Monarplan PVC
Single Ply Waterproofing Systems
# Contents

## Contents

- Introduction ................................................................................................................................................. 5
  - Icopal Synthetic Membranes ......................................................................................................................... 5
    - Monarplan PVC ........................................................................................................................................... 5
  - Monarplan PVC System Benefits .................................................................................................................. 5
- Correct Specification ....................................................................................................................................... 6
  - Roof Types .................................................................................................................................................. 6
  - Method of Attachment ................................................................................................................................. 6
  - Choosing The Correct Membrane ............................................................................................................... 7
    - Application of membrane to Insulation Substrates ..................................................................................... 7
    - Application Direct to Common Substrates (cold or inverted roof situations) ........................................... 7
- Product Range at a Glance ............................................................................................................................... 8
  - System Components .................................................................................................................................. 8
    - Membranes ............................................................................................................................................... 8
    - Ancillaries .................................................................................................................................................. 8
    - Accessories .............................................................................................................................................. 8
    - Adhesives, Solutions and Compounds ...................................................................................................... 9
  - Delivery and Storage of Materials ............................................................................................................. 10
- Tools and Equipment ....................................................................................................................................... 11
  - Introduction ............................................................................................................................................... 11
    - Automatic Welder .................................................................................................................................... 11
    - Hand Welder ............................................................................................................................................ 11
    - Tool Kit ................................................................................................................................................... 11
  - Membrane Application ................................................................................................................................. 12
    - Hot-Air Welding – General ......................................................................................................................... 12
    - Hot-air welding ......................................................................................................................................... 12
      - Welding Operation – Automatic Welders ................................................................................................. 12
      - Welding Operation - Hand Welder ........................................................................................................... 13
    - Hot-Air Welding - Working conditions ..................................................................................................... 13
    - Hot-Air Welding - Tests ............................................................................................................................. 13
      - Welds - Checking of seams ..................................................................................................................... 14
  - Deficiencies ................................................................................................................................................. 15
  - T-Joints & Cross-Joints ............................................................................................................................... 15
  - Perimeter Fastening ................................................................................................................................. 16
    - Icopal Fixing Bar ..................................................................................................................................... 16
    - Monarplan Coated Metal ......................................................................................................................... 16
  - Membrane Termination ............................................................................................................................. 17
Appendix .................................................................................................................................................... 35

Product Range Overview ............................................................................................................................................... 35

Monarplan PVC Membranes ............................................................................................................................................................................................. 35
Monarplan Ancillaries ......................................................................................................................................................................................................... 35
Icopal Fasteners ................................................................................................................................................................................................................... 36
Thermal Insulation .............................................................................................................................................................................................................. 36
Vapour Control Layers ........................................................................................................................................................................................................ 36
Introduction

Icopal Synthetic Membranes
The Icopal Group have been active in the manufacture and distribution of synthetic roofing systems since 1969. Continued expansion and investment in synthetic single ply membrane manufacture during 2008 ensures that Icopal remains at the forefront of waterproofing technology.

Icopal’s experience with single layer membranes continues to grow, resulting in a product portfolio which is one of the most comprehensive within the UK roofing industry.

Monarplan PVC
PVC membranes from Icopal have been in use for over 30 years, covering roofs of all types and form. Whether it’s domestic or commercial, public or private; Monarplan PVC membranes offer a flexible and lightweight waterproofing solution with a proven track record. Monarplan is a flexible PVC (polyvinyl chloride) single ply membrane offering excellent characteristics of strength, elongation and weathering, making it ideal for new build or refurbishment projects.

Roofing Membranes
All roofing materials are subjected to environmental conditions that can alter the physical and chemical properties of the material. These conditions include ozone, heat, solar radiation, thermal cycling, freeze/thaw, pollution, biological growth and ponding rainwater.
Roof membrane properties must be maintained during exposure to the roof environment or the roof will not perform as expected. The inherent performance benefits of Monarplan PVC ensure both the specifier and building owner of a versatile, durable and stable roofing option.

Durability
Monarplan PVC provides exceptional weather resistance and protection against all temperature extremes. Monarplan PVC is UV resistant and remains virtually unchanged throughout its serviceable life. Accelerated age testing completed on the Monarplan membranes provide an anticipated life expectancy in excess of 30 years demonstrating superior durability and system service life performance.

Compatibility
Monarplan roof membranes can be installed on all major roof deck types such as plywood, timber boards, profiled metal, concrete and cementitious screeds. However, PVC membranes can be adversely affected by contact with bituminous or coal tar products. In this situation or when used over expanded polystyrene insulation a geotextile separation layer will be required.

Security in Application
Adjoining sheets of Monarplan PVC are fused together to form a homogeneous lap using hot air equipment (eg. manual hot air welders or automatic equipment).

Monarplan PVC System Benefits

- Excellent physical characteristics
- Flexible methods of installation
- 3rd Party Accreditation (BBA and ETA certified product)
- Guarantee options for 10, 15 & 20 years
- Complimentary range of accessories
- Sustainability - A+ BREEAM Rating (subject to roof buildup)
Correct Specification

Roof Types
There are generally three types of flat roof construction:

Warm Roof
The thermal insulation is positioned above the roof deck immediately below the waterproofing, resulting in the structural deck and ceiling being at a temperature close to that of the interior of the building. A vapour control layer is placed between the roof deck and the insulation to minimise the risk of condensation. Ventilation of the roof void is not required. However due consideration must be given to providing a minimum upstand requirement of 150mm above the finished roof level for all details.

Cold Roof
This type of roof must be carefully designed to avoid premature failure and should be avoided wherever possible. Thermal Insulation is positioned beneath the structural deck resulting in the roof covering and structural deck being substantially colder in winter than the interior of the building. The structural deck therefore becomes a potential point for condensation, and so it is important to provide a minimum 50mm void between the top of the insulation and the roof deck. This void must be ventilated and cross ventilation must be provided with a minimum 25mm continuous opening at eaves on opposing sides of the roof. A suitable sealed air-leakage barrier, or vapour control layer installed at ceiling level is good practice, as this will help restrict the passage of warm moisture laden air into the roof structure.

Inverted roofs
Sometimes referred to as an ‘upside down’ roof, the thermal insulation is positioned above the roof covering, resulting in the roof covering, structural deck and ceiling being at a temperature close to that of the interior of the building.

Since the insulation is above the waterproofing system the insulation must be water-resistant and it must be ballasted to prevent floatation of the insulation boards and to protect against wind uplift. Therefore, the roof deck must be capable of withstanding the additional loading of a ballasted roof.

Method of Attachment
The roof system must be secured to the roof structure to protect against wind uplift. The components of the roof system can be secured in a number of ways.

Mechanically Fastened
The membranes and insulation are secured using screw fasteners which are fixed directly to the structural deck.

Adhered
The layers can be adhered using adhesive compounds to attach the membranes or insulation to the substrate beneath.

Ballasted
The membranes and insulation can be secured using a selected material, such as river-washed pebble or concrete paving slabs to weight the layers down to protect against wind uplift or floatation. A protection layer may be required beneath the ballast material to protect the underlying layers from damage.

Depending on project requirements and scheduling it is possible to use a combination of methods, eg mechanical fastening of insulation, and adhering of the waterproofing layers.
Choosing The Correct Membrane

The choice of membrane will depend on the application and substrate.

Step 1: Type of Roof
- Warm / Cold / Inverted / Refurbishment

Step 2: Deck Type
- Plywood / OSB / Metal / Concrete / Timber boards

Step 3: Method of Application
- Mechanically Fastened / Fully Adhered / Ballasted / Combination

Application of membrane to Insulation Substrates

The following tables are intended to offer a simple summary. Please consult with Icopal Technical Services on project specific situations.

<table>
<thead>
<tr>
<th>WARM Roofs</th>
<th>Monarplan G</th>
<th>Monarplan GF</th>
<th>Monarplan FM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insulation Type</td>
<td>Mech Fixed</td>
<td>Adhered</td>
<td>Ballasted</td>
</tr>
<tr>
<td>PIR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glass Tissue Face</td>
<td>NA</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Foil Faced/Other</td>
<td>NA</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Composites</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perlite</td>
<td>NA</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Cork</td>
<td>NA</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Mineral Wool</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plain/ tissue</td>
<td>NA</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

For insulation boards not supplied by Icopal Limited, consult insulation manufacturer for guidance.

Application Direct to Common Substrates (cold or inverted roof situations)

<table>
<thead>
<tr>
<th>Substrate Type</th>
<th>Monarplan G</th>
<th>Monarplan GF</th>
<th>Monarplan FM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mech Fixed</td>
<td>Adhered</td>
<td>Ballasted</td>
<td>Mech Fixed</td>
</tr>
<tr>
<td>Concrete</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cellular/Rough</td>
<td>NA</td>
<td>No</td>
<td>Yes [5]</td>
</tr>
<tr>
<td>Cast</td>
<td>NA</td>
<td>No</td>
<td>Yes [5]</td>
</tr>
<tr>
<td>Ply/OSB3</td>
<td>NA</td>
<td>No</td>
<td>Yes [5]</td>
</tr>
<tr>
<td>Profiled Metal</td>
<td>NA</td>
<td>Note Z</td>
<td>Note Z</td>
</tr>
</tbody>
</table>

1. Icopal Single-Ply Fleeceback Adhesive.
2. Monarplan Contact Adhesive.
3. Monarplan Contact Adhesive. Please note, coverage rates are adversely affected.
4. Icopal Xtra-Seal Membrane Spray Adhesive.
6. Direct contact not possible. Use thickness of suitable insulation board, or similar.
7. Existing single-ply must be slash cut and removed where feasible.
8. Consult insulation manufacturer for guidance.

Note Z: Requires over-boarding. Consult Icopal Technical Services for guidance.
Product Range at a Glance

Monarplan PVC is a range of thermoplastic heat weldable reinforced waterproofing membranes suitable for flat, curved and pitched roofs.

Monarplan ancillaries have been individually designed to ensure total compatibility and ease of application and play a vital role in achieving the total integrity of the Monarplan PVC waterproofing system.

System Components

Membranes

- Monarplan GF
- Monarplan G
- Monarplan FM

Ancilliaries

1. **Monarplan Coated Metal** is a 0.6mm hot dipped galvanised steel sheet coated with a layer of 0.6mm non-reinforced PVC film for an overall thickness of 1.2mm. 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. **Monarplan Reinforced Strip** is used to achieve a watertight detail where end laps of the Monarplan GF membrane are butt jointed. It is also used in conjunction with coated metal drips and upstands.

3. **Monarplan D 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. **Monarplan W Walkway Membrane** is a weather resistant PVC membrane which is anthracite in colour and incorporates an aggressive, non-slip, interlocking herringbone tread pattern.

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

6. **Monarplan Pipe Flashings** are moulded preformed PVC pipe flashings (pipe boots) designed to suit a range of pipe diameters, achieving a watertight seal.

7. **Monarplan PVC Standing Seam Profiles** are used to replicate the appearance of lead standing seam or metal profiles.

Accessories

8. **Monarplan Outlets** are manufactured from rigid PVC incorporating a Monarplan flange for easy welding to the roof membrane. Connection is made with the plumbing using a rubber gasket. The Monarplan Outlet range is completed with leaf guards where required. Outlets are available in standard and refurbishment versions. Also available is a Monarplan Parapet Outlet. Please consult product information sheet for further information.

9. **Monarplan Cowled Telescopic Vent** is manufactured from high quality steel. Monarplan Cowled Telescopic Vents are designed to maintain waterproofing integrity around soil vent pipe penetrations. The telescopic double pipe slides on to the upstand pipe and into the soil vent pipe. An internal seal is achieved between the smaller diameter of the two pipes and the soil vent pipe via a rubber "O" ring.

10. **Monarplan Multiple Cable Duct** consist of a PVC pipe providing a rigid upstand, capped with two PVC pipe elbows. The integral PVC membrane flange can be welded to the underlying membrane to maintain the waterproofing detail.

11. **Monarplan Single Cable Duct** consist of a continuous 24mm diameter PVC pipe providing a rigid upstand to accommodate thin cables. The integral PVC membrane flange can be welded to the underlying membrane to maintain the waterproofing detail.
Monarplan Lightning Conductor Pads comprise a lightning conductor cable clip mechanically attached to a circular PVC membrane disc which is welded to the main Monarplan PVC roof membrane. The clips are available to suit either a bare copper, or a PVC-coated conductor strip. Standard membrane colour available is light grey.

Icopal Galvanised Fixing Bar (peel stop) is a 3m galvanised steel bar with pre-drilled holes at specified centres to facilitate the mechanical restraint of Monarplan membranes at the base of upstands or angle changes. It should be fastened to the more stable substrate, i.e., fixed vertically to the structural deck or horizontally to masonry or concrete upstands.

Icopal 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.

Icopal 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.

Icopal 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.

Adhesives, Solutions and Compounds

Icopal Single-Ply Fleeceback Adhesive is a high strength, single component moisture curing polyurethane adhesive that has been formulated for bonding fleece-backed single ply roofing membranes to various substrates including suitable roof insulation panels, such as Thermaxone Roofboard. The cured adhesive film has very good resistance to heat and hydrolysis, and is blue/green in appearance.

Monarplan Contact Adhesive is a high strength solvent-based contact adhesive that allows the bonding of Monarplan PVC non-fleeceback membrane to various porous and non-porous substrates. The adhesive provides instant contact adhesion and is particularly useful at details such as upstands and abutments.

Xtra-Seal Membrane Spray Adhesive is a versatile spray-applied, high performance industrial contact adhesive. The adhesive is water resistant and offers instant adhesion between the membrane and substrate. Xtra-Seal Membrane Spray Adhesive is not suitable for use on Monarplan non-fleecebacked membranes.

Monarplan Sealant is a single component mastic designed to be used in conjunction with termination details at upstands and pipe penetrations to complete the waterproofing element.
**Delivery and Storage of Materials**

Handle all materials to prevent damage. All single ply membranes must be stored horizontally on a clean flat level surface, undercover and away from direct sources of heat. The rolls are usually individually wrapped with a protective film. If internal storage is not possible, rolls must be suitably secured and protected.

Place materials off the ground and on pallets and fully protect from moisture and sunlight. Cover with a clean tarpaulin.

Icopal Thermazone 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.**

Adhesives must be stored at temperatures around 20 °C depending upon the product (consult the individual product technical datasheet for specific storage instructions). All flammable materials shall be stored in a cool, dry area away from sources of heat, sparks and open flame. Follow the precautions outlined on the label of the container.
Tools and Equipment

Introduction
The following is intended as a basic list of tools and equipment and their operation necessary to install a Monarplan PVC 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 Monarplan PVC membrane. Icopal 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. 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 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 Welder
These are used for detailing and making welds not accessible by automatic welders. The hand welder should be set to a temperature of 360 °C. Many of the care and operating notes for the automatic welders apply to the hand 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 Handheld Welder
- A 40mm flat nozzle
- A 20mm flat nozzle
- A 20mm angled nozzle
- A pair of scissors
- A wire brush
Membrane Application

Hot-Air Welding – General

Monarplan roofing membranes are hot air welded to each other and the compatible range of PVC ancillaries in a homogeneous manner. The welding zone must be clean (free from dust) and dry. All welds shall be a minimum continuous width of 40mm.

The roofing membrane must be unrolled without tension and free of wrinkles. The overlap area between sheets is 50mm minimum. On heat sensitive substrates (eg. foamed insulation boards) and on curved decks (vaults) as well as on soft or uneven substrates, the overlap should be increased to 70mm or more according to the situation.

To achieve a good weld, the following criteria should be considered:

- welding temperature
- welding speed / traction of the welding machine,
- volume of air as well as the ambient temperature
- membrane temperature
- water absorption

Hot-air welding

All joints in the Monarplan PVC Roofing System are hot air welded. It is recommended that automatic welders are used for all field joints. Manual hand held welders should be used for details and inaccessible areas only.

The figures below act as a guideline (at standard conditions 20 °C, relative humidity of 60%):

- **Automatic Welding machine:**
  - Air temperature: 480 °C
  - Traction: 2m/min,

- **Manual Hot air welder:**
  - Air temperature: 360 °C.

Welding temperatures will vary dependent upon the weather conditions of the day. Test welds should always be carried out before commencing work, adjusting the temperature settings as necessary to achieve the perfect weld.

Welding Operation – Automatic Welders

Position the automatic hot air welding machine with the pressure wheel approximately 3mm over the weld edge to ensure a sealed edge.

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.
**Welding Operation - Hand Welder**

Use a hand-held welder and silicone covered roller to complete welds and details where the automatic welder is inappropriate.

When the welding parameters are adjusted correctly, there is a certain development of smoke and the surface of the lower sheet turns shiny-brilliant when heated correctly. A change of colour, scorching or the formation of ashes on the nozzle or the welding zone indicates that the welding temperature is too high.

When there is a risk of wrinkles or sliding of strips and sheets, it is advisable to provisionally stitch (spot weld or pre-weld) the two sheets every 20–30 cm.

The weld must have a minimum width of 40 mm. This avoids a local peak of peel forces under wind uplift at isolated areas where there are sudden changes of width.

**Hot-Air Welding - Working conditions**

For hot air welding there is no general limit for working at lower temperatures. It is crucial that the sheet can be rolled out without wrinkles and the temperature difference between the membrane and the hot air does not become too great (this leads to wrinkles outside the welding zone).

When stored in a warm or heatable location the material should have a temperature of at least +5 °C to 15 °C (ideally 10 °C). When the waterproofing is installed roll by roll, work can proceed at very low temperatures – general conditions for welding apply – i.e. welding parameters and tests.

**Hot-Air Welding - Tests**

Before starting work on site (morning and afternoon) and whenever there has been a change in the weather conditions, the welding parameters have to be verified and adjusted accordingly by carrying out a welding test. This is a site test and samples are torn by hand in the absence of a calibrated peel tester in the lab.

Width of the sample:

<table>
<thead>
<tr>
<th>Welding machine:</th>
<th>&gt;50 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manual Hot air welders:</td>
<td>&gt;20 mm</td>
</tr>
</tbody>
</table>

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 PVC 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 20 mm wide. 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
- 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.
Welds - Checking of seams

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 100mm 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 minimum diameter of 100 mm.
**Deficiencies**

Wrinkles, capillaries and fish-mouths are to be avoided. When these deficiencies occur they shall be repaired immediately.

**Notice**

Complete all roofing work and flashing each day to prevent water from getting under completed roof sections. Any areas where water has penetrated the completed roof must have any moisture and wet insulation removed. Temporary sealing of the edge of the roofing membrane is the responsibility of the contractor. The tie-off must be higher than the drain, and slope to the drain.

**T-Joints & Cross-Joints**

At T-joints, the thickness of the middle sheet has to be chamfered back to “zero” with a chamfering tool or the 40mm flat nozzle of the hot air gun.

In order to minimize this operation it is advisable to round off the edge or cutting off a triangle of the middle sheet or to weld the two lower membranes over the width of the overlap.

On the other side a cross seam meets a continuous sheet below. The edge of the middle sheet should also be rounded or cut off.

When planning the layout of the sheets cross-joints should be avoided. When the roof is long or when this should prove to be too arduous a membrane strip of min. 300 mm width shall be centered and welded over the overlap. Treatment is similar to that of T-joints.
**Perimeter Fastening**

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 rooflights 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 65mm. It should then be mechanically fastened as close as possible to the foot of the upstand. It should be fastened to the more stable substrate, ie 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 Icopal Fixing Bar (peel stop)
- using Icopal Tube Washers or Pressure Plates
- a 90° angle of Monarplan Coated Metal

**Icopal Fixing Bar**

The horizontal field membrane is secured at the foot of the upstand using an Icopal Fixing Bar fixed back to the more stable substrate, ie fixed vertically to the structural deck or horizontally to masonry or concrete upstands.

The angle is then waterproofed with the flashing sheet.

In some situations, the field membrane may be turned over the angle, tightly folded, and hot-air welded back onto itself. It should be secured at a rate of 5 fixings per metre.

**Monarplan Coated Metal**

**Non-Fleecebacked membrane**

The perimeter of the Monarplan G or FM reinforced membrane on the field area is welded continuously to the horizontal flange of a mechanically fastened 90° membrane-coated metal angle.

**Fleecebacked Membrane**

The perimeter of the Monarplan GF Fleeceback field membrane is secured by mechanically fastening a membrane-coated metal angle to the foot of the upstand. This is then waterproofed using the Monarplan (G or FM) non-fleeceback membrane dressed to the upstand, welding to the field sheet and at least the horizontal flange of the coated metal angle.

For further clarification regarding the method of perimeter restraint, refer to the range of Monarplan Standard Drawings.
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 ‘Termination Bar’ which is then weatherproofed by pointing a suitable mastic sealant along the top edge between the construction and the Termination Bar.

The waterproofing should finish on the vertical a minimum 150mm from the finished roof level, in accordance with ‘BS 6229:2003 Flat roofs with continuously supported coverings. Code of practice’. 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.

**Flashings**

Lead flashings should be installed in accordance with codes of practice and recommendations of the Lead Sheet Association. Alternatively, Icopal FormFlash lead-free flashing may be used instead, and installed in the same fashion.

The flashing should provide sufficient coverage of the waterproofing, extending down a minimum 75mm over the waterproofing system.

**Termination Bar**

Depending on the method of installation and the type of termination bar used, the waterproofing membrane may first require mechanical restraint using the Icopal Fixing Bar. The termination bar is mechanically fastened to the wall at regular fixing centres. A suitable mastic sealant is applied behind the lip of the termination bar just prior to the final tightening of the fasteners. This provides a compression to the sealant ensuring that the detail is sufficiently weatherproof.
Methods of Application

With today’s construction trends of highly intricate and complex structures and the requirement for higher thermal insulation values, only membranes which aspire to the highest quality standards and possess unquestionable technical properties, will be considered in the design process. The versatility of Monarplan PVC ensures the designer total freedom and security when specifying the roof waterproofing system.

The Monarplan PVC roofing system can be applied in a number of ways depending upon the requirements for the specific project.

Mechanically Fastened Membrane
Mechanically fixed systems are often favoured above timber or metal decks where the exposure of the fastener on the underside of the structure is not a consideration. This method of application involves the use of thermally broken fasteners fixed at pre-determined centres and is a fast and cost effective method of installing the single ply membrane which is less dependent upon amicable weather conditions.

Adhered Membrane
Fully adhered systems are more commonly used above concrete substrates where the process of installing mechanical fixings is invasive and labour intensive. Fully adhered systems are reliant upon suitable weather conditions (which should be considered) however, complex geometries and pitched surfaces can be accommodated with great success. Fully adhered membranes can also provide a superior surface finish.

Ballasted Membrane
The Monarplan PVC membrane is loose-laid and welded together at the overlaps prior to the application of a ballast which holds the membrane in place. This method offers maximum restraint to wind uplift and fast application times, while providing protection from mechanical and solar/UV damage. This method can be used in both inverted and warm roof situations. For inverted roofs the membrane is applied directly to the deck and so the suitability of this method will be dependent upon the condition and nature of the substrate.
Mechanically Fastened System

Membrane Used: Monarplan FM Membrane

Introduction

In mechanically fastened systems the Monarplan FM reinforced membrane is fastened in the overlap seam along one edge of the membrane and secured directly to the structural deck. The adjacent sheets of membrane are then hot-air welded together with a hot-air welder to provide the continuous waterproof covering.

The membrane is protected from mechanical damage by using an Icopal Tubular Washer or Icopal Pressure Plate in conjunction with the appropriate screw fastener.

For confirmation of the appropriate size of washers and fasteners to use, refer to the Icopal Fastener product datasheet.

Prior to application of the Monarplan FM reinforced membrane, a wind uplift calculation must be carried out in accordance with BS EN 1991: Parts 1 – 4 to determine the correct fixing centres specific to the project.

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.

Methodology

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

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 60mm past the fastening plates / washer. The weld must have a compulsory minimum width of 40mm.

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 13mm free zone between the fasteners edge and the edge of the membrane must be observed. The minimum overlap should be approximately 110mm.

A: 40mm Hot-air Weld
B: Icopal Membrane Tube Washer (Ø 45 mm)

The overlap is calculated in following manner: 13mm free edge + width of washer (45mm for a Tube Washer) + 50mm 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 40 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.

Perimeter Fastening

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 rooflights and penetrations. This ensures that any tensions generated in the field membrane are not transferred to other areas.

Please refer to the main text on perimeter fastening under the Membrane Application section.
**Roof Edges / Drips / Trims**

Whenever possible, external roof edges shall be constructed using Monarplan Coated Metal.

Separate lengths of the Monarplan Coated Metal drip trim are butt jointed. The sheets should be fastened with two rows of fasteners, typically screws, at 150mm staggered centres. A 5 mm gap should be left to allow for expansion of the metal.

The joints should then be taped with a 50mm wide duct or crepe tape. The joint should then be strapped with 150mm wide Monarplan D Unreinforced Flashing, hot-air welded to the coated metal with a 40mm weld.

Depending on the construction detail, the edge of the roof should be made air-tight. A strip of Monobond LT or other suitable sealant should be installed along the edge beneath the coated metal. If a compatible vapour control layer is specified, then the vcl can dress up onto the timber edge batten, and again, be terminated with a strip of sealant. Consult Icopal’s standard drawings for further information.
**Adhered System**

In adhered systems the Monarplan PVC membrane is attached to the substrate using an adhesive. The adjacent sheets of membrane are then hot-air welded together with a hot-air welder.

Icopal Limited offer two types depending on the membrane used, and the type of substrate.

**Fleeceback Membranes**

**Membrane Used: Monarplan GF Fleeceback Membrane**

**Introduction**

The Monarplan GF Fleeceback membranes are adhered using Icopal Single-ply Fleeceback adhesive or Icopal Xtra-Seal Membrane Spray Adhesive to the pre-secured insulation board.

The insulation boards are secured to the structural roof deck by either mechanical fasteners, insulation adhesive or hot bitumen, etc.

**Icopal Single-Ply Fleeceback Adhesive**

Monarplan GF Fleeceback Membrane is fully bonded to Thermazone Roofboard insulation using Icopal Single-Ply Fleeceback Adhesive.

Set out the roll to ensure proper alignment, and roll the membrane back up again. The fleeceback membrane has a fleece-free selvedge in the overlap area, to enable the side lap to be hot-air welded. Ensure no adhesive contaminates the weld zone.

The adhesive should be poured onto the insulation board and manipulated using a rubber squeegee and perlon roller to achieve uniform distribution avoiding puddles.

Immediately apply the Monarplan GF Fleeceback membrane into the adhesive by unrolling, ensuring no wrinkles or air pockets are present. Once applied, roller the surface of the membrane using a weighted roller to encourage adhesion. Repeat the rolling process at 15 minute intervals until 45 minutes have elapsed to ensure a complete bond has been achieved.

**Icopal Xtra-Seal Membrane Spray Adhesive**

Alternatively, Xtra-Seal Membrane Spray Adhesive may be used with the fleecebacked membrane. Xtra-Seal Membrane Spray Adhesive is designed to be applied to both surfaces to be joined.

Spray an even coat of adhesive to cover 80% to 100% of the surfaces. Do not wet the surface. Allow to dry for approximately 3 to 5 minutes, until it is tacky. For porous surfaces, it is recommended to apply a second coat after the first has become tacky.

Present the two coated surfaces together and apply uniform pressure for maximum adhesion, ensuring no air pockets beneath the surface. Full adhesion will be reached in 24 hours.

Please note: adhesive and substrate should be at 60 °F (15 °C) or higher for best results. Also, ensure that surfaces are dry and free from dirt, grease, oils and any other solvents.
Non-Fleeceback Membranes

Membrane Used: Monarplan FM
Monarplan G

Icopal FPO Contact Adhesive
The Monarplan FM and Monarplan G reinforced membranes can be adhered using Monarplan Contact Adhesive.

Monarplan Contact Adhesive is a solvent based adhesive.

This method is typically employed at details such as upstands, rooflights, etc.

The surface, on or against which adhesive is to be applied, shall be clean, smooth, dry, free of fins, sharp edges, loose and foreign materials, oil and grease. Depressions greater than 6 mm should be feathered, using epoxy, mortar or other approved patching material. All sharp projections should be removed by sweeping, blowing or vacuum cleaning.

After thorough stirring (minimum 5 minutes), apply Monarplan Contact Adhesive to both substrate and membrane using a 25mm medium nap roller. Application shall be continuous and uniform avoiding globs or puddles.

An open time of 5 to 50 minutes, based on drying conditions is recommended before assembly. Monarplan Contact Adhesive must be allowed to dry until it does not string or stick to a dry finger touch.

Any coated area which has been exposed to rain should be allowed to dry and then recoated. Do not apply adhesive to areas to be hot air welded.

Roll the membrane onto the adhesive coated substrate while avoiding wrinkles. Immediately brush down the bonded portion of the sheet with a soft bristle push broom or a clean dry roller applicator to achieve maximum contact, without air pockets or wrinkles.

Note: The Monarplan FM and Monarplan G membranes are not suitable to be adhered using the Icopal Xtra-Seal Membrane Spray Adhesive.
Side Laps
Monarplan GF Membranes are manufactured with a 75mm fleece free selvage. Position the adjoining sheet allowing for a 50mm side lap bond in place as above. The weld must have a compulsory minimum width of 40mm.

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
At end laps, or where there is no fleece free selvedge (thus a hot-air weld cannot be made) the membranes should be butt jointed.

Overlay the butt joint with a 150mm strip of Monarplan Reinforced Strip membrane centred over the joint and fully weld along both edges. End laps should wherever possible be staggered to the adjacent sheet.

The weld must be a compulsory minimum width of 40mm. Checking the seams is a compulsory action at the end of any area of work. The welded seams are to then be allowed to cool down to ambient temperature before probing.
**Roof Edges / Drips / Trims**

Whenever possible, external roof edges shall be constructed using Monarplan Coated Metal.

1. Monarplan GF Fleeceback membrane.
2. Insulation Board.
3. Vapour Control Layer.
4. Hot-air weld, min 40mm
5. Monarplan Coated Metal.
6. Icopal Fleeceback Adhesive
7. Substrate.

Separate lengths of the Monarplan Coated Metal drip trim are butt jointed. The sheets should be fastened with two rows of fasteners, typically screws, at 150mm staggered centres. A 5 mm gap should be left to allow for expansion of the metal.

The joints should then be taped with a 50mm wide duct or crepe tape.

The joint should then be strapped with 150mm wide Monarplan D Unreinforced Flashing, hot-air welded to the coated metal with a 40mm weld. The edge of the coated metal and field sheet should then be strapped with Monarplan Reinforced Strip and hot-air welded with a min 40mm weld to finish the seal.

Depending on the construction detail, the edge of the roof should be made air-tight. A strip of Monobond LT or other suitable sealant should be installed along the edge beneath the coated metal. If a compatible vapour control layer is specified, then the vcl can dress up onto the timber edge batten, and again, be terminated with a strip of sealant. Consult Icopal’s standard drawings for further information.
General Information
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 Monarplan PVC system (see below).

Acceptable Substrates

The Monarplan PVC 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 Monarplan PVC Roofing System:

Profiled metal
Minimum 0.7mm galvanised steel to BS EN 10147: 2000. The profiled deck must be overboarded to support the Monarplan PVC 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.

Aluminium decks shall be a minimum 0.9mm BS EN 485-2: 1995 AA3004 H34. Reference should also be made to BS EN 1396: 1997 as appropriate. For mechanically fastened systems, refer to Icopal’s Technical Department for confirmation of suitability of fastener.

Plywood or Oriented Strand Board
New 18mm exterior grade plywood (to BS EN 636-2003: Clause 8) or OSB/3 (to BS EN 300:1997) fixed in accordance with the current revision of BS 8217 & BS 6229 ensuring it is of adequate rigidity for the joist spans involved and fixed with corrosion resistant ring shanked nails or screws at 150mm centres to the perimeter of the panels and 300mm along the intermediate supports. Fixings should be well driven to avoid damage to the membrane.

Timber Boarding
New timber boarded roof deck in accordance with the current revision of BS 8217, BS 6229 & BS 5268-2. Boarding should not be less than 25mm nominal thickness, planed and clamped together with tongued and grooved joints or closely butted and secured by ring shanked nails or screws at a rate of 2 per board width at both ends and at every intermediate support. Fixings should be well driven to avoid damage to the membrane.

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

Structural Concrete:
The reinforced concrete roof slab surface should be finished to provide an even surface free from ridges and hollows. New in-situ cast concrete should be given adequate time to dry out, prior to installing the waterproofing system.
**Other Substrates:**
Sprayed in-situ urethane foam – **Not Acceptable**
Stramit / Straw Board – **Not Acceptable**
Chipboard - Refer to Icopal’s Technical Department
Woodwool - Refer to Icopal’s Technical Department

Stramit, Chipboard and Woodwool substrates are regarded as a fragile material under the guidance in document "HSG33: Health and safety in roof work" published by the Health & Safety Executive. Works on roofs with such substrates as decks need a careful risk assessment agreed before commencement. It is recommended that these deck types are replaced with a more structurally sound material.

It is recommended that all decks in a warm roof construction be sealed prior to installing the roofing system to prevent air infiltration beneath the membrane. Sealing the deck is accomplished by installing a vapour control layer over the deck and sealing around all perimeters and penetrations.

**Fastener Withdrawal Resistance Criteria**

Fastener withdrawal resistance tests are recommended on certain refurbishment projects to determine the suitability of the roof deck. The withdrawal resistance test may be conducted by an independent laboratory or the fastener manufacturer or their designated representative. The results of the pullout tests must be designated on a roof plan to indicate the areas at which the tests were conducted and forwarded to Icopal Limited for review.

On refurbishment projects, a core cutter should be used to remove existing roofing material prior to conducting the withdrawal resistance test (even if the existing roofing membrane is specified to remain). Existing roofing materials will contribute to a higher, misleading pullout value.

The withdrawal resistance tests should be carried out in various locations of the roof deck, such as:
- at roof corners;
- at perimeter areas (minimum of 3 each);
- in field of the roof (with at least 2 tests conducted at the low areas of the roof deck).
Resistance to Wind Load

The affect of wind upon a single ply roof covering should be determined at an early stage. Wind loads are determined by completion of a calculation as recommended in BS EN 1991: Parts 1-4. The calculation will take the following factors into account:

- Geographical Location (eg, coastal, urban, rural)
- Site topography
- Building height
- Building design
- Large openings
- Method of attachment

This calculation must be carried out early on in the design process and is generally done following receipt of the preliminary Project Registration Form.

Completion of the membrane wind uplift calculation will confirm the fasteners centres / spacings for the following roof zones:
- Corners / Perimeter
- Field Area or central zone

The calculation will give the appropriate fastening centres for each of these zones. It will also confirm the width of the perimeter zone.

Regardless of the type of membrane attachment, mechanical fasteners are always required at the roof perimeter, angle changes and any roof details. This ensures that any tension generated in the field membrane is not transferred to other areas.

In warm roofs, the insulation boards may also be mechanically attached. This should always be kept separate from the attachment of the waterproofing membrane.

Icopal recommends that Thermazone Insulation boards be secured at a rate of 11 fasteners per 2400 x 1200mm board (3.8 fixings/m²).

For further clarification on the mechanical attachment of insulation boards refer to the SPRA Design Guide for Single Ply Roofing and BRUFMA. Where alternative insulation boards are used refer to manufacturer’s recommendations.
Other manufacturers’ products

The use of other manufacturers’ materials and accessories which become an integral part of the waterproofing system shall be avoided. As an exception to this rule Icopal can individually approve other materials for a single project.

Examples:
- Rainwater outlets
- Ready-made accessories
- Adhesives

This clause also refers to membranes and fleeces which are attached to the Monarplan PVC roofing membranes by bonding or weight of ballast or roof plant.

Examples:
- Walkway sheets or pads,
- Anti-slip sheets, protection mats placed beneath roof plant & equipment, mats of granulated rubber or other anti-vibration materials.

Prior to installation, the chemical compatibility must be proven and the product must be approved by Icopal Limited or supplied by them.

Products not supplied by Icopal are excluded from any Icopal issued warranty or guarantee.
System Components

Vapour Control Layers

The presence of a vapour control layer helps to maintain the airtightness of the roof. Part L of the building regulations stipulates that compliance is achieved where a permeability to air figure not exceeding 10m²/h/m² at 50Pa.

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.

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

Polyethylene Membranes

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 Icopal Technical Services.

Installation of Loose Laid Polyethylene Membranes

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.

Bituminous Membranes

Icopal heat-activated self-adhesive vapour control layers are manufactured from SBS-modified bitumen and reinforced with an extra strong glass fibre fleece with a PET aluminium foil.

Micoral SK has a blue SYNTAN resin upper surface allowing the appropriate insulation board to be adhered using Icopal Insulation Adhesive.

Micoral NB is finished with a polyethylene film, and is suitable for use in mechanically fastened applications only.

These membranes are suitable for direct use on metal, timber and concrete deck types only.

Also available are Total Torch VCL, and Micotherm SK. Please see individual product literature for further information.

Since these membranes are adhered, they can provide a weatherproof temporary finish to the roof structure prior to the application of the insulation and final waterproofing system.

Installation of Self-Adhesive/Heat-Activated Membranes

Prepare substrate surface using Xtra-Seal SF Primer. Install Micoral SK layer ensuring minimum 100mm overlaps.

Where external temperatures dictate (ie. cold temperatures) the use of a gas torch may be required to facilitate adhesion by gently warming the underside of the membrane during application. Seal all laps and turn the vapour control layer up all upstands, kerbs and penetrations etc while making consideration to the compatibility of the membranes with each other.
**Insulation**

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 acceptable 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 and Levelling Layers**

In many roof applications, the roofing membrane has to be separated from other incompatible elements or protected against mechanical damage. In some cases free movement between layers has to be allowed for (in-situ [reinforced] concrete or ceramic tiles in mortar bed). 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-woven's made of polyester, polypropylene (PP) or a mix of PES and PP can function as separation layers. Polyester shall not be used when an alkaline environment is likely (eg. freshly poured concrete or concrete washed out).

**Protection layers**

Protection layers are required for the mechanical protection of the roofing sheet prior to the application of roof ballast or green roofs.

A polyester geotextile (eg. SLP 300 Protection Fleece) approximately 300 g/m² will protect the Monarplan PVC membrane whilst also acting as a filtration layer. Overlaps shall be with the fall of the roof and in excess of 200mm.

**Levelling layers**

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

The geotextiles shall have a minimum weight of 200 g/m² depending on the actual situation on the roof (eg. SLP 300 Protection Fleece). A sufficient resistance against perforation and compression is required.
Completion

Quality Assurance

Please note; the validity and the extent of the Icopal warranty will only apply where Monarplan PVC membranes and accessories (or products made by others approved by Icopal prior to commencement of works) have been used. Any alterations to agreed system specifications shall render any warranty offer null and void.

Furthermore, should the Monarplan PVC system fail to be installed in accordance with the current guidelines (unless otherwise agreed), the warranty offer shall be rendered null and void.

For Icopal 'Insured System Plus' guarantees installation shall be by an Icopal Monarplan PVC approved contractor.

The roof will be inspected by an Icopal representative during works and then on completion of the project.
Sufficient notification to the Icopal representative should be given.

Integrity Testing

Upon completion of the Monarplan PVC single ply roof, it is the contractor’s responsibility to carry out an independent non-destructive integrity test to ensure the roof membrane is 100% watertight. Further information concerning such tests can be found in SPRA Guidance Document 09 - Non-Destructive Testing of Single Ply Membrane Roof Coverings.

If, the independent report shows failure points, these should be repaired, and the roof retested.

The independent third-party report showing that the system is 100% watertight should be forwarded to Icopal Limited when requesting an Icopal warranty.
**Maintenance**

The following care and maintenance requirements are for Monarplan PVC membrane roofing systems. Icopal recommend that maintenance staff and/or maintenance contractor inspect the roof periodically or at least twice a year (as per the recommendations given in Annex B BS 6229: 2003) ideally before and after the winter period. This ensures that dirt and debris is removed before it can cause damage and that signs of any failure can be reported and remedial action taken at an early stage. Maintenance items, including flashings and sealants, are the responsibility of the building owner and are not included within the scope of the Icopal Roofing System Warranty.

<table>
<thead>
<tr>
<th>Item</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internally</td>
<td>Check internal surfaces visually for signs of moisture, leakage or condensation (e.g. damp patches, staining etc)</td>
</tr>
<tr>
<td>General</td>
<td>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.</td>
</tr>
<tr>
<td>Drainage</td>
<td>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.</td>
</tr>
<tr>
<td>Laps</td>
<td>Visually check the membrane laps for securement.</td>
</tr>
<tr>
<td>Petroleum Products</td>
<td>Keep all petroleum products (solvents, greases, paints, oils, or any liquids containing petroleum products) off the membrane to avoid degradation.</td>
</tr>
<tr>
<td>Animal Fats</td>
<td>Do not exhaust kitchen wastes (vegetable oils) or other animal fats directly onto the roof surface. They could degrade the membrane.</td>
</tr>
<tr>
<td>Chemicals</td>
<td>Contact Icopal if any chemicals come in contact with the roofing membrane. Some chemicals could degrade the membrane or cause swelling.</td>
</tr>
<tr>
<td>Foot Traffic</td>
<td>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.</td>
</tr>
<tr>
<td>Roof Alterations</td>
<td>Check with Icopal 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 &amp; ventilation equipment or telephone cables fitted.</td>
</tr>
<tr>
<td>Cleaning</td>
<td>Handprints, footprints, general traffic grime, industrial pollutants and environmental dirt may be cleaned from the surface of the membrane using regular household dish washing liquid, then rinsing with clean water. To maximize reflectivity, white membrane(s) should be cleaned once every two years.</td>
</tr>
<tr>
<td>Metal Work</td>
<td>Keep roof maintenance items, such as counterflashing, metal curbs and metal ducts sealed watertight at all times</td>
</tr>
<tr>
<td>Leaks</td>
<td>Report leaks immediately to Icopal. 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. Physical damage to the membrane or flashing is not covered by the warranty. Please notify Icopal’s Warranty Services at 0161 865 4444 if the leak is determined to be membrane related. The building owner is liable to the cost of investigation and repair if the problem is found to be outside the scope of the waterproofing warranty.</td>
</tr>
<tr>
<td>Temporary Repairs</td>
<td>Use a good grade sealant to make temporary repairs. Notify Icopal of this action in writing.</td>
</tr>
<tr>
<td>Rooftop Maintenance</td>
<td>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.</td>
</tr>
<tr>
<td>Roof Cement</td>
<td><strong>DO NOT USE ROOF CEMENT</strong> to repair or install membrane. Roof cement contains petroleum products, which may degrade the membrane.</td>
</tr>
</tbody>
</table>

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 refrigerant leaks, chemical spills from any roof plant machinery, 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. Failure to adequately maintain the roof may invalidate any Icopal warranty.
Appendix

Product Range Overview
The Monarplan PVC range has been designed to ensure total compatibility and ease of application playing a vital role in achieving the total integrity of the waterproofing system. Separate technical data sheets on all products are available upon request.

Monarplan PVC Membranes

<table>
<thead>
<tr>
<th>Product</th>
<th>Thickness</th>
<th>Roll Size</th>
<th>Colour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monarplan GF Fleeceback</td>
<td>1.5 mm + fleece</td>
<td>2.12 x 15 m</td>
<td>Light Grey &amp; Anthracite</td>
</tr>
<tr>
<td>Monarplan G</td>
<td>1.5 mm</td>
<td>2.12 x 15 m</td>
<td>Light Grey &amp; Anthracite</td>
</tr>
<tr>
<td>Monarplan FM 1.2</td>
<td>1.2 mm</td>
<td>1.5 x 20 m</td>
<td>Light Grey &amp; Anthracite</td>
</tr>
<tr>
<td>Monarplan FM 1.5</td>
<td>1.5 mm</td>
<td>1.5 x 20 m</td>
<td>Light Grey &amp; Anthracite</td>
</tr>
<tr>
<td>Monarplan FM 1.8</td>
<td>1.8 mm</td>
<td>1.5 x 20 m</td>
<td>Light Grey &amp; Anthracite</td>
</tr>
</tbody>
</table>

Monarplan Ancillaries

<table>
<thead>
<tr>
<th>Product</th>
<th>Thickness</th>
<th>Roll Size</th>
<th>Colour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Membrane Ancillaries</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monarplan Reinforced Strip</td>
<td>1.5 mm</td>
<td>0.15 x 15 m</td>
<td>Light Grey &amp; Anthracite</td>
</tr>
<tr>
<td>Monarplan D Unreinforced Flashing</td>
<td>1.5 mm</td>
<td>1.4 x 15 m</td>
<td>Light Grey &amp; Anthracite</td>
</tr>
<tr>
<td>Monarplan W Walkway Membrane</td>
<td>2.0 mm</td>
<td>1.06 x 15 m</td>
<td>Anthracite</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Product</th>
<th>Thickness</th>
<th>Size</th>
<th>Colour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-fabricated Corners</td>
<td></td>
<td>each</td>
<td>Light Grey &amp; Anthracite</td>
</tr>
<tr>
<td>Monarplan Internal Corners</td>
<td></td>
<td>each</td>
<td>Light Grey &amp; Anthracite</td>
</tr>
<tr>
<td>Monarplan External Corners</td>
<td></td>
<td>each</td>
<td>Light Grey &amp; Anthracite</td>
</tr>
<tr>
<td>Coated Metal / Standing Seam / Lightning Conductor Clips</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monarplan Coated Metal</td>
<td>1.2 mm</td>
<td>1 x 2 m</td>
<td>Light Grey &amp; Anthracite</td>
</tr>
<tr>
<td>Monarplan PVC Standing Seam</td>
<td></td>
<td>25 mm x 3 m</td>
<td>Light Grey &amp; Anthracite</td>
</tr>
<tr>
<td>Monarplan Lightning Conductor Clips</td>
<td></td>
<td>3mm &amp; 5mm</td>
<td>Light Grey</td>
</tr>
<tr>
<td>Outlets</td>
<td></td>
<td>Ø 50 / 70 / 80 / 100 / 125 / 150 mm</td>
<td>Light Grey</td>
</tr>
<tr>
<td>Monarplan Refurbishment Outlets</td>
<td></td>
<td>Ø 50 / 70 / 80 / 100 / 125 / 150 mm</td>
<td>Light Grey</td>
</tr>
<tr>
<td>Monarplan Universal Leaf Grate</td>
<td></td>
<td></td>
<td>Black</td>
</tr>
<tr>
<td>Monarplan Parapet Outlet</td>
<td></td>
<td>100 mm</td>
<td>Light Grey</td>
</tr>
<tr>
<td>Roofgard Parapet Leaf Grate</td>
<td></td>
<td></td>
<td>Stainless Steel</td>
</tr>
<tr>
<td>Pipe Boots / Vents / Tube Ducts</td>
<td></td>
<td>Ø 24 mm</td>
<td>Light Grey</td>
</tr>
<tr>
<td>Monarplan Single Cable Duct</td>
<td></td>
<td>Ø 100 mm</td>
<td>Light Grey</td>
</tr>
<tr>
<td>Monarplan Multiple Cable Duct</td>
<td></td>
<td>Ø 130/90 mm</td>
<td>Light Grey</td>
</tr>
<tr>
<td>Monarplan Cowled Telescopic Vent</td>
<td></td>
<td>Ø 75 – 125 mm</td>
<td>Light Grey &amp; Anthracite</td>
</tr>
<tr>
<td>Adhesives/Sealants</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monarplan Contact Adhesive</td>
<td></td>
<td>20 kg</td>
<td>Red</td>
</tr>
<tr>
<td>Icopal Single-Ply Fleeceback Adhesive</td>
<td></td>
<td>20 kg</td>
<td>Blue/Green</td>
</tr>
<tr>
<td>Monarplan Mastic</td>
<td></td>
<td>290 ml</td>
<td>White</td>
</tr>
</tbody>
</table>
Icopal Fasteners
Icopal supply a range of specialist fasteners for securing thermal insulation and Monarplan PVC membranes to a variety of structural roof decks including steel, concrete and timber.

<table>
<thead>
<tr>
<th>Product</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tube Washers / Pressure Plates / Fixing Bars</td>
<td></td>
</tr>
<tr>
<td>Icopal Membrane Tube Washer (Ø = 45mm)</td>
<td>40 / 60 / 80 / 90 / 100 / 120 / 150 / 180 / 210 mm</td>
</tr>
<tr>
<td>Icopal Insulation Tube Washer (Ø = 75mm)</td>
<td>40 / 60 / 80 / 90 / 100 / 120 / 150 / 180 / 210 mm</td>
</tr>
<tr>
<td>Pressure Plates</td>
<td></td>
</tr>
<tr>
<td>Icopal Flat Steel Pressure Plate (rigid substrates)</td>
<td>82 x 40 mm</td>
</tr>
<tr>
<td>Icopal Deep-Dish Steel Pressure Plate (compressible substrates)</td>
<td>82 x 40 mm</td>
</tr>
<tr>
<td>Fasteners</td>
<td></td>
</tr>
<tr>
<td>Icopal 5.8mm Carbon Steel Fasteners (into timber &amp; metal decks)</td>
<td>40 / 55 / 65 / 75 / 85 / 95 / 105 / 115 / 125 / 150 / 175 / 200 mm</td>
</tr>
<tr>
<td>Icopal HD 6.1mm Carbon Steel Fastener (into concrete decks)</td>
<td>32 / 50 / 75 / 85 / 100 / 125 / 150 / 175 / 200 mm</td>
</tr>
<tr>
<td>Fixing Bars</td>
<td></td>
</tr>
<tr>
<td>Icopal Galvanised Fixing Bar (Peel Stops)</td>
<td>3m x 25 mm</td>
</tr>
<tr>
<td>Icopal Termination Bar</td>
<td>3m x 25 mm</td>
</tr>
</tbody>
</table>

Thermal Insulation

<table>
<thead>
<tr>
<th>Product</th>
<th>Thickness</th>
<th>Board Size</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>PIR Insulation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thermazone Foilboard</td>
<td>30 / 35 / 40 / 50 / 60 / 70 / 80 / 90 / 100 / 110 / 120 mm</td>
<td>1200 x 2400 mm</td>
<td>Mechanically Fixed</td>
</tr>
<tr>
<td>Thermazone Roofboard</td>
<td>30 / 35 / 40 / 50 / 60 / 70 / 80 / 90 / 100 / 110 / 120 mm</td>
<td>1200 x 2400 mm</td>
<td>Mechanically Fixed &amp; Fully Adhered</td>
</tr>
<tr>
<td>EPS Insulation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thermazone Hydroshield IVR*</td>
<td>120 / 150 / 160 / 170 / 180 / 205 / 220 / 240 / 260 / 320 mm</td>
<td>1200 x 590 mm</td>
<td>Inverted Roofs</td>
</tr>
</tbody>
</table>

* Thermazone Hydroshield IVR to be used in conjunction with Monarperm water reducing layer.

Vapour Control Layers

<table>
<thead>
<tr>
<th>Product</th>
<th>Thickness</th>
<th>Roll Size</th>
<th>Method of Attachment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reinforced Polyethylene</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Netofol</td>
<td>0.2 mm</td>
<td>2 x 50 m</td>
<td>Loose-laid &amp; Mechanically Fixed</td>
</tr>
<tr>
<td>Monofilament 250</td>
<td>0.25 mm</td>
<td>2 x 50 m; 4 x 50 m</td>
<td>Loose-laid &amp; Mechanically Fixed</td>
</tr>
<tr>
<td>Reflex 275</td>
<td>0.275 mm</td>
<td>2 x 25 m</td>
<td>Loose-laid &amp; Mechanically Fixed</td>
</tr>
<tr>
<td>Reinforced Bitumen Membranes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Micoral SK</td>
<td>1.5 mm</td>
<td>1 x 15 m</td>
<td>Heat-activated/ Self-adhesive</td>
</tr>
<tr>
<td>Micoral NB</td>
<td>0.25 mm</td>
<td>1.08 x 50 m</td>
<td>Heat-activated/ Self-adhesive</td>
</tr>
<tr>
<td>Micotherm SK</td>
<td>3.0 mm</td>
<td>1 x 7.5 m</td>
<td>Heat-activated / Torch-activated stripes</td>
</tr>
<tr>
<td>Total Torch VCL</td>
<td>3.5 mm</td>
<td>1 x 7.5 m</td>
<td>Torch-applied</td>
</tr>
<tr>
<td>Vapourbar</td>
<td>1.8 mm</td>
<td>1 x 20 m</td>
<td>Bonding Bitumen (Pour &amp; Roll)</td>
</tr>
</tbody>
</table>
NOTE: This information is given in good faith being based on the latest knowledge known to Icopal Limited. Whilst every effort has been made to ensure the contents of the publication are current while going to press, 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 our Technical Services Department on request.

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All products are sold subject to our standard conditions of sale, available on request.

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