

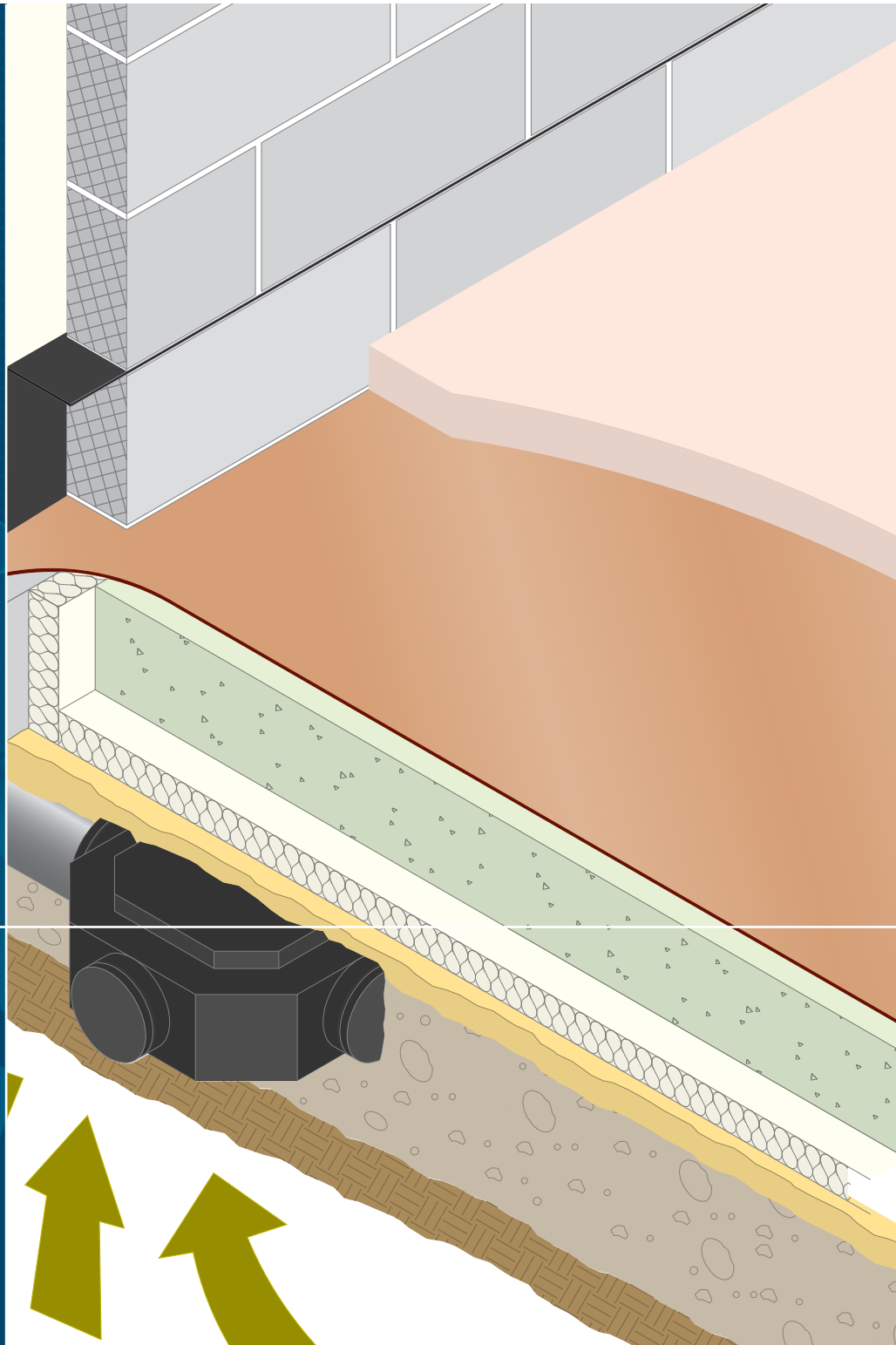
# Monarflex Radon Control Systems

**Anderson  
Monarflex**



CI/SfB June 2007  
| (13.9) Ln6 | L2 |

Provides effective,  
long-term  
protection from  
radon gas



A range of high performance protection systems  
designed to meet todays exacting standards

# The Problem of Radon Gas



This brochure describes the use of Icopal's Monarflex Radon Control Systems to protect building occupants from the harmful effect of radon gas. Icopal is a world leader in building protection offering the UK's most complete range of construction membranes.

## The Threat of Radon Gas

Radon is a naturally occurring radioactive gas, produced as uranium decays to lead. Where Radon rises outside buildings it disperses harmlessly, however, harmful radon concentrations can occur where the gas rises within buildings.

Prolonged exposure to radon can cause health problems. Approximately 2,500 deaths per year are attributed to lung cancer resulting from radon inhalation. Exposure to radon is the biggest single cause of radiation exposure to the population of the UK.

Radon concentrations occur in buildings because temperature differentials and air movement will tend to produce lower internal air pressure which will draw the gas into the building through small gaps and cracks in the fabric (see Figure 1).

Radon concentration is measured in Becquerels ( $Bq\ m^3$ ). In most homes the average level of radon is  $20\ Bq\ m^3$ . However, where levels exceed  $200\ Bq\ m^3$  - the National Radiological Protection Board action level - building owners should take measures to reduce radon concentrations to the lowest practicable levels.

## Maps

Radon levels, and therefore internal radon concentrations, vary across the UK. The map on this page produced by the National Radiological Protection Board (NRPB) indicates the percentage of homes above the Action Level. New houses within those affected areas must incorporate radon protection measures.

## National Radiological Protection Board (NRPB)

Source: NRPB

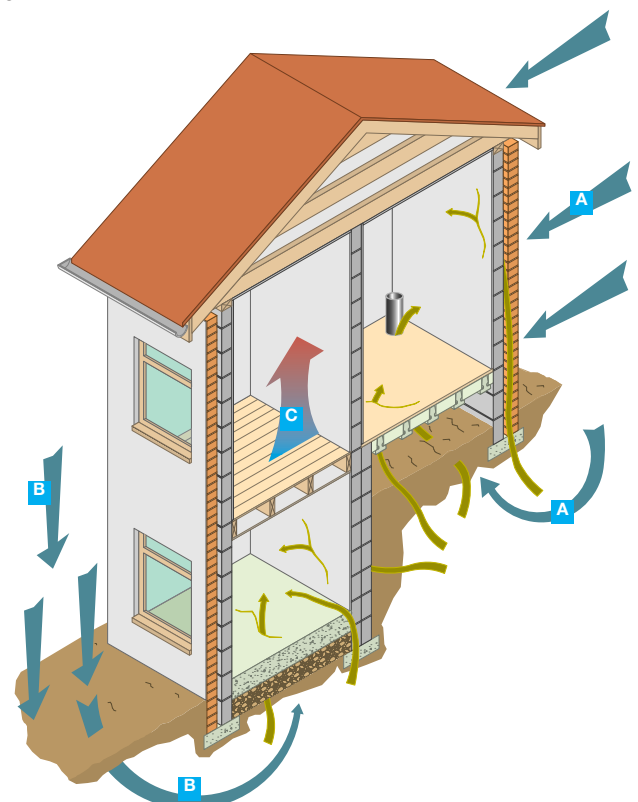
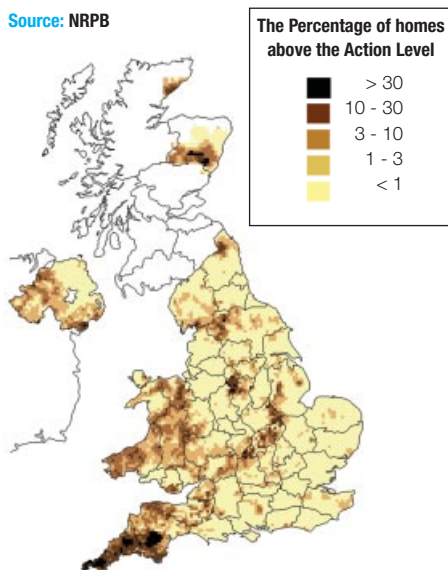


Figure 1

Radon gas drawn into buildings by:

- A** Air movement
- B** Internal/external pressure differences
- C** Stack effect

# Monarflex Radon Control Systems

## Radon Protection Requirements

There are two levels of Radon Protection; Basic Protection and Full Protection.

**Basic Protection:** consists of a continuous Radon barrier across the whole footprint of the building, including the external walls.

**Full Protection:** consists of a continuous Radon barrier across the whole footprint of the building, including the external walls plus provision for sub-floor ventilation (i.e. a Radon sump with pipework going to a convenient external wall for possible connection to an extract fan should levels of Radon exceed 200 Bq m<sup>3</sup>. In the case of suspended concrete or beam and block floor where full protection is required, air bricks should be fitted around the perimeter of the building at 2m centres and no more than 1.4m from the corners. The sub-floor ventilation is used in conjunction with the continuous membrane installed across the footprint of the building.

## Monarflex Radon Protection Systems from Icopal

Monarflex Radon Protection Systems have been developed to provide a flexible solution for radon protection in dwellings, schools and other buildings. The systems are suitable for both basic and full protection and are based around two high performance Radon Protection Barriers; Monarflex Reflex Super and Monarflex RMB 400.

## Radon Protection Barriers

**Monarflex Reflex Super:** a five layer high performance membrane formed of aluminium foil and a polyester reinforcing grid sealed between layers of virgin LDPE.

Use Reflex Super for medium to high Radon concentrations.

**Monarflex RMB 400:** a three layer membrane formed from two layers of low density, virgin polyethylene with a polyester reinforcing grid between to give high strength and tear resistance.

Use RMB 400 for low to medium Radon concentrations.

**Xtra-Shield GRM:** a self adhesive Radon barrier.

**Xtra-Shield Alugram:** a bitumen membrane with a sand finish for pour & roll applications.

**Alumite DPC/Cavity tray:** gas resisting DPC for preventing radon penetration of cavity walls. Use in conjunction with preformed internal and external corners.

## Radon Sumps

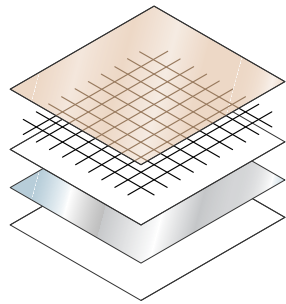
**Monarflex Easi-Sump®:** preformed, open base, polyethylene sump.

**Monarflex Easi-Sump® Cap-Link®:** external termination cap for sump system.

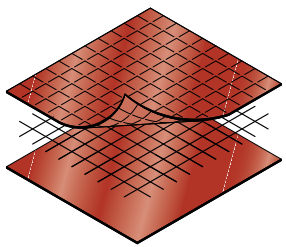
## Radon Accessories

**Monarflex Top Hats:** preformed top hats for sealing services which penetrate a Radon barrier.

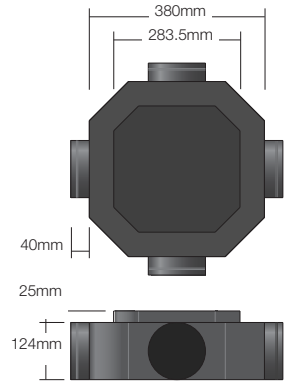
**Monarflex Monobond LT:** 30mm wide, low temperature, flexible, double-sided sealant tape for sealing joints in the membranes.



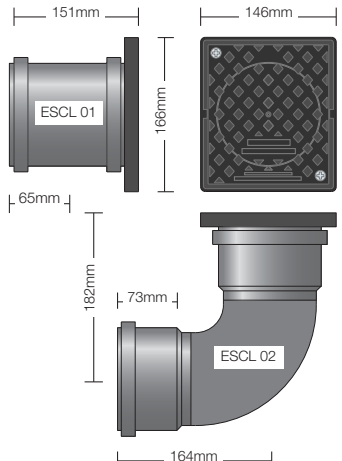
Monarflex Reflex Super



Monarflex RMB 400



Monarflex Easi-Sump®



Monarflex Easi-Sump® Cap-Link®

# Installation of Monarflex Radon Protection Barriers



## Requirements

Building Regulation C2 (G in Scotland) requires occupants of buildings to be protected from the effects of gaseous contamination in the ground. The installation of a Monarflex Radon Control System will enable designers to meet that requirement.

## Preparatory work

Before specifying a Monarflex Radon Control System the likely risk of harmful concentrations of radon should be determined. The Local Authority Building Control Department should be consulted if uncertain.

## Groundbearing floors

In floors formed with groundbearing concrete slabs the gas resistant membrane may be laid over or under the slab.

**Figure 2:** Where the membrane is sited under the slab it should be laid onto a gas permeable layer such as hardcore blinded with sand.

**Figure 3:** Where the membrane is installed over the slab the upper surface should be free from projections which might damage the membrane. The membrane should then be covered by a screed or flooring.

Monarflex Radon Protection Barriers are suitable for use as a damp proof membrane within groundbearing floors.

## Suspended Floors

**Figure 4 & 5:** For suspended floors the gas resistant membrane should be laid over the floor and covered with a screed or flooring. In a beam and block floor before the membrane is laid, the surface of the blocks should be grouted with a cement sand mortar and any projections which might damage the membrane should be removed.

## Perimeter DPC

As the Monarflex Radon Protection Barrier must cover the footprint of the building, where it penetrates an internal or external wall, Alumite DPC should be used. The details on the opposite page illustrate standard detailing practices for differing construction situations.

## Joints

To form joints between adjacent sheets of Reflex Super or RMB 400 lap the membranes by 150mm and seal with one strip of 15mm, 30mm wide Monobond LT. [\(see Figure 6\)](#)

## Penetrations

Wherever possible, services should not penetrate the gas resistant membrane. Unavoidable penetrations for service pipes and cables should be sealed with Monarflex 'top hat' sections. [\(see Figure 7\)](#)

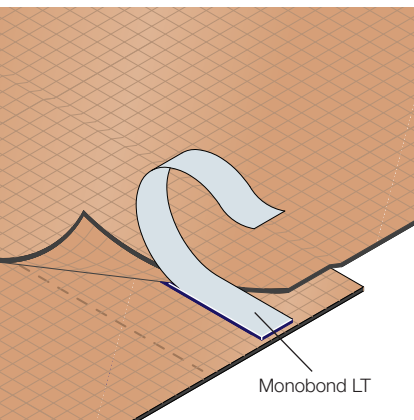
## NBS Specification Clause



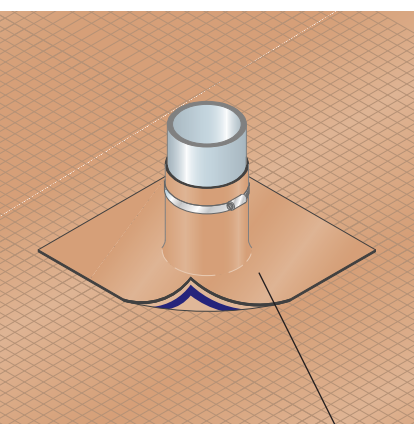
Specify Monarflex Radon Control Systems using the following NBS clauses:

- **F30/360 Gas resistant DPC's/Cavity Trays**
- **J40/115 Venting hardcore beds**
- **J40/140 Polyethylene gas retardant/damp-proof membrane**
- **P30/525 Plastic Radon sumps**

To make specification easier NBS clauses for all local products are included in the NBS PLUS section of NBS Specification writer/Specification Manager software.

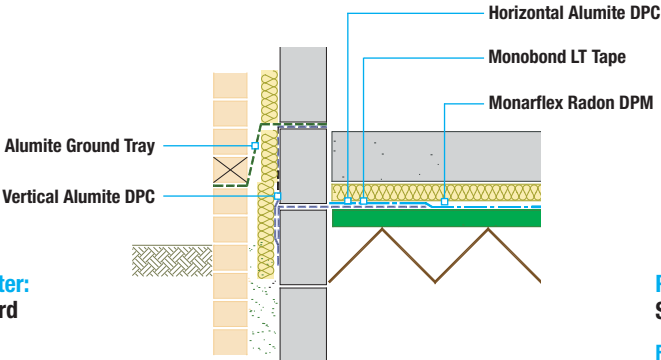


**Figure 6**

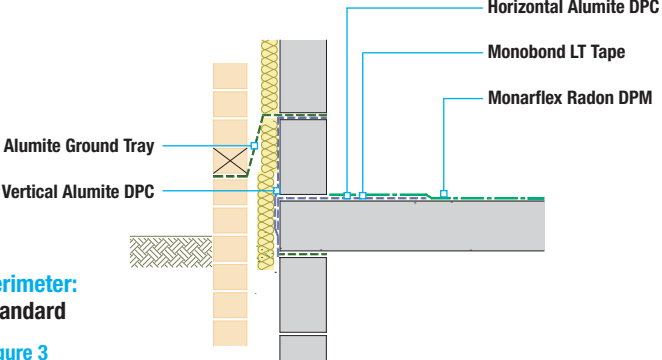


**Figure 7** Monarflex Top Hat

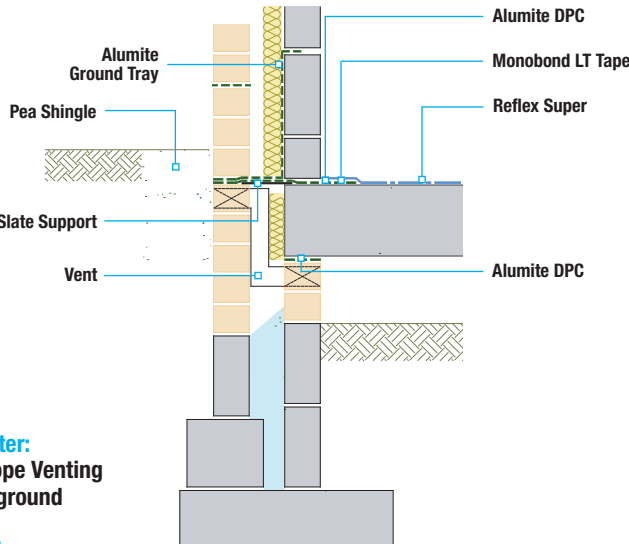
**Typical Detailing**



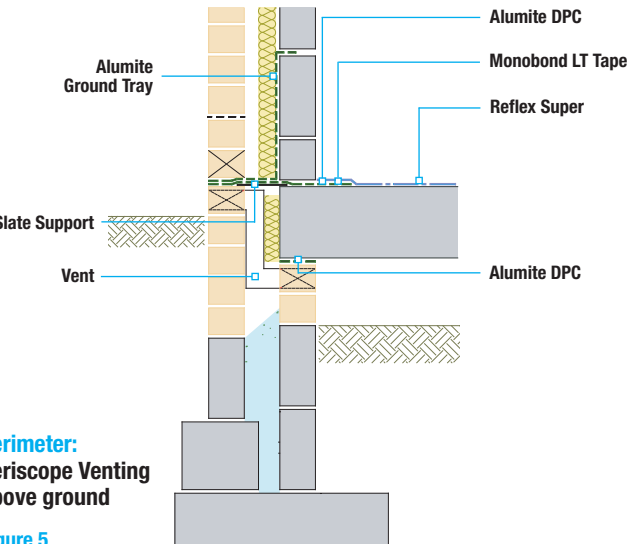
**Perimeter:  
Standard**  
Figure 2



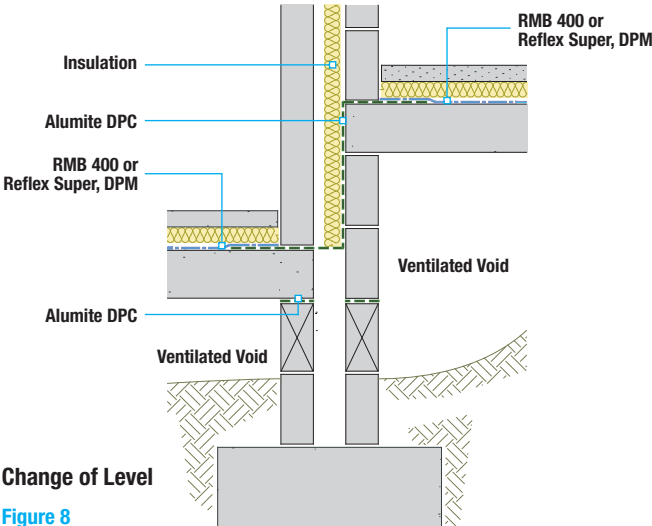
**Perimeter:  
Standard**  
Figure 3



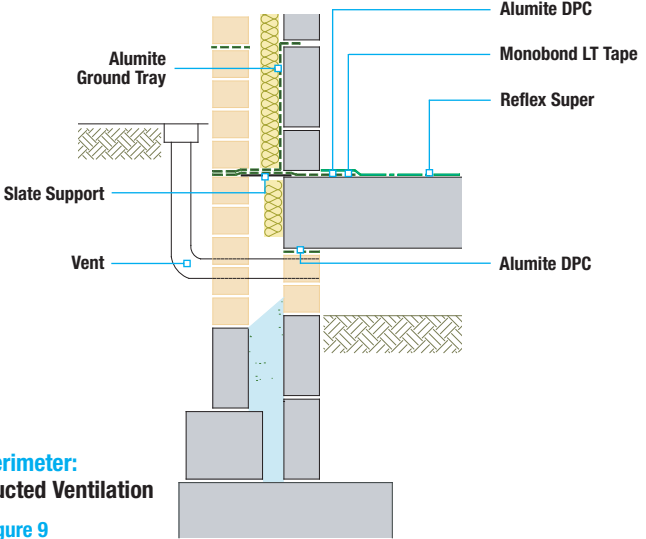
**Perimeter:  
Periscope Venting  
below ground**  
Figure 4



**Perimeter:  
Periscope Venting  
above ground**  
Figure 5



**Change of Level**  
Figure 8



**Perimeter:  
Ducted Ventilation**  
Figure 9

Free Cavity tray detailing service is available from Icopal technical services.

# Installation of Monarflex Radon Sumps



## Radon Sumps

If post completion testing shows a radon level in excess of 200 Bq m<sup>3</sup>, the system should be activated by the installation of venting pipework running from the sump and terminating above the eaves. Radon gas beneath the membrane collects in the sump and is drawn up in the pipework to discharge safely to the atmosphere. An in-line extractor fan may be required to facilitate this function.

Where the pipework rises within the building the air currents generated by the stack effect will often be sufficient to vent the sump, although in some cases a fan may be required.

Monarflex Radon Sumps are designed to be set within a gas permeable layer beneath the Monarflex Radon Barrier. One sump is sufficient to draw gas from approximately 250m<sup>2</sup>. To make activation easier the pipework from the sump can be terminated at ground level with a Monarflex Easi-Sump<sup>®</sup> Cap-Link<sup>®</sup>. (see Figure 10)

## Preparatory Work

- The Easi-Sump<sup>®</sup> Cap-Link<sup>®</sup> is the external termination cap for the sump system.
- Establish where the Easi-Sump<sup>®</sup> Cap-Link<sup>®</sup> exits the building remembering that it may be necessary to install an in-line extractor fan in the future.
- Minimum distances from window openings should be met.

## Groundbearing Slab

- Prepare a suitably sized hole in the hardcore and set the sump onto a firm level base. Backfill the hardcore around the sump.
- Connect the outlet pipe (110mm diameter) to the sump and seal where it penetrates the external wall. (see figure 11)
- Blind the hardcore and install Monarflex Radon Gas Barrier as appropriate.
- Complete the installation of the Easi-Sump<sup>®</sup> Cap Link<sup>®</sup> (If post completion tests show radon concentrations are above the action level; connect the venting pipework to the sump).

If activating a full protection system, remove the cap plate and insert the venting pipe firmly into the Easi-Sump<sup>®</sup> Cap-Link<sup>®</sup>.

## Compartments

If the subfloor includes several compartments, gaps or sections of pipe should be placed within the walls to allow depressurisation and the passage of gas to a sump or sumps. (see Figure 12)

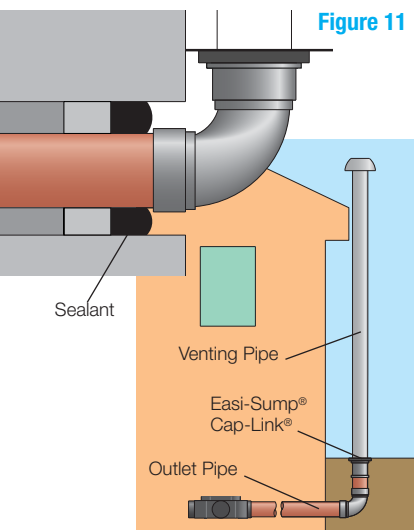


Figure 10

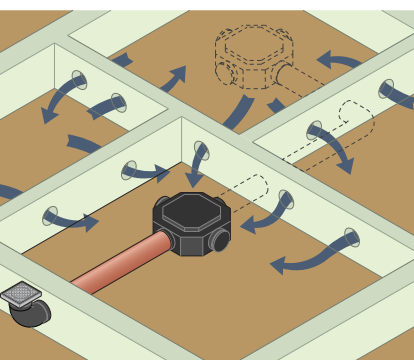
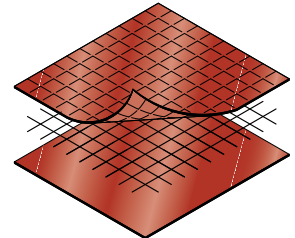


Figure 12

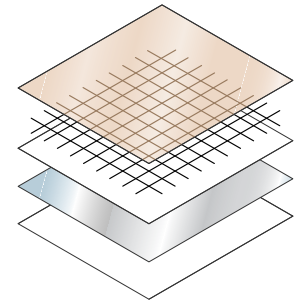




|                                       | Monarflex RMB 400 Radon Membrane   |        | Monarflex Reflex Super Radon Membrane  |        |
|---------------------------------------|--|--------|--|--------|
| <b>Composition</b>                    | 3 layer, low density polyethylene (LDPE) with a polyester reinforcing grid |        | 5 layer, LDPE with aluminium foil and polyester reinforcing grid                 |        |
| <b>Thickness</b>                      | 0.40mm   |        | 0.40mm   |        |
| <b>Colour</b>                         | Red  |        | Sand   |        |
| <b>Roll width</b>                     | 2.0m   | 4.0m   | 2.0m   | 2.0m   |
| <b>Roll length</b>                    | 25.0m  | 25.0m  | 25.0m  | 50.0m  |
| <b>Roll weight</b>                    | 20.5kg   | 41.0kg | 21.0kg   | 42.0kg |
| <b>Tensile strength</b>               | 750 N/50 mm  |        | 700 N/50 mm  |        |
| <b>Elongation</b>                     | 15-30%   |        | 15-30%   |        |
| <b>Tear strength</b>                  | > 510 N  |        | > 290 N  |        |
| <b>Water vapour transmission Rate</b> | < 0,20 g/m <sup>2</sup> /day   |        | Below limit of detection:<br>< 0,03 g/m <sup>2</sup> /day                        |        |
| <b>Radon transmittance</b>            | 13-18 x 10 <sup>-9</sup> m/s   |        | Old test < 1,05 x 10 <sup>-9</sup> m/s<br>New test is in progress                |        |
| <b>Radon permeability</b>             | 5-8 x 10 <sup>-12</sup> m <sup>2</sup> /s                                  |        | Old test < 0,33 x 10 <sup>-12</sup> m <sup>2</sup> /s<br>New test is in progress |        |

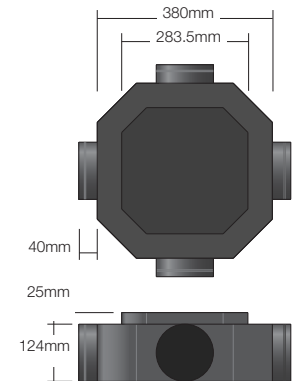


Monarflex RMB 400



Monarflex Reflex Super

|                       | Xtra-Shield GRM                          | Xtra-Shield Alugram                                 |
|-----------------------|--|---|
| <b>Composition</b>    | Self Adhesive bitumen with release sheet | Self Adhesive bitumen for Pour and Roll Application |
| <b>Roll Dimension</b> | 19.05m x 1.05m                           | 8m x 1m   |
| <b>Thickness</b>      | 1.2m                                     | 1.5m  |

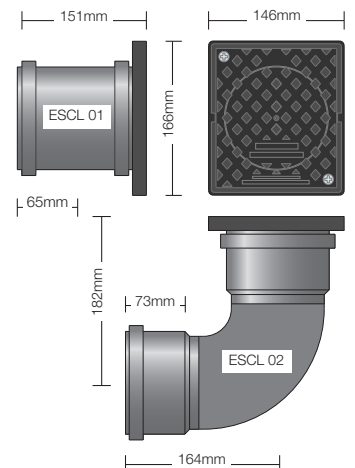


Monarflex Easi-Sump®

|                    | Monarflex Easi-Sump®        |
|--------------------|-----------------------------|
| <b>Composition</b> | Medium density polyethylene |
| <b>Colour</b>      | Black                       |
| <b>Unit weight</b> | 1.85 kg                     |



|                    | Monarflex Easi-Sump® Cap-Link®                        |
|--------------------|---|
| <b>Composition</b> | Unplasticized polyvinyl chloride with removable cover |
| <b>Colour</b>      | Black   |
| <b>Unit weight</b> | 0.61 kg (model ESCL 01)<br>0.92 kg (model ESCL 02)    |



Monarflex Easi-Sump® Cap-Link®

|                             | Alumite DPC/cavity tray                                   |
|-----------------------------|---|
| <b>Composition</b>          | Black, flexible DPC/cavity tray                           |
| <b>Thickness and length</b> | 3mm x 8m  |
| <b>Available widths</b>     | From 100mm to 1.0m in increments to suit all applications |
| <b>Pre-formed Units</b>     | All sizes available                                       |

|                    | Monarflex Monobond LT Sealant tape                                |
|--------------------|---|
| <b>Composition</b> | Non-hardening, permanently flexible, low temperature sealant tape |
| <b>Roll size</b>   | 30mm x 24m  |
| <b>Colour</b>      | Blue  |

## Icopal Ltd

Barton Dock Road  
Stretford, Manchester  
M32 0YL  
Telephone: 0161 865 4444  
Fax: 0161 864 1178  
email:  
marketing.uk@icopal.com  
[www.icopal.co.uk](http://www.icopal.co.uk)

## The Icopal range also includes:

- Flat and Pitched Roofs
- Vapour barriers
- Breather membranes
- Roof vents
- Eaves guards
- Scaffold sheeting
- Tarpaulins
- Containment membranes
- DPM's & DPC's
- Radon & methane barriers
- Acoustic flooring

Every effort has been taken in the preparation of this brochure to ensure the accuracy of representations contained herein. Recommendations as to the use of materials, construction details and methods of installation are given in good faith and relate to typical situations. However, every site has different characteristics and reliance should not be placed upon the foregoing recommendations. Advice can be given as to specific applications of the products, upon request.

## Availability

Monarflex Radon Control Systems are available from our Nationwide network of over 2,000 stockists.

## Packaging, delivery, handling and storage

Rolls of Monarflex Reflex Super and Monarflex RMB 400 are delivered to site individually shrink-wrapped and labelled: installation instructions are printed on the back of the product label.

The rolls should be stored horizontally on a clean, dry surface and protected from the weather.

Monarflex Easi-Sump® and Monarflex Easy-Sump® Cap-Link® are individually wrapped.

## Research and Development

Icopal have an on-going programme of research and product development to maintain our position at the forefront of membrane technology. The solutions we offer are the most appropriate from a performance and cost point of view.

## Quality Assurance

All Icopal products are manufactured to strict quality guidelines. As part of our commitment to the highest standard of quality and service, Icopal are registered to ISO 9001.



Certificate No. Q05556  
ISO 9001 : 2000

## References

Approved Document C.

BRE - Radon: guidance on protective measures for new dwellings.

BRE - Radon: guidance on protective measures for new dwellings in Scotland.

BRE - Protective measures for housing on gas-contaminated land.

BS8215: 1991 Code of practice for Design and installation of damp-proof courses in masonry construction.

## Technical services

Icopal technical consultants are experienced in all aspects of radon control and provide free advice on the system's specification and installation.

Our specialists help to ensure optimum solutions at the design stage and can visit site during installation to provide practical assistance in overcoming any problems.

## NBS PLUS Specification Clauses

To make specification easier, NBS specification clauses for all Icopal products are included in the NBS PLUS section of NBS Specification Writer/Specification Manager software.



## CPD

Icopal is a member of the RIBA CPD Providers Network. We are happy to provide RIBA approved CPD presentations to specifiers and designers. Please call for further details.



## RIBA Product Selector

Information on the Icopal range of products can be found in the RIBA PRODUCT SELECTOR and PRODUCT SELECTOR-plus® CD listed under the name Icopal & Monarflex.

