene (PP) or a mix of PES and PP can function as separation layers.

Protection layers

Protection layers are required for the mechanical protection of the roofing sheet.

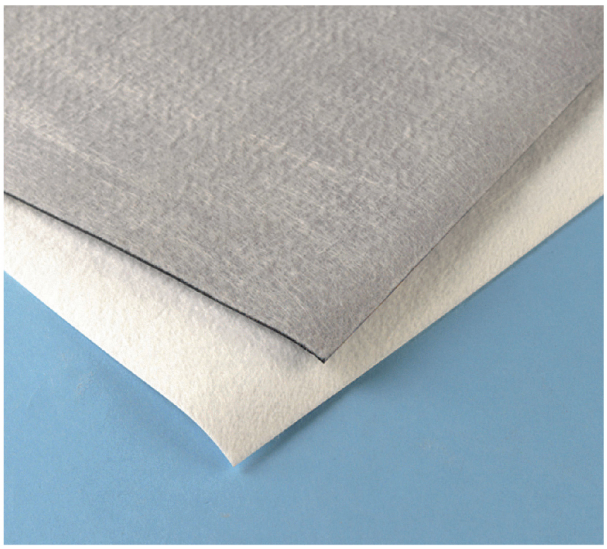
A polyester geotextile, e.g. Witec Protection Fleece 300 g/m², will protect the EverGuard TPO membrane. Overlaps shall be in excess of 200 mm.

When laying the membrane on flammable insulating materials (EPS), a fire protection layer made of glass fleece 120 g/m² is required for membrane thickness of 1.5mm or above.

Levelling layers

Levelling layers are installed between rough and /or uneven substrates and the water proofing layer (generally above tamped concrete surfaces).

A polyester geotextile, e.g. Witec Protection Fleece 300 g/m², will protect the EverGuard TPO membrane. Overlaps shall be in excess of 200 mm.



Substrates

The load bearing structure must comply with all associated national standards and regulations, ensuring that the load bearing capacity is sufficient for any additional loads imposed upon the construction. It is important to consider the possibility of future deflection of the construction when designing roof drainage.

Substrates must be strong enough to permit the penetration of fixings whilst maintaining suitable pull out strength. It is recommended that pull out tests are conducted prior to the application of the EverGuard TPO system (see below).

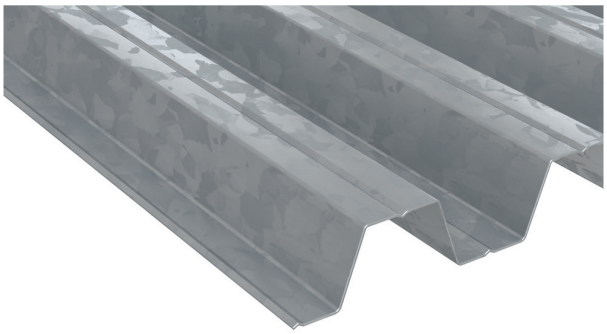
ACCEPTABLE SUBSTRATES

The EverGuard TPO Roofing System can be installed on new construction or over existing roofs, when the existing roofing assembly is dry or the wet areas have been removed and replaced; or when the existing roof is completely removed to the deck. The roofing contractor has the final responsibility of acceptance of the surface to receive the roofing system.

The following structural substrates are acceptable for the EverGuard TPO Roofing System:

Structural Concrete

The reinforced concrete roof slab surface should be finished to provide an even surface free from ridges and hollows. Where undulating surfaces exist, install a 300 g/m² geotextile fleece above the concrete. New in-situ cast concrete should be given adequate time to dry out, prior to installing the waterproofing system.



Profiled Metal

Minimum 0.7 mm galvanised steel to EN 10147: 2000 and FM Approved assembly system. The profiled deck must be overboarded to support the EverGuard TPO membrane.

In mechanically fixed roof build-ups, it is crucial ensure that the rows of fasteners are installed in a perpendicular direction to the metal deck's corrugations in order to avoid a concentration of uplift forces on any one single element.

Plywood / Oriented Strand Board (OSB)

New exterior grade plywood to EN 636-2003: Clause 8 or OSB/3 to EN 300:1997, thickness and fixed in accordance with relevant national standards ensuring it is of adequate rigidity for the joist spans involved and fixed with corrosion resistant fasteners. Fixings should be well driven to avoid damage to the membrane.

EverGuard TPO Mechanically Fixed Application Guidelines

Mechanically Fixed Application Guidelines

In mechanically fixed systems the EverGuard TPO reinforced membrane can be either fastened in the overlap seam along one edge of the membrane, or field fixed and induction welded. The adjacent sheets of membrane are then hot-air welded together with an automatic welder to provide the continuous waterproof covering.

MECHANICALLY FASTENED IN THE OVERLAP

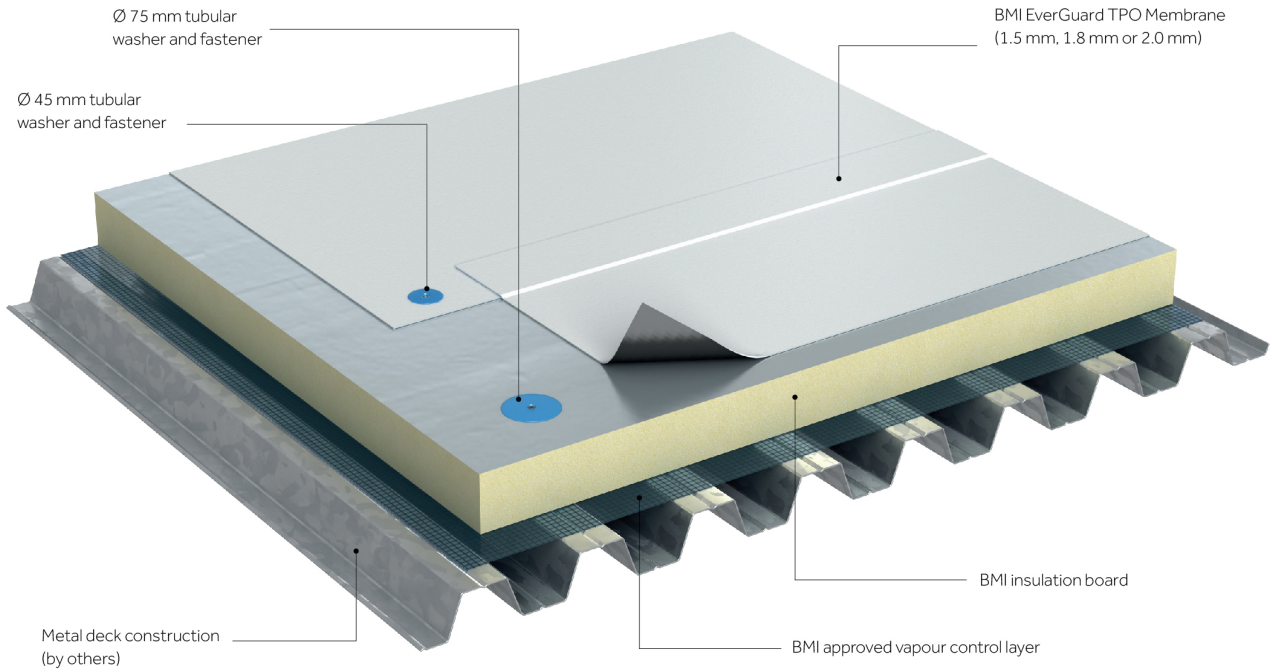
Prepare substrate surfaces thoroughly prior to application of new roofing materials. This is particularly important for refurbishment applications.

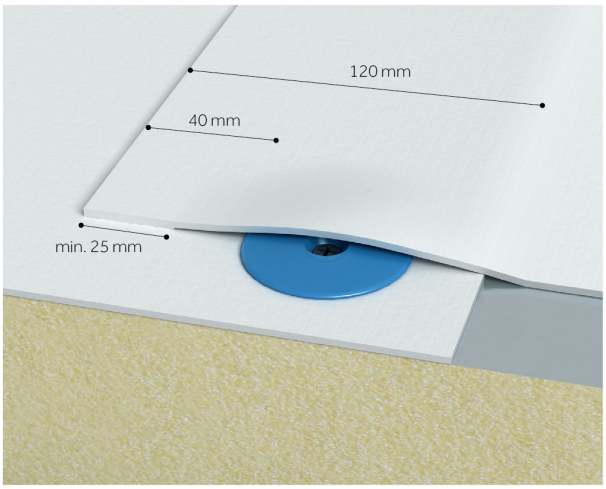
Providing a smooth, even, sound, clean, and dry substrate minimises the likelihood that underlying deficiencies will cause premature deterioration or even failure of the new roofing system.

Alongside the previously described requirements for the load bearing structure, it must be ensured that the surfaces have been thoroughly cleaned and any standing water removed before the subsequent construction of the additional roofing layers.

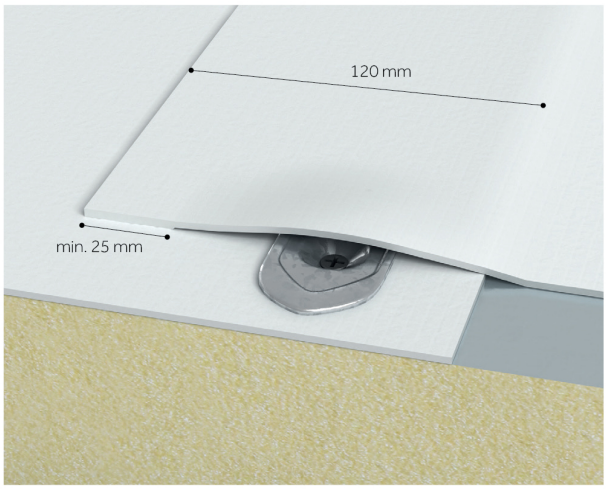
When laying the membrane directly on rough substrates, concrete, screed or wood, it is always necessary to use a protective / separating layer of PES protection fleece 300 g/m².

Prior to application of the EverGuard TPO reinforced membrane, a wind uplift calculation must be carried out in accordance with EN 1991: Parts 1 – 4 to determine the correct fixing centres specific to the project. For confirmation of the appropriate size of washers and fasteners to use, refer to the BMI fastener product datasheet.





Side lap overlap with tube washer fixing.



Side lap overlap with seam plate fixing.

Mid-sheet fixings may be required dependent upon the results of the wind uplift calculation. These additional fixing points are therefore strapped with a section of membrane and hot-air welded on each side of the fixing line.

Where the substrate comprises profiled metal sheet, the waterproof membrane should be fixed at right angles to the longitudinal rib of the metal profile.

Before and during membrane installation, inspect and correct the substrate; (i.e. voids or gaps, uneven conditions, and any other surface irregularities that can cause voids in the weld).

Side Laps

Position sheets so they run square and with sufficient overlap to the adjacent sheet. In the case of the mechanically fastened system the side lap should extend a minimum 60 mm past the fastening plates / washer. The weld must have a compulsory minimum width of 25 mm.

Where possible, position laps so that water runs across or parallel to the laps. Checking the seams is a compulsory action at the end of any area of work. The welded seams have to cool down to ambient temperature before probing.

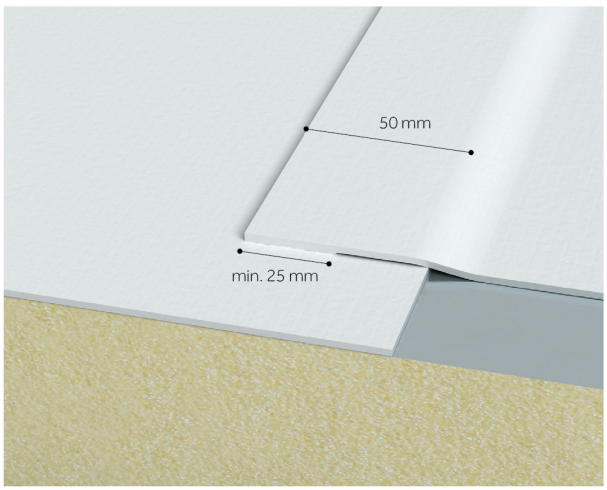
When the sheets are fastened mechanically, a minimum 10 mm free zone between the fasteners edge and the edge of the membrane must be observed. The minimum overlap should be approximately 120mm.

The overlap is calculated in following manner: 20 mm free edge + width of washer (45mm for a tube washer) + minimum 20 mm free zone + 25 mm welding zone.

End Laps

End laps should be a minimum of 50 mm, and wherever possible should be staggered to the adjacent sheet.

The weld must have a compulsory minimum width of 25 mm. Checking the seams is a compulsory action at the end of any area of work. The welded seams have to cool down to ambient temperature before probing.



End lap weld.

MECHANICALLY FASTENED IN THE FIELD BY INDUCTION

Prepare substrate surfaces thoroughly prior to application of new roofing materials. This is particularly important for refurbishment applications.

Providing a smooth, even, sound, clean, and dry substrate minimises the likelihood that underlying deficiencies will cause premature deterioration or even failure of the new roofing system.

Alongside the previously described requirements for the load bearing structure, it must be ensured that the surfaces have been thoroughly cleaned and any standing water removed before the subsequent construction of the additional roofing layers.

When laying the membrane directly on rough substrates, concrete, screed or wood, it is always necessary to use a protective / separating layer of PES protection fleece 300 g/m².

Prior to application of the EverGuard TPO reinforced membrane, a wind uplift calculation must be carried out in accordance with EN 1991: Parts 1 – 4 to determine the correct fixing centres specific to the project. For confirmation of the appropriate size of washers and fasteners to use, refer to the BMI fastener product datasheet.

Field fixed installations incorporate induction welding technology to mechanically restrain the insulation and the EverGuard TPO membrane over its full area. Single ply membranes fixed in this way can be achieved using fewer fasteners and requires the use of induction welding tools, pressure plates and magnets.

Where the substrate comprises profiled metal sheet, the waterproof membrane should be fixed at right angles to the longitudinal rib of the metal profile.

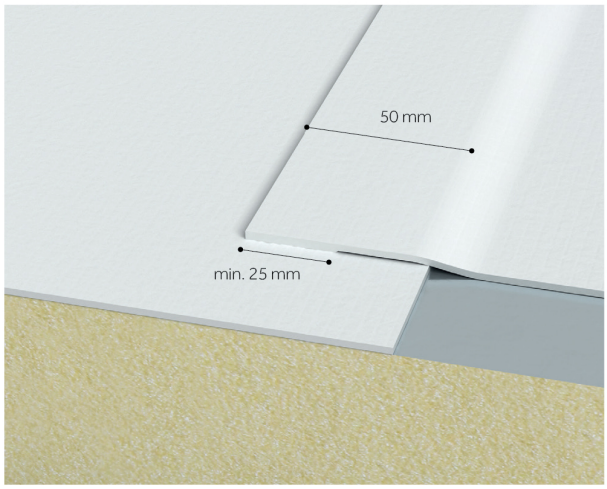
Prior to and during membrane installation, inspect and correct the substrate; (i.e. voids or gaps, uneven conditions, and any other surface irregularities that can cause voids in the weld).

Side Laps & End Laps

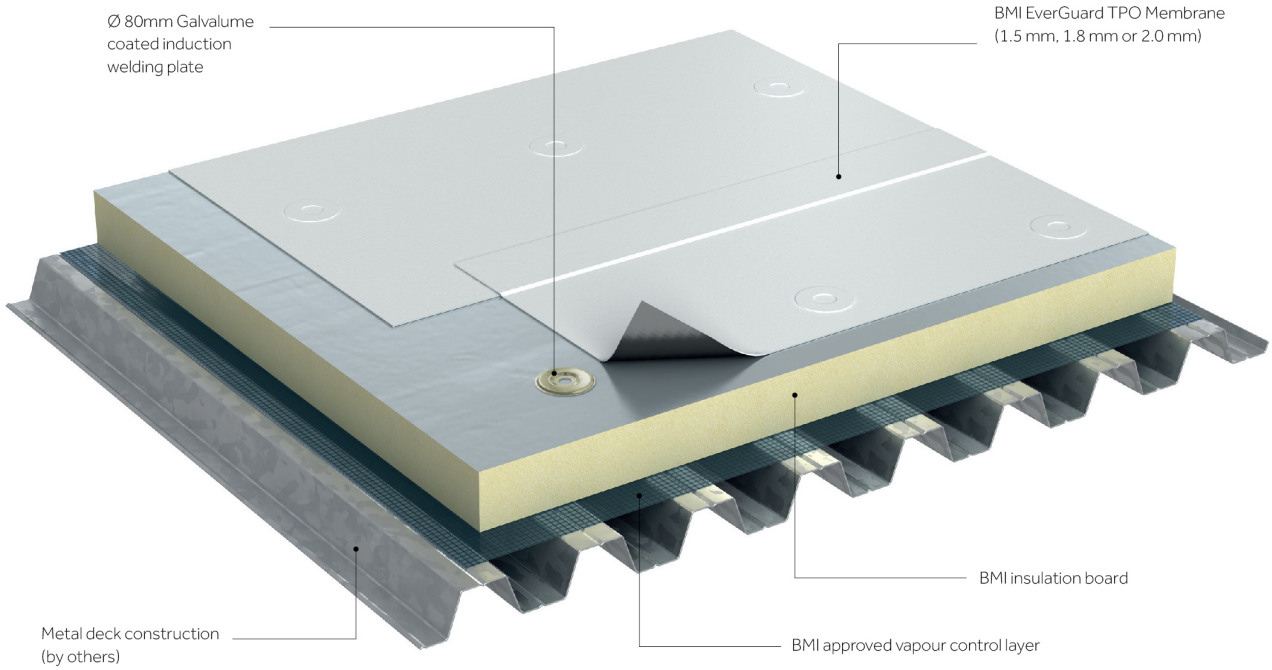
Position sheets so they run square and with 50 mm overlap to the adjacent sheet. The weld must have a compulsory minimum width of 25 mm.

Where possible, position laps so that water runs across or parallel to the laps. Checking the seams is a compulsory action at the end of any area of work. The welded seams have to cool down to ambient temperature before probing.

End laps should be a minimum of 50 mm, and wherever possible should be staggered to the adjacent sheet.



Side / end lap weld.




OMG
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INDUCTION FASTENING SYSTEM

PERIMETER FIXING & ANGLE CHANGES

Regardless of the type of membrane attachment, mechanical fastening of the field membrane is always required at the roof perimeters, angle changes and any details, for example roof lights and penetrations. This ensures that any tensions generated in the field membrane are not transferred to other areas.

At the foot of upstands the single ply membrane on the field area should be installed vertically a minimum of 50 mm. It should then be mechanically fastened as close as possible to the foot of the up-stand. It should be fastened to the more stable substrate, i.e., fixed vertically to the structural deck or horizontally to masonry or concrete upstands.

The field membrane can be fastened with screw fasteners in conjunction with the following:

- a 90° angle of EverGuard TPO Coated Metal (preferred method, see Figure 1);
- the EverGuard Fixation Bar (with peel stop, see Figure 2); or
- the use of tube washers or pressure plates (see Figure 3).

The fasteners used for absorbing the exerted tensile force are to be compatible with the type and strength of the substructures.
The fastenings must be assessed for tensile forces of at least 2.5 kN/m.

If auxiliary structures or substructures are required to absorb the tensile forces, these are to be fixed in place in such a way that they absorb the tensile forces from the linear fasteners. For this reason, it may be necessary to increase the number of mechanical fixings in comparison to those stated in Table 1 below. If required, an individual building-specific calculation is to be carried out.

Mechanical restraint at upstand detail or angle change, can be horizontal or vertical, dependent on substrate.

Mechanical fixing types that are compatible and approved for the substructure are to be used. The mechanical fixings must be installed so that they do not exert any damaging effect on the waterproofing membranes.

As an alternative to fastening with linear profiles, it is also possible to use approved individual fasteners (plate fasteners and screws) with a maximum spacing of 250 mm on buildings with a height of up to 12 m without internal pressure and not in wind exposed locations.

It is not permitted for these fastenings to be additionally used for protecting the roofing layers against wind lift.

Table 1. Proven and approved fasteners

Substrate Type	Trapezoidal Sheet Metal	Reinforced Concrete	Lightweight Concrete	Wooden Beams, Wooden Sarking, Chipboard
Fixation Bar	Self-drilling screw Ø 4.5 mm spacing ≤ 21 cm	Dowel 10 mm with screw 8 mm spacing ≤ 21 cm or spike twister spacing ≤ 21 cm	Nail anchor ≤ 8 mm spacing ≤ 21 cm	Wood screw 4.5/40 mm spacing ≤ 16 cm
Coated metal steel sheet bracket, horizontal arm minimum 40 mm	Steel blind rivet Ø 5 mm spacing 12 cm	Dowel 10 mm with screw 8 mm spacing ≤ 30 cm or spike twister spacing ≤ 30 cm	Nail anchor ≤ 8 mm spacing ≤ 12 cm	Wood screw 4.5/30 mm spacing ≤ 15 cm
Wooden plank thickness > 3 cm width > 8 cm	Self-drilling screw Ø 4.5 mm spacing 20 cm	Dowel 10 mm with screw 8 mm spacing ≤ 30 cm or spike twister spacing ≤ 30 cm	Nail anchor ≤ 8 mm spacing ≤ 30 cm	Wood screw ≤ 8 mm spacing ≤ 30 cm

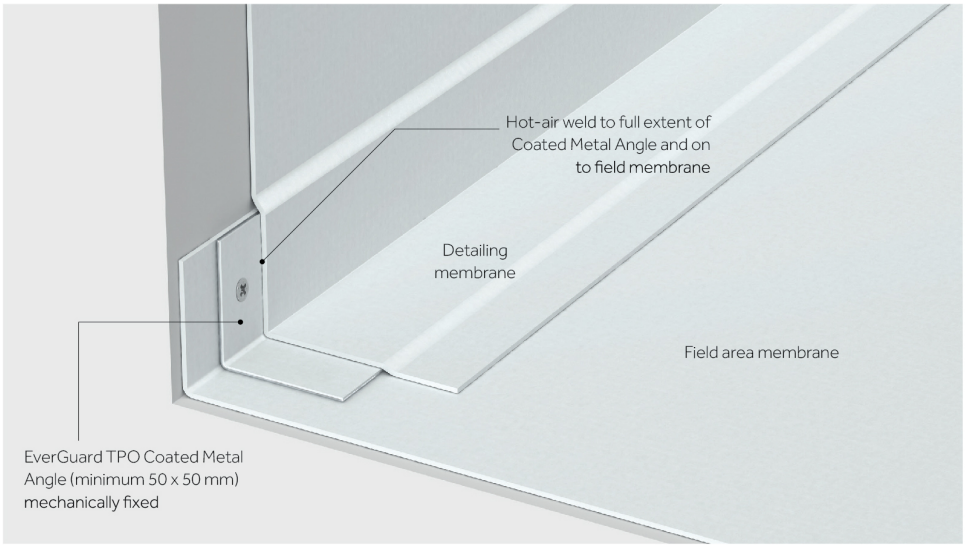


Figure 1. Perimeter fixing using EverGuard TPO Coated Metal.

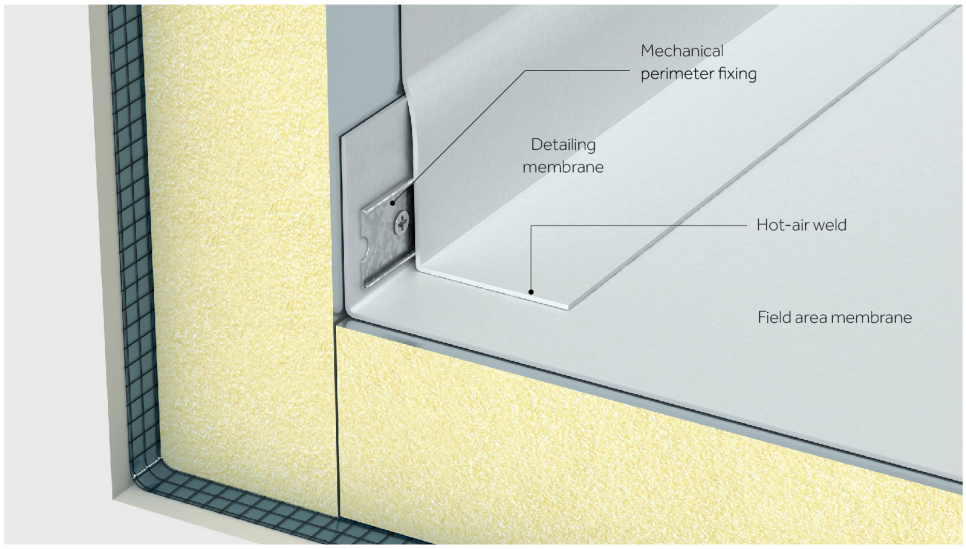


Figure 2. Perimeter fixing using fixation bar.

Figure 3. Perimeter fixing using fastener and washer.

DRIP EDGES & VERGES

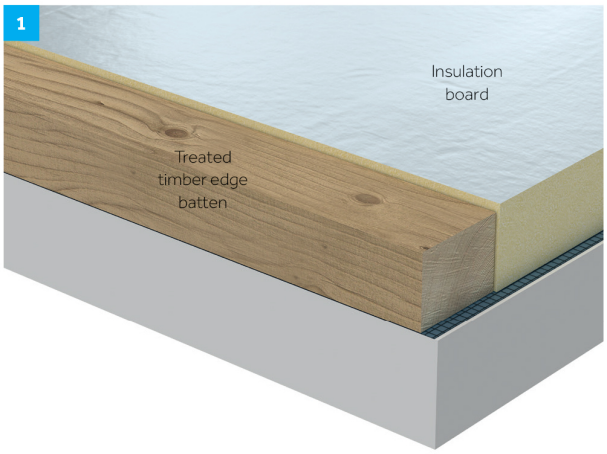
EverGuard TPO coated metal sheet profiles are required as connecting and trim profiles for wall connections, roof trims, etc. when laying EverGuard TPO membranes. They are cut and chamfered from EverGuard TPO coated metal sheet plates.

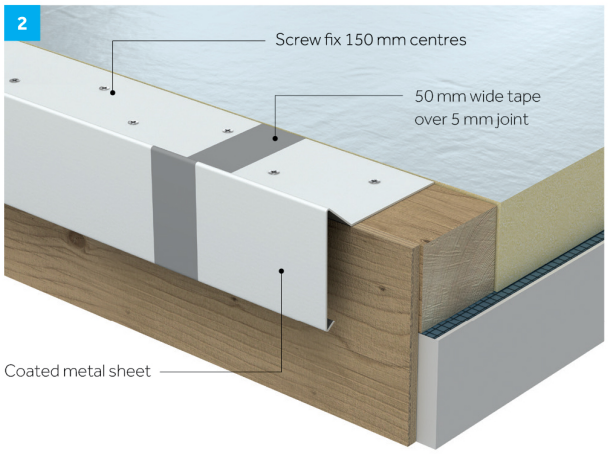
The profile butt joint, 5 mm wide, is sealed over with at least 25 mm wide crepe strips and welded tight with at least 100 mm wide strips of EverGuard TPO detail membrane. For composite sheet verge flashing, joint connectors are also required.

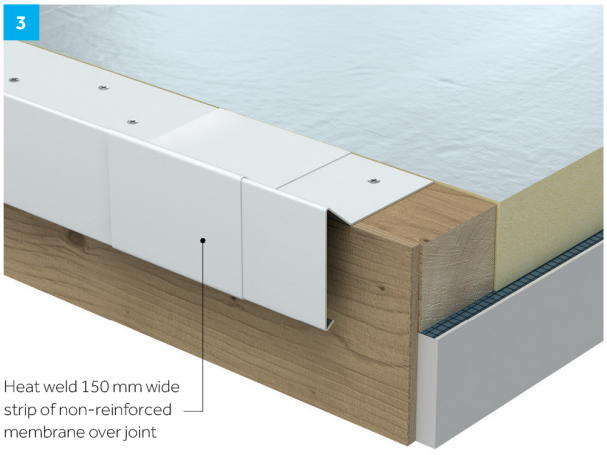
Coated metal sheet profiles, such as verge flashing profiles, must be connected to the substructure in such a way that they can withstand the relevant wind loads. If required, an individual building specific calculation is to be carried out in accordance with EN 1991. When installing on cement-based substrates, a separating layer made out of e.g. Witec Protection Fleece 300 g/m² should be fitted.

Depending on the length of the external vertical leg of the coated metal sheet profile and the height of the building, it may be necessary to install additional wind tape or continuous cleat.

Install EverGuard TPO coated metal sheet verge flashing profiles of a suitable shape and fit flush to the external edge of the building (fix the horizontal leg in accordance with Table 1). Weld the EverGuard TPO waterproofing membrane that runs to the edge of the building onto the horizontal leg and over the fastening points on the leg.







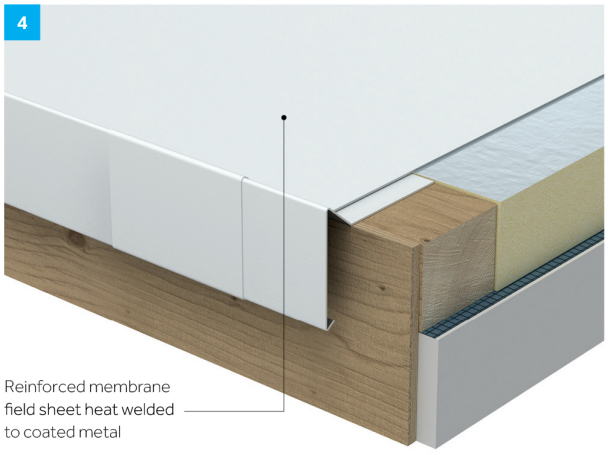


Figure 5. Drip edge detail with water check.

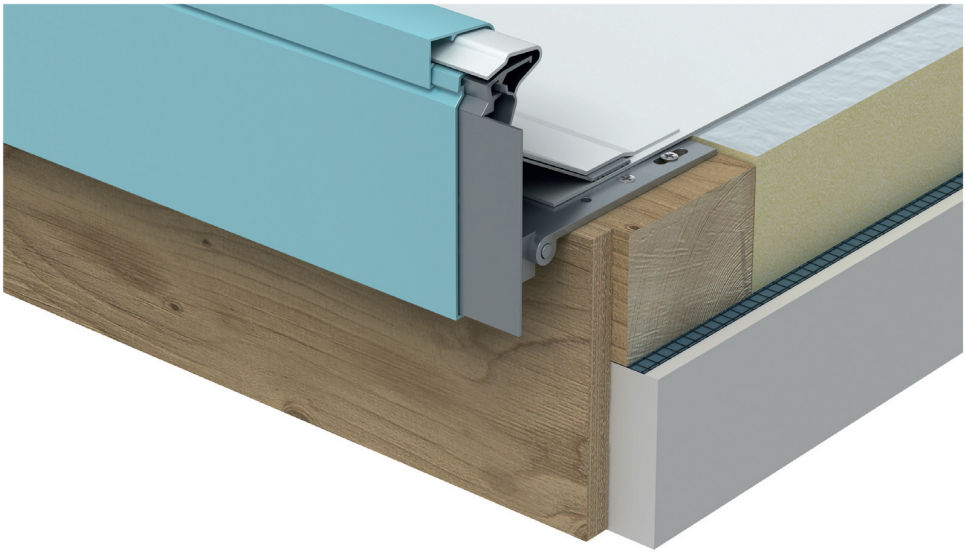


Figure 6. Verge water check with multi-part clamping profile detail.

INTERMEDIATE FASTENING

In the case of connection height greater than 500 mm (loose laid connecting membranes) and greater than 1 m (connecting membranes laid with adhesive), it is necessary to fit an additional intermediate fastening halfway up the connection height or every 500 mm/1 m.

The edge of the waterproofing at the top of the parapet must be sealed so as to be windproof.

The installation method and direction of the waterproofing membranes are to be determined depending on the characteristics of the building (height of the parapet, width of parapet top, building material, perimeter fastenings, etc.

For parapets up to 500 mm height, membranes can be loose laid without fixing on the wall. For parapets over 500 mm height, the membranes must be either fully bonded (TPO Contact Adhesive), or secured intermediately with a strip of EverGuard TPO Coated Metal.

A strip of coated metal sheet (cut to a length of 70 mm, at least 10 mm on both sides folded over by 180°) or a Fixation bar installed half way up the connection height or every 500 mm/1 m (max. fastening distance 210 mm). A strip of EverGuard TPO waterproofing membrane is to be welded over this intermediate fastening (see Figures 7 and 8).

A Z-shaped coated metal sheet profile is to be installed half way up the connection height (fastening distance 200 mm). The two pieces of the connecting membrane are to be welded on to it (Figure 9).

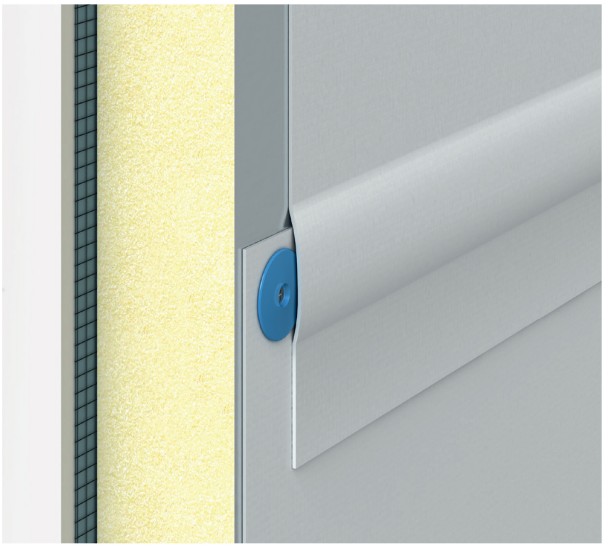


Figure 6. Intermediate fixing with tube washer and fastener. For non-insulated upstands use seam plates.

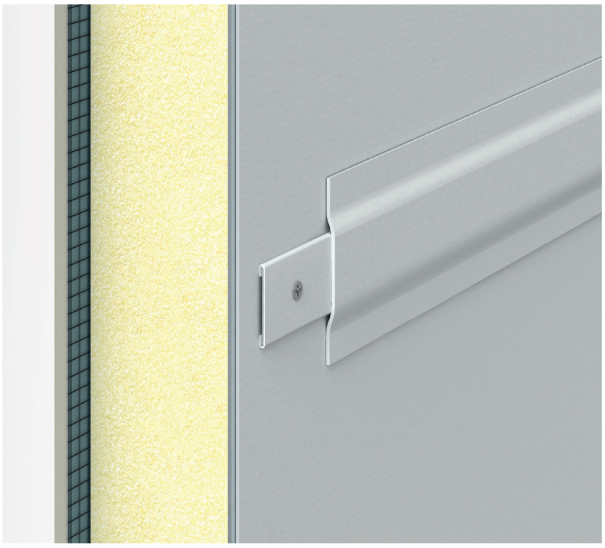


Figure 7. Intermediate fixing with strip of coated metal (shown) or fixation bar.

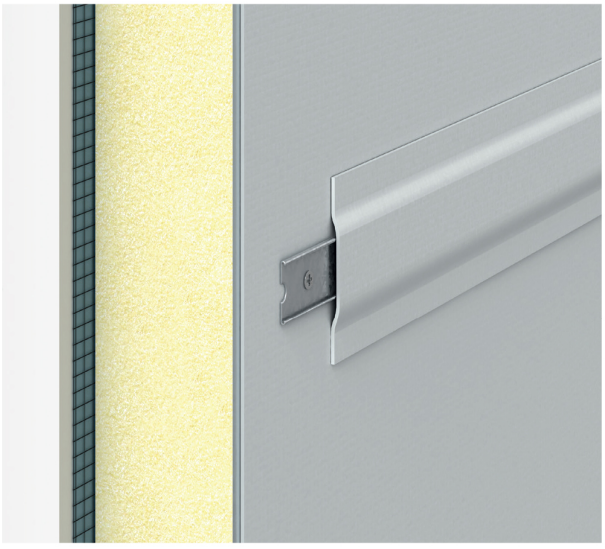


Figure 8. Intermediate fixing with fixation bar.

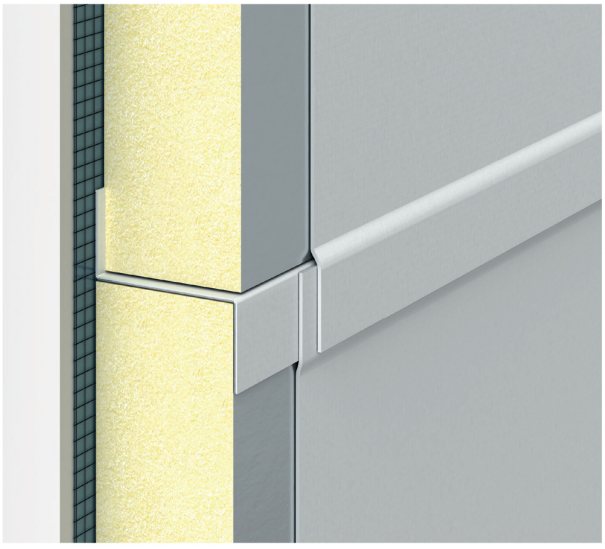


Figure 9. Intermediate fixing with z-angle strip of coated metal.

PARAPET WITH METAL CAPPING

Install EverGuard TPO coated metal sheet brackets (e.g. 30 mm / 70 mm legs) flush to the external edge of the building, press the 30 mm high vertical leg to the exterior of the building and fasten the 70 mm wide horizontal leg at least every 250 mm.

Weld the EverGuard TPO waterproofing membrane that runs to the edge of the building onto the horizontal leg and over the fastening points on the leg. Prefabricated metal capping (by others) to be installed to parapet.

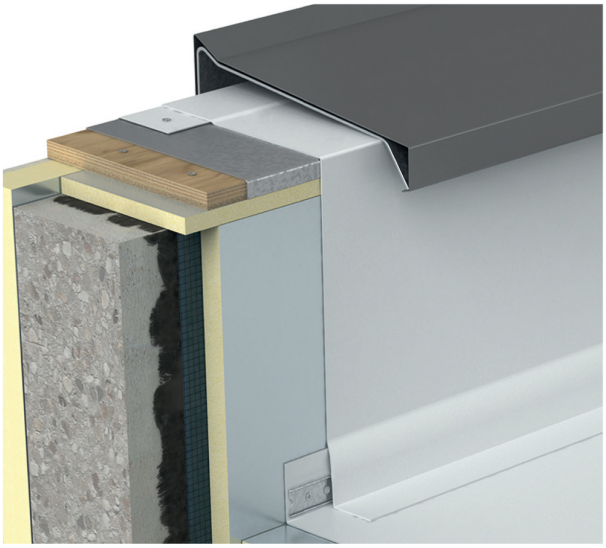


Figure 10. Parapet with metal capping detail

TERMINATION TO SKYLIGHTS

Run the EverGuard TPO waterproofing membrane from the surface of the roof approx. 50 mm up the base of the skylight. Mechanically restrain the EverGuard TPO membrane at the base of the upstand through the horizontal flange of the skylight using mechanical fixings with countersunk heads that are suitable for the substructure.

Cut strips of EverGuard TPO waterproofing membrane to the required dimensions. Align and run the connecting strips onto the waterproofing membrane on the surface of the roof and weld together.

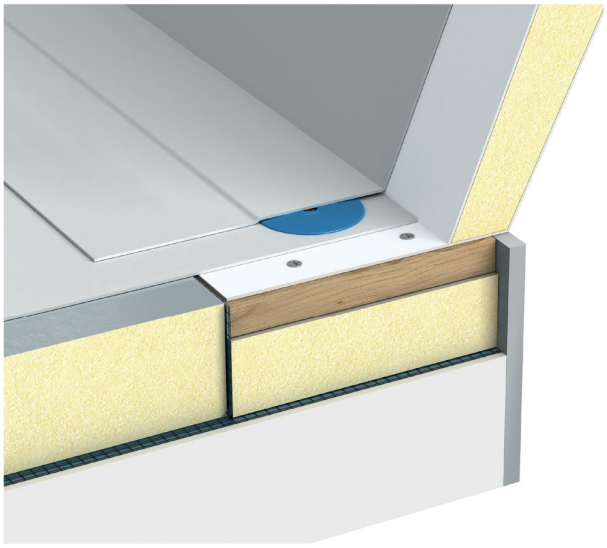


Figure 11. Membrane termination to skylight detail.

MEMBRANE TERMINATION

The waterproofing system must be suitably terminated to the surrounding construction to prevent water penetration 'behind' the new waterproofing system.

Depending upon the nature of the installation and construction, the membrane should be protected with a cover flashing. Alternatively, the membrane may be secured with a fixation bar which is then weatherproofed by pointing a suitable mastic sealant along the top edge between the construction and the fixation bar.

The waterproofing should finish on the vertical a minimum 150mm from the finished roof level. In the case of roofs with paving or other coverings such as a green roof, the 150mm should be from the uppermost finished level, and not the level of the waterproofing.

Fixation Bar with Cover Flashing

Depending on the method of installation and the type of fixation bar used, the waterproofing membrane may first require mechanical restraint using the fixation bar. The fixation bar is mechanically fastened to the wall at regular fixing centres. The leading edge of the membrane is subsequently protected by the instalaltion of a pressed metal cover flashing. A suitable sealant is applied to the upper edge of the flashing to complete the detail.

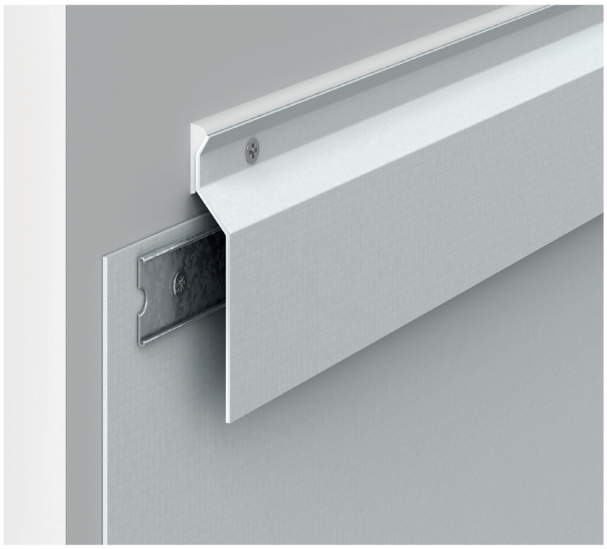


Figure 12. Membrane secured with fixation bar and pressed metal cover flashing.

CONNECTING TO DRAINS

The standard method is to connect the EverGuard TPO waterproofing membrane to drainage elements with a flange made out of corresponding EverGuard TPO membrane. When creating the flange, the connection to the waterproofing membrane on the surface of the roof must be made with a separate EverGuard TPO membrane sleeve. The installation guidelines issued by the relevant outlet manufacturer must be observed.

Note: Installation must comply with national / regional standards.

ENCLOSING PIPES

The standard method for connecting EverGuard TPO waterproofing membrane to the penetrating pipes is to use BMI EverGuard TPO split vent boots or pipe boots.

Cut the prefabricated pipe boot at the relevant diameter to ensure a tight fitting over the pipe. Slide the pipe boot onto the pipe and push down until firmly in position.

Weld the base of the pipe boot around its circumference to the underlying single ply roofing membrane. Probe the seam to check the weld quality. Repair any suspect areas as necessary.

Around the top edge of the pipe boot, apply a polyurethane mastic before mechanically clamping with a jubilee clip.

BUILDING EXPANSION JOINTS

Expansion joints are construction joints that need to be carefully taken into account when waterproofing the roof and selecting the roofing layers. The vapour barrier as well as insulation, waterproofing and, where relevant, usable surface layers need to be installed so that they can accommodate movements in all three possible dimensions without causing any damage. BMI Technical Support or planner should be consulted for more information.

WALKWAYS

Weld EverGuard TPO Walkway directly to the underlying EverGuard TPO single ply roofing membrane, by first pre-welding before fully welding along the edge. All edges of the EverGuard TPO Walkway should be fully welded in this manner.

Leave a 15mm gap between adjacent sections of walkway where crossing over a lap in the single ply roofing membrane below. A gap should also be left where the walkway membrane impedes the flow of water across the roof.

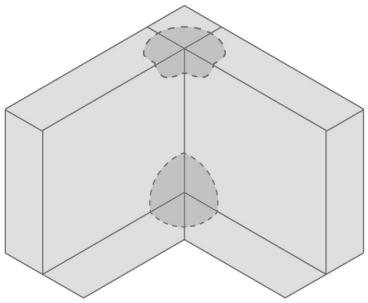
CORNERS

The membranes must be laid so as to have as little covering layers lying on top of each other as possible at the parapet corners. Membranes laid parallel to the parapet are butt jointed together at the corner areas or laid around corners. The lap width at the butt joint should be approximately 10 cm.

If corners are formed with EverGuard TPO Preformed Corners, they are to be welded with hand-held hot-air gun with a recommended nozzle width of 20 mm.

Internal Corners

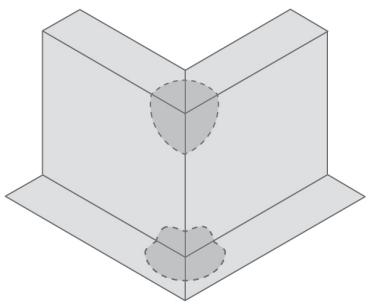
- Cut the trim strip EverGuard TPO membrane at right angles and cut off the overlap to the corner.
- Weld the seams.
- Weld in the internal corners
- Upper trim of the parapet completed with cut-to-size EverGuard TPO membrane and 90° external corner.



External Corners

- Cut the EverGuard TPO trim strip to size.
- Weld all seams
- Weld in external corner.
- Upper trim of the parapet completed with prefabricated internal corner, reversed.

Check all seams and chamfer T- joints.



EverGuard TPO Welding Guidelines

Welding Guidelines

EverGuard TPO roofing membranes can be hot-air welded to create a homogenous seal between adjacent membranes. **Field area seams should be welded with either an automatic, self-propelled hot air welding machine (e.g., Leister Variamat) or by using a hand held hot air welder. Waterproofing details must be conducted using hand-held welders.**

REQUIREMENTS PRIOR TO WELDING

The membrane must be clear of dirt and possible surface contaminants. It should also be dry and free from dew, rain, and other sources of moisture. Factory fresh membrane will typically not require cleaning prior to automatic welding. Membrane that has been unrolled and left exposed for more than 12 hours or has become contaminated will require additional cleaning and testing prior to use.

Membrane that has been exposed overnight (up to a few days) to air-borne debris, foot traffic, or dew or light precipitation can usually be cleaned with a white cloth moistened with Witec Cleaner (as a preparation and prior to this, the surface needs to be cleaned with a water wet cloth first). In case of long term exposure to water, it is recommended to use a cloth moistened with THF Solvent to eliminate water from the surface. Be sure to wait for the solvent to flash off prior to welding.

Dirt Based Contamination: Membrane that demonstrates encrusted surface dirt will require the use of a low-residue cleaner, (floor cleaning agent) and a mildly abrasive scrubbing pad to remove the dirt. This must be followed by cleaning with a white cloth moistened with Witec Cleaner and THF same as above. Be sure to wait for solvent to flash off prior to welding.

Please consider the following points for the hot-air welding:

- The welding temperature depends on the welding equipment, the welding speed, the substrate and the weather conditions.
- Avoid overheating of the seam because this may cause a weakening of the membrane material and a degradation of the seam strength.
- The weld must be effected with contact pressure. Where using a hand held detail welder, use a silicone or PTFE roller to press the surfaces together. When using an automatic welding machine, the weight of machine is typically sufficient. Where necessary, additional weights may be added. The pressure resistance of the insulation material must correspond with the necessary compacting pressure during welding as well as the respective manufacturer's instructions.
- Voltage variations caused by long power supply lines or other electricity consumers can lead to inconsistent and weak welded seam qualities. Adjust the welding temperature as required to avoid this. Conduct further test welds where necessary.
- The roofer / roofing contractor must have sufficient knowledge and ability for welding and handling synthetic membranes.
- Different material thicknesses and changing climatic conditions cause different welding temperatures and speeds. Test welds are therefore recommended on the actual substrate prior to work commencing. After the welding test seam has cooled down check the seam quality thoroughly.

WELDING PRACTICE

Unroll the single ply membranes completely to release any tension and overlap them according to the installation guideline. Consider a minimum welding width of 25 mm. Apply heat to the surfaces to be welded (overlap area) using a detail welder to connect the membranes together. After that, press down the seam area immediately with a ceramic TPO roller to create a homogenous seam. Avoid wrinkles in the seam area as they can lead to water ingress by capillary action.

WELDING TEST

Before work commences carry out a test weld on the actual substrate as the outside temperature and humidity can affect the quality of the finished weld. Conduct a peel test and adjust the welder accordingly. A good weld will have been achieved if you are unable to peel off the overlapping membrane. The membrane will tear outside the weld along the complete width of the testing strip.

Width of the sample:

- Automatic welding machine: >50 mm
- Manual hot air welders: >20 mm

The requirement for a good weld is that the peel resistance / shear resistance is greater than the inter-laminar adhesion between the top and bottom TPO layers.

The peel test (by hand) shall not be carried out before the sample has cooled down to ambient temperature. Prior to performing the peel test, cut the sample material into strips to the required width (Figure 13, below). The samples shall be torn by hand in lengthwise and crosswise direction respectively. When there is a delamination of either the top or bottom sheet the requirement is fulfilled and the welding parameters are set correctly. The delamination means a controlled destruction of the product. When the seam peels off without a delamination of the membrane layers, it is indicated that the welding parameters were insufficient. A visual check can give a lead to whether:

- the air temperature was too low;
- the traction of the machine was too great;
- the pressure was not big enough and / or
- the material itself was too cold or damp.

New tests must be carried on cooled samples until the correct parameters can be set for the next period of work.

MANUAL WELDING

The nozzle width of hand-held welders for area joint welding is 40 mm. For detailing, it is recommended to use a 20 mm nozzle. Digital controlled hand-held welders should be set to suit climatic conditions.

A silicone or PTFE pressure roller is recommended to achieve a sufficient compacting pressure in the seam area. Remove combustion residue at the nozzle outlet with a brass wire brush.

Three steps of welding process:

1. Tacking: apply tack welds (points) at the rear of the seam to be welded.
2. Pre-weld: apply a continuous pre-weld directly in front of the tack welds to seal the back edge of the overlapping membranes.
3. Final-weld: use the pressure roller parallel to the nozzle (Figure 14, below) and roll it with light pressure beyond the seam.

Figure 13. Carrying out a welding test.

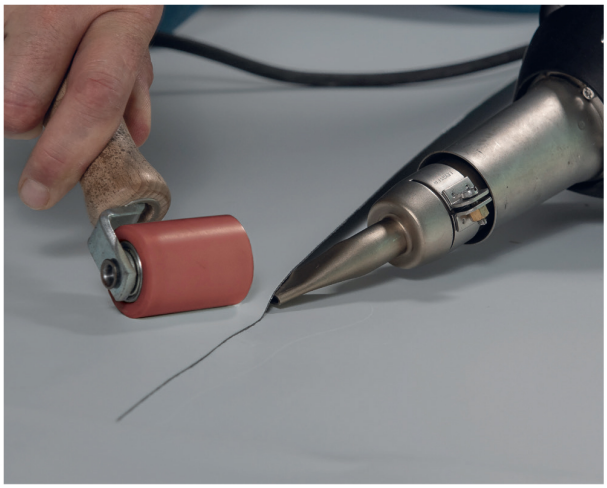


Figure 14. Manual welding with a hand-held welder and silicone roller.

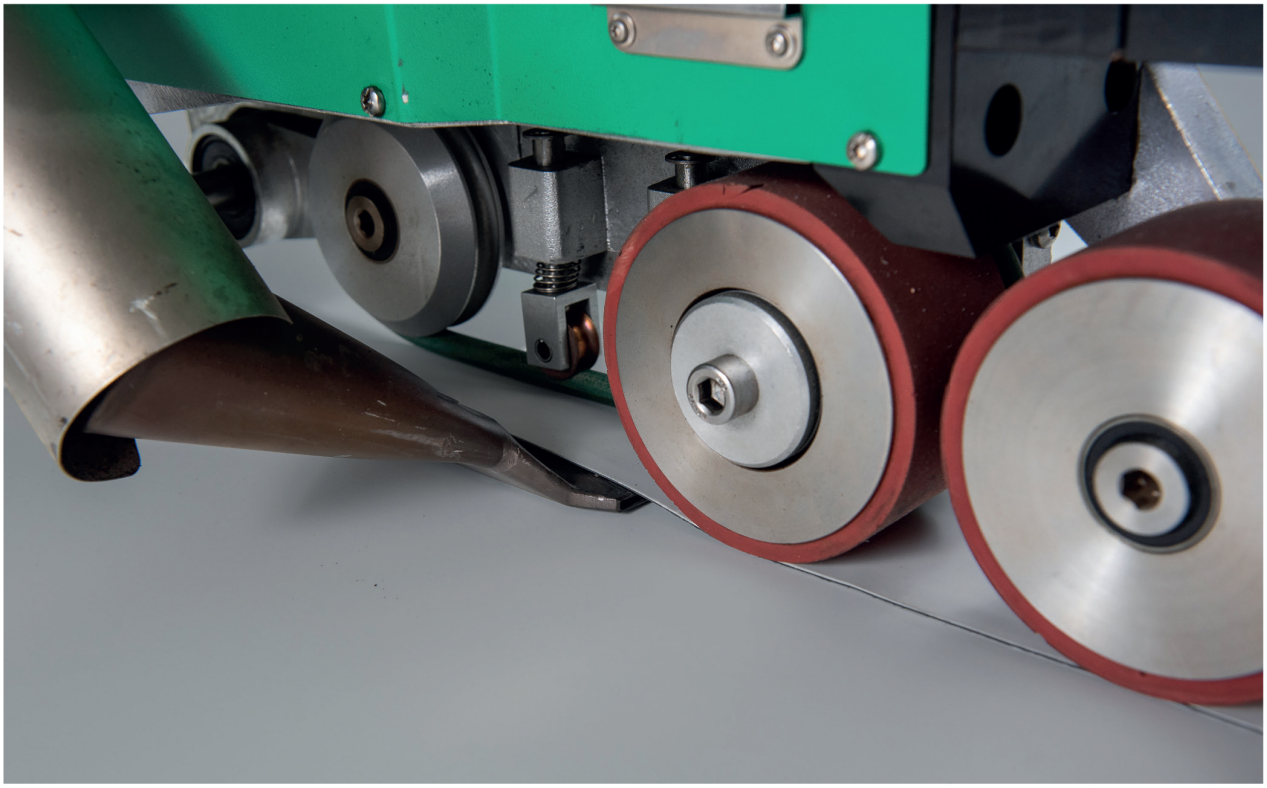


Figure 15. Automatic hot air welding machine.

AUTOMATIC WELDING

Before work commences carry out a test weld on the actual substrate it is recommended to use automatic welders with temperature measure in the nozzle and automatic temperature control.

Welding tests have to be completed before you start welding (see Welding Test).

Depending on the air humidity, substrate and local ambient temperature the guide temperatures in Table 2 are recommended.

Table 2. Automatic Welding Guide Temperatures.

Welding Machine	Temperature	Speed
Hot air welding machine	430 °C	2 m / min
Hot air welding machine with special dye (e.g. Leister Varimat V2)	430 °C	3 m / min

Position the automatic hot air welding machine with the pressure wheel approximately 3 mm over the weld edge to ensure a sealed seam. Lift the overlapping membrane sheet and insert the blower nozzle between the overlap. Immediately begin moving the machine along the lap to prevent scorching of the membrane. At the end of the run, remove the nozzle first and then stop the machine's forward motion.

When the automatic welder moves over an insulation plate, insulation step off, lap crossover, etc., these areas should immediately be hand-rolled to ensure a complete weld.

With the automatic welder you will not achieve a clear welding bead. A shiny area of membrane adjacent to the welded seam which is between 50 mm and 100 mm in width will demonstrate a good weld. If the temperature is too high you will notice brown discolouration of the membrane, the reinforcement will push through and a clear welding bead will be present.

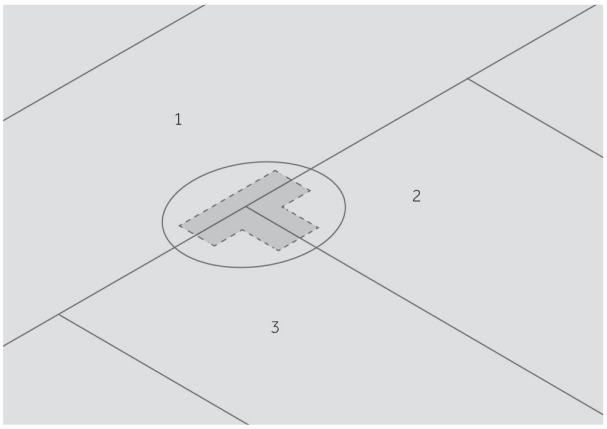
WELDING OF T-JOINTS

Multiple overlapping membrane layers (e.g, at head butt joints – T-Joints) require special attention during the hot air welding process.

T-Joints can be sealed using one of the two following methods:

- chamfering the membrane; or
- welding a T-patch.

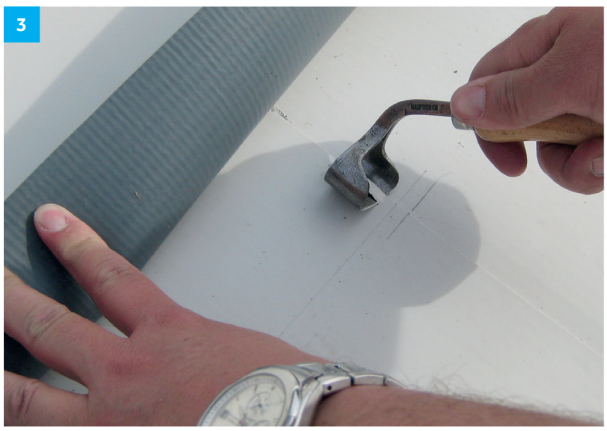
Whilst both methods are acceptable, where a full BMI system is to be installed offering an extended warranty it is recommended that the TPO patch solution is used.



Chamfering

The EverGuard TPO membrane layer needs to be chamfered at the location of the weld. This can be done by the following:

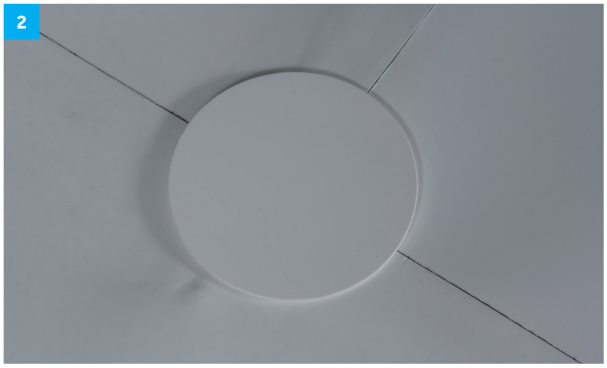
1. using a hand-held welder to heat the membrane edge and scraping off the material with the nozzle of the welder;
2. heating the membrane edge with the hot air welder and then rolling over the edge with the pressure roller (not shown); or
3. Using a chamfer plane.

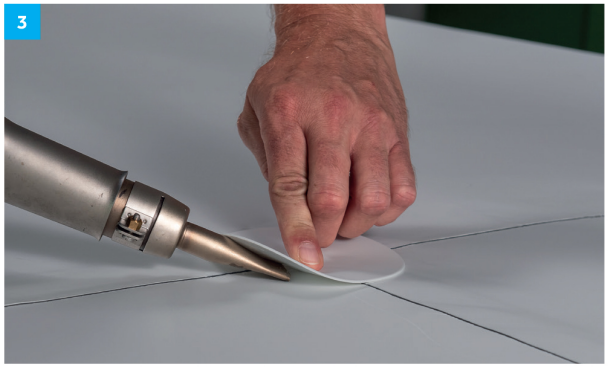


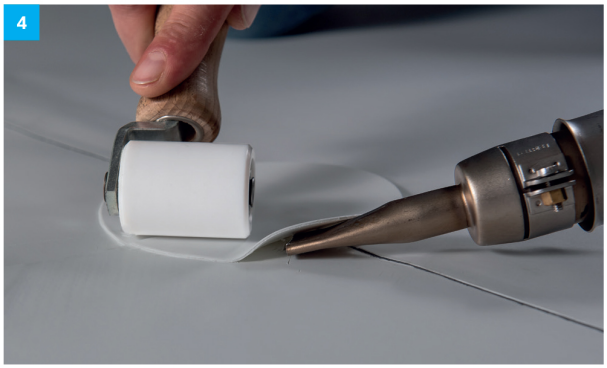
WELDING OF T-JOINTS (CONTINUED)

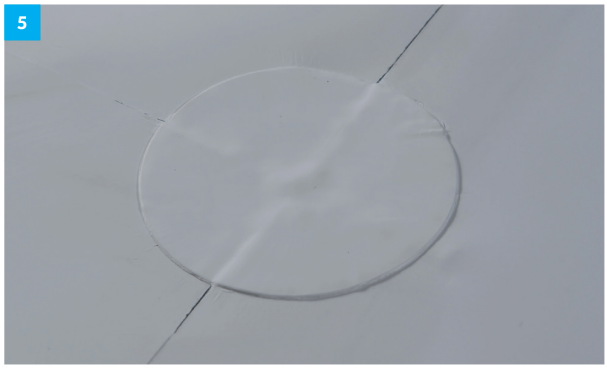
T-Joint Patches

1. Field membrane T-Joint.
2. Cut circular patch to cover T-Joint.
3. Secure the patch in position with an initial tack weld at the centre of the patch.
4. Fully weld the T-Joint cover patch ensuring the patch is firmly pressed along the overlap line.
5. Completed T-Joint patch









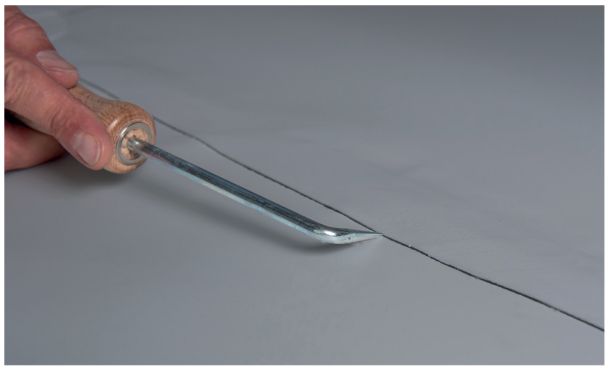
WELDING SEAM CHECKING

After having finished welding check all seams with a test needle or screwdriver with rounded top and re-weld if necessary. The test needle is to lead with slight pressure along the seam edge.

Checking the seams is a compulsory action at the end of any area of work. The welded seams have to cool down to ambient temperature.

Tool: Seam probe. The tool shall slide along the seam with little pressure continuously. When a deficient weld is detected, it should be immediately visibly marked and repaired as soon as possible.

Always use a patch of 100 x 100 mm minimum with rounded edges. When the deficiencies are 'long' cut the patch to the size of the problem zone plus a 50 mm perimeter overlap. Circular patches shall have a diameter of 100 mm minimum.



CARE & MAINTENANCE

The following care and maintenance requirements are for EverGuard TPO Membrane Roofing Systems. Where safe roof access is available, BMI recommend that maintenance staff and / or maintenance contractor inspect the roof periodically or at least twice a year - ideally before and after the winter period. This ensures that any dirt and debris is removed before causing damage and that signs of any failure can be reported and remedial action taken at an early stage. Maintenance items are a responsibility of the building owner (unless otherwise agreed).

The inspection should concentrate on high-risk areas such as roof hatches, drains and around all rooftop equipment as well as general inspection of the entire roof. The inspector should be looking for membrane damage (cuts and tears), oil or Freon leaks, chemical spills, or water infiltration into the roofing system. Compliance with the above listed care and maintenance requirements will aid in assuring a durable, watertight membrane roofing system.

Table 3. EverGuard TPO Single Ply Membrane Care & Maintenance Requirements

Item	Action
Internally	Check internal surfaces visually for signs of moisture, leakage or condensation (e.g damp patches, staining, etc).
General	Remove any unnecessary debris from the roof area particularly objects which could cause damage to the membrane. Do not use the roof as a working platform for adjoining buildings or further works. If access is required, adequate protection must be provided so as not to damage the membrane.
Drainage	Keep the roof surface clean at drain areas to avoid clogging. Clear leaves, silt or other debris, which may cause blockage of outlets or otherwise impede drainage. Check that ponding water is drained from the roof within 48 hours following rain.
Laps	Visually check the membrane laps for securement. Seam probe where necessary.
Petroleum Products	Keep all petroleum products (solvents, greases, paints, oils, or any liquids containing petroleum products) off the membrane to avoid degradation.
Animal Fats	Do not exhaust kitchen wastes (vegetable oils) or other animal fats directly onto the roof surface. They could degrade the membrane.
Chemicals	Contact BMI if any chemicals come in contact with the roofing membrane. Some chemicals could degrade the membrane or cause swelling. Refer to chemical compatibility chart for further information.
Foot Traffic	Walkways must be provided if regular traffic is required or if rooftop equipment has a regular thirty (30) day or less maintenance schedule. Exercise caution when not walking on walkways, especially on white membranes since ice or frost build-up may not be visible. Membranes are slippery when wet.
Roof Alterations	Check with BMI that the proposed alteration will not invalidate the warranty. Work must be carried out by the approved roofing contractor who carried out the original installation. Do not allow other trades to fix through the waterproofing membrane without proper advice. This is especially important when having aerials, heating and ventilation equipment or telephone cables fitted.
Cleaning	Handprints, footprints, general traffic grime, industrial pollutants and environmental dirt may be cleaned from the surface of the membrane using Witec Cleaner, then rinsing with clean water. To maximize reflectivity, white membrane(s) should be cleaned once every two years.
Metal Work	Keep roof maintenance items, such as counterflashing, metal curbs and metal ducts sealed watertight at all times.
Leaks	Report leaks immediately to BMI. Try to determine if it is a roof membrane leak or a wall, curb, skylight, metal ductwork or plumbing leak. Deterioration or failure of building components that causes a leak is not covered by the warranty. A water leak may be indicated by soft or warped insulation or the presence of water under the membrane. Please notify BMI's Technical Services Department if the leak is determined to be membrane related.
Repairs	Damaged or punctured EverGuard TPO membrane can be repaired with the application of a patch of EverGuard TPO hot air welded above the affected area. Clear all debris and thoroughly clean the damaged area with Witec Cleaner. Cut the repair section of EverGuard TPO membrane to the required size and round off the corners. Hot air weld the patch above the damaged area, ensuring a minimum 25mm hot air weld is achieved.
Rooftop Maintenance	When it is necessary for workers to be on the roof to service rooftop equipment, e.g., HVAC units, antennas, etc., workers should be cautioned to use walkways and to exercise care with their tools and equipment to avoid puncturing the roofing membrane.
Roof Cement	**DO NOT USE ROOF CEMENT** to repair or install membrane. Roof cement contains petroleum products, which may degrade the membrane.

NOTES

This information is given in good faith being based on the latest knowledge known to BMI Group. Whilst every effort has been made to ensure the contents of the publication are current, customers are advised that products, techniques and Codes of Practice are under constant review and liable to change without notice. Up to date information is available from the Technical Services Department on request. Responsibility cannot be accepted for the application of products, and no claims can be considered, where the manufacturer's instructions have not been followed. The user should not assume; based on information provided in this sheet, that the product is suitable for any abnormal use. All products are sold subject to standard conditions of sale, available on request.

The current EverGuard TPO Installation and Welding Guidelines are to be observed for the skilled handling of EverGuard TPO waterproofing membranes and component parts.

Any fitting of the waterproofing membranes that deviates from these guidelines as a result of changed local conditions or combinations of materials unless approved already by BMI requires written approval, otherwise BMI accept no liability for the suitability of the EverGuard TPO waterproofing membranes for the described applications.

Any questions or further information required can be provided by contacting BMI's Technical Services Department.

EverGuard TPO Guarantees

Guarantees

BMI Group offers enhanced roof guarantees for all roofing system specifications published in this Guide in full accordance with the terms and conditions set forth in this Guide, and the procedures for obtaining a guarantee are followed.

PRODUCT, SYSTEM & SOLUTION GUARANTEES

EverGuard TPO Roof Systems
The selection of membrane type, thickness, and attachment is the responsibility of the architect, engineer, owner, or roof consultant. BMI EverGuard roof membranes must be used in roofing systems as listed below to be guaranteed by BMI.

Overview of all available BMI guarantees.

	BMI Product Guarantee	BMI System Guarantee	BMI Solution Guarantee
EverGuard TPO Membrane 1.5 mm	Membrane cover only. Limited to material replacement. **10 YEAR GUARANTEE**	'Edge to Edge' cover against water ingress for BMI System components (membrane, detailing, fixings, insulation and VCL), when installed correctly in accordance to this Guide. **15 YEAR GUARANTEE**	Complete 'Edge to Edge' cover against water ingress for BMI System components and installation, when completed by BMI RoofPro certified contractor. **20 YEAR GUARANTEE**
EverGuard TPO Membrane 1.8 mm	Membrane cover only. Limited to material replacement. **10 YEAR GUARANTEE**	'Edge to Edge' cover against water ingress for BMI System components (membrane, detailing, fixings, insulation and VCL), when installed correctly in accordance to this Guide. **20 YEAR GUARANTEE**	Complete 'Edge to Edge' cover against water ingress for BMI System components and installation, when completed by BMI RoofPro certified contractor. **25 YEAR GUARANTEE**
EverGuard TPO Membrane 2.0 mm	Membrane cover only. Limited to material replacement. **10 YEAR GUARANTEE**	'Edge to Edge' cover against water ingress for BMI System components (membrane, detailing, fixings, insulation and VCL), when installed correctly in accordance to this Guide. **25 YEAR GUARANTEE**	Complete 'Edge to Edge' cover against water ingress for BMI System components and installation, when completed by BMI RoofPro certified contractor. **30 YEAR GUARANTEE**

All BMI EverGuard TPO roofing membranes, Insulations, VCL, fasteners, pre-bended coated metal details, and accessory products as job appropriate are required for guarantees unless otherwise approved in writing by a local technical/product manager or Director prior to installation.

All guaranteed roofing systems must be flashed in accordance with the BMI flashing requirements and details included in this Guide.

BMI will be the sole judge as to whether or not a roofing guarantee will be issued to cover any proposed or completed roof. The issuance of a guarantee and its effectiveness or the continued liability thereunder is contingent upon payment of BMI's guarantee fee and payment in full to the roofing contractor and materials suppliers.

BMI has no obligation to issue a roofing guarantee on any roof. Any inspection prior to issuance is solely for the benefit of BMI and does not constitute a waiver of any terms or conditions in the guarantee. In the event that a roof system does not conform to BMI's standards and a guarantee is not issued, no portion of the guarantee fee is refundable.

BMI will not accept Notices of Award of Contract that indicate that the owner or architect has the option to accept or reject the guarantee upon completion of the roof.

Specifications not listed in this guide may also be eligible for BMI guarantees. For further information on guarantee requirements and for approval of modifications to published specifications, consult with BMI organisations.

BMI is not responsible for consequential damages in case of roof system failure. BMI has no control over a building's contents, type, quantity, positioning, or protection.

A BMI guarantee cannot be withdrawn once it has been issued, although it may be cancelled subsequently by BMI for violation of its terms and conditions.

Disclaimer: Please reference the specific BMI EverGuard Guarantee policy for full terms and conditions over above outline in this Guide

Table 4. BROOF (t1) External Fire Class Certification

EverGuard TPO Membrane Thickness	Membrane Attachment	Protction Layer	Insulation	Vapour Control Layer	Substrate**	Roof Pitch
All thicknesses*	Mechanical	None	Aluminium foil-faced or glass tissue-faced PIR	Optional	Profiled steel, concrete or wood	< 20°
All thicknesses*		None	Mineral wool	Optional		
Minimum 1.5 mm*		120 g/m² glass fleece	Expanded polystyrene (EPS)	Required		

*Approved membrane colours include white, tan and grey. **Continuous wood deck, non-perforated trapezoidal steel deck or concrete with gaps not exceeding 5 mm.

30,000 m² of BMI EverGuard installed in Valencia, for Crown, a multinational food packaging company.

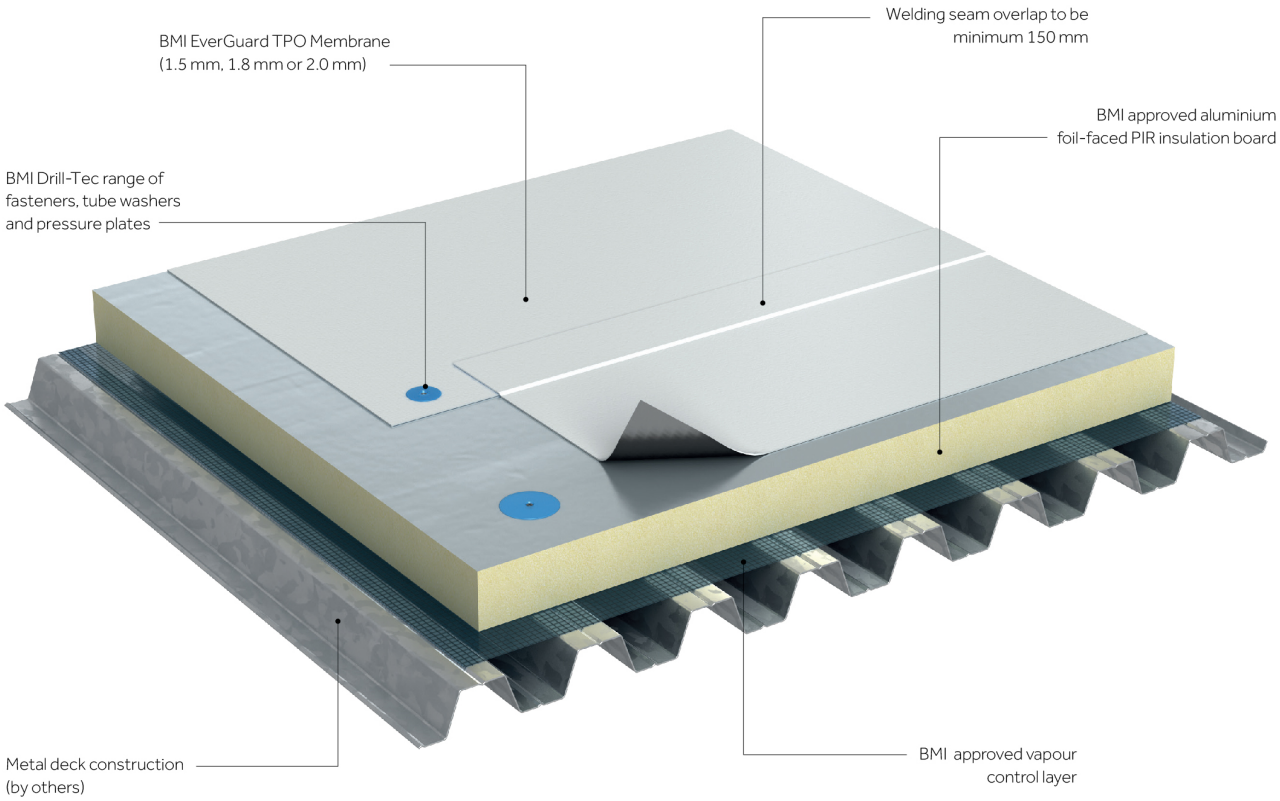
Appendix

Appendix: FM Approved Assemblies

BMI EVERGUARD TPO FM APPROVED ROOF ASSEMBLY ON TRAPEZOIDAL METAL DECK

BMI System recommendation

- BMI EverGuard TPO membrane
- BMI Drill-Tec fasteners
- BMI insulation - PIR or mineral wool
- BMI approved vapour control layer
- Metal deck construction (by others)

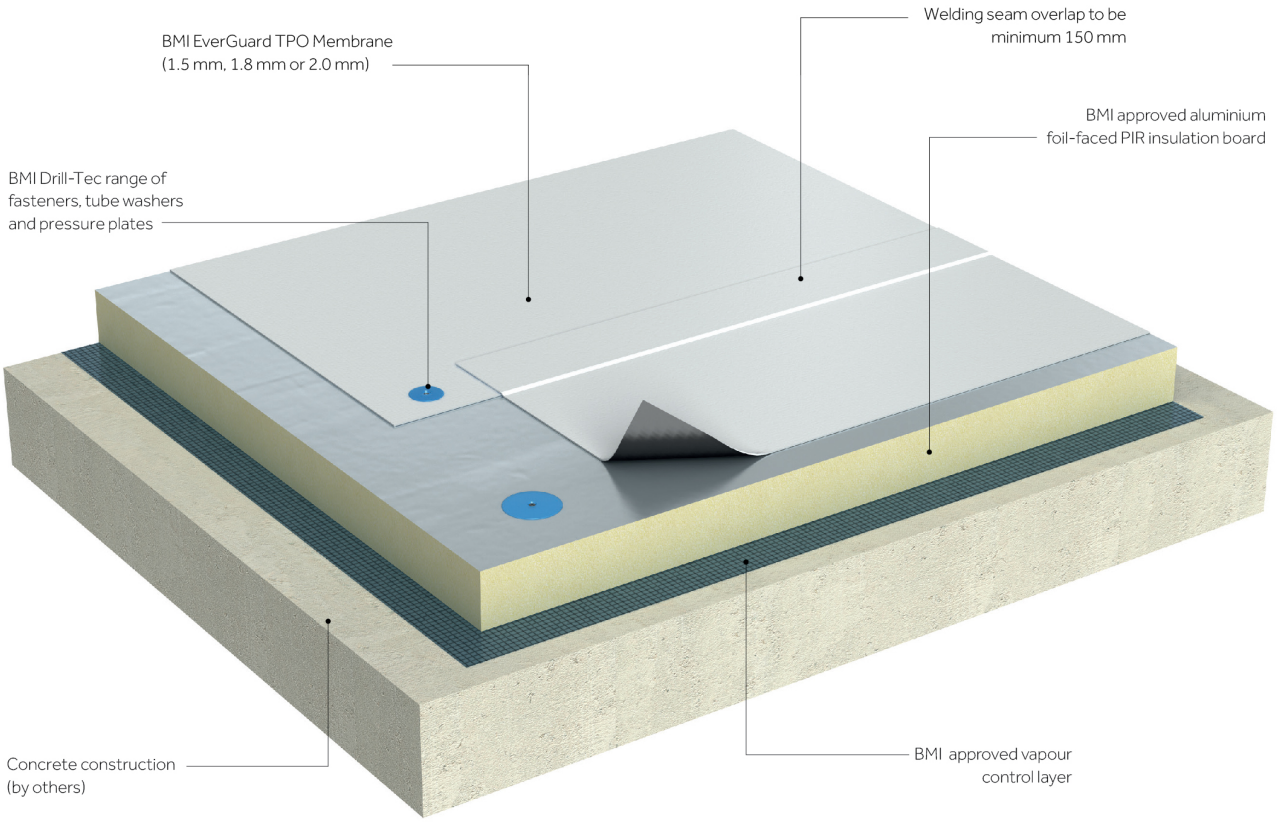


FM APPROVED

BMI EVERGUARD TPO FM APPROVED ROOF ASSEMBLY ON CONCRETE DECK

BMI System recommendation

- BMI EverGuard TPO membrane
- BMI Drill-Tec fasteners
- BMI insulation - PIR or mineral wool
- BMI approved vapour control layer
- Concrete construction (by others)



FM APPROVED

Appendix: Storage Guidelines for Synthetic Membranes

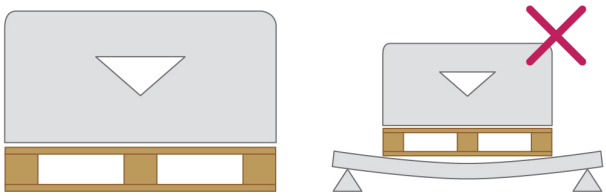
The following guidelines define the storage conditions and requirements for the storage and stacking of synthetic membranes.

Storage at warehouse

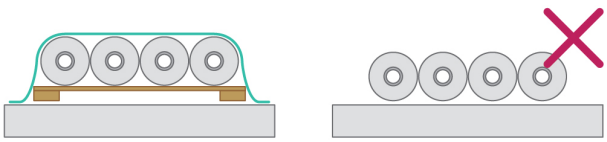
- Pallets must remain horizontal in original packaging, clean, dry, cool, protected from direct sunlight, rain, frost and humidity, damages and dirt.
- Pallets must not be stacked on top of each other permanently in the yard / on site. Stacking pallets for transportation is acceptable.
- Maximum storage times, as follows:
  Monarplan range, Cosmofin GGL, Cosmofin FG: 6 months.
  Wolfin, Tectofin, Cosmofin GG plus, Inofin and Monarfin:
  12 months.
- **In cases of longer storage, and directly before delivery, a welding test according to EN 12316-2 must be carried out, min > 150N/50 mm.**

Storage at building site

- Pallets must remain horizontal in original packaging, clean, dry, cool, protected from direct sunlight, rain, frost and humidity, damages and dirt.
- Pallets must not be stacked on top of each other.
- **Safety note: Pallet weight may be up to 1,200 kg, depending on material type, therefore the load bearing capacity of the roof must be checked! Special attention is advised in relation to trapezoidal metal deck or wooden constructions - risk of collapse!**

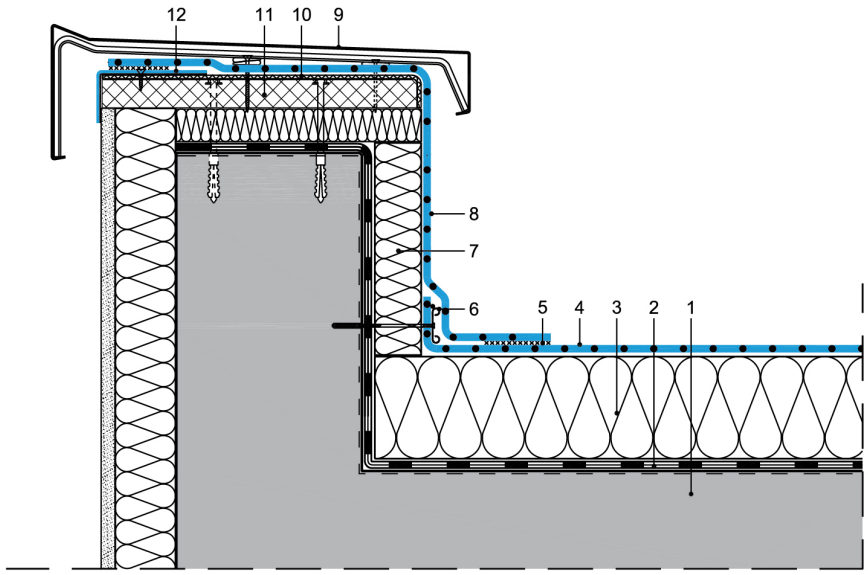


- Only remove protective packaging before application of the roofing membrane.
- Membrane will require cleaning depending on the results of the mandatory on-site welding test.
- Opened pallets must be resealed if subject to prolonged outdoor storage.
- Single rolls must be stored horizontally on pallets or elevated support plates, and covered with protective tarpaulin to protect from rain – do not store directly on the roof.



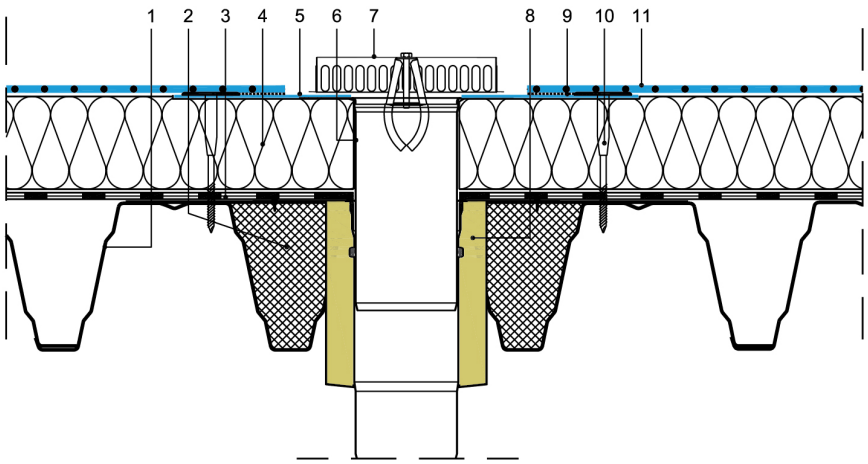
Appendix: Typical Construction Details

UPSTAND WITH TERMINATION



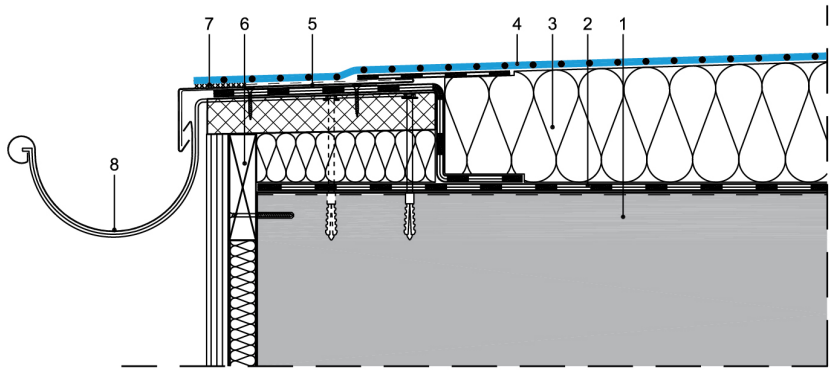
1 Substrate
2 Vapour Control Layer
3 Insulation
4 EverGuard® TPO
5 Hot-air weld
6 Fixation bar
7 Insulation
8 EverGuard® TPO connecting strip
9 Wall capping profile with brackets
10 Protection layer fleece
11 Wood panel
12 Bended coated metal profile

WARM ROOF SYSTEM OUTLET



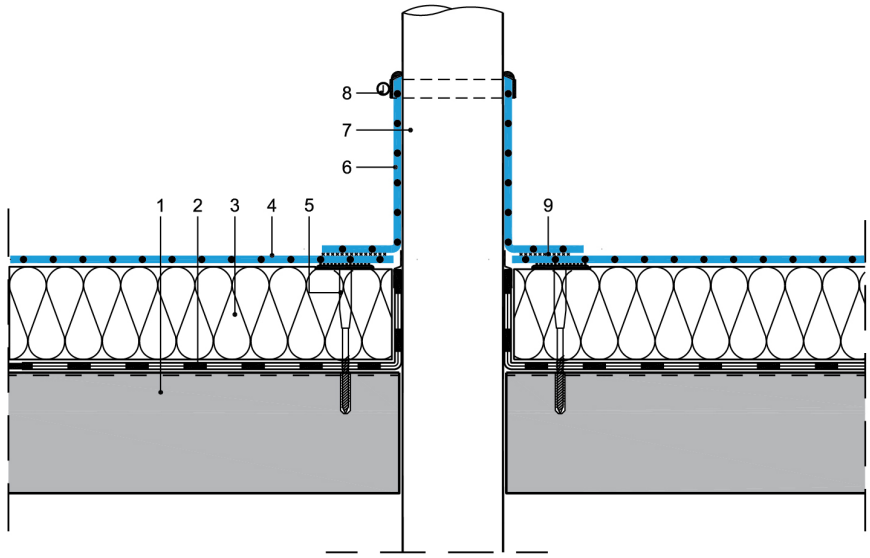
1 Trapezoidal metal sheet
2 Sick filler
3 Vapour Control Layer
4 Insulation
5 Membrane flange
6 Stainless steel 2 components drain
7 Roofgard leaf Grate
8 EverGuard® TPO connecting strip
9 Hot-air weld
10 Fastener
11 EverGuard® TPO

WARM ROOF EAVES



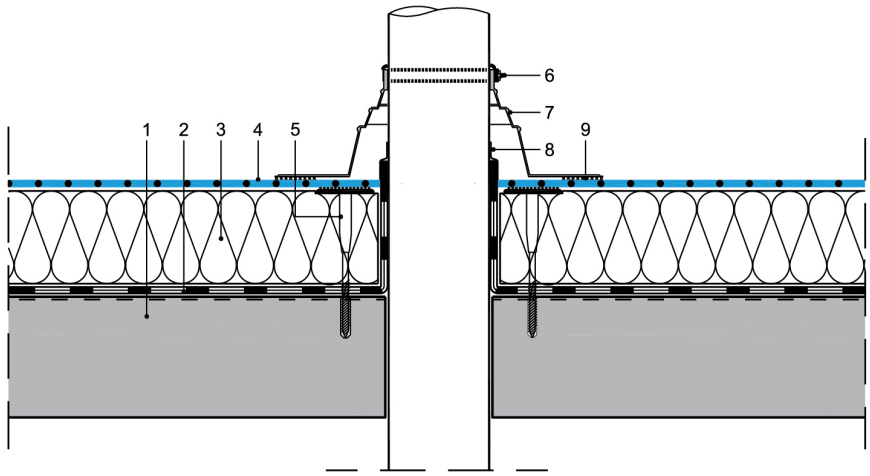
1 Substrat
2 Vapour Control Layer
3 Insulation
4 EverGuard® TPO
5 Coated Metal
6 Timber packer
7 Hot-air weld
8 Gutter

PENETRATION WITH SPLIT PIPE BOOT



1 Substrat
2 Vapour Control Layer
3 Insulation
4 EverGuard® TPO
5 Mechanical Restraint
6 Jubilee Clip
7 Prefabricated Split Pipe Boot
8 Airtight seal
9 Hot-air weld

PENETRATION WITH PIPE BOOT



1 Substrat
2 Vapour Control Layer
3 Insulation
4 EverGuard® TPO
5 Mechanical Restraint
6 Jubilee Clip
7 Prefabricated Pipe Boot
8 Airtight seal
9 Hot-air weld

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ABOUT BMI GROUP

BMI Group was born out of a recognition that customers now expect a single point of expertise to help them find their ideal roof. Bringing together some of the industries most trusted brands to become the largest supplier of both flat and pitched roofing and waterproofing solutions throughout Europe, BMI Group has over 165 years of experience and innovation to offer its clients.

As a **Standard Industries** company, BMI Group, headquartered in London, has the support, reach and resources of a global enterprise. With over 120 production facilities across Europe, Africa and Asia, and more than 9,500 employees worldwide, the business is well positioned to provide an unparalleled level of service to homeowners, specifiers, contractors, property owners and developers.

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