



NSAI
Agrément

**IRISH AGRÉMENT BOARD
CERTIFICATE No. 09/0328**

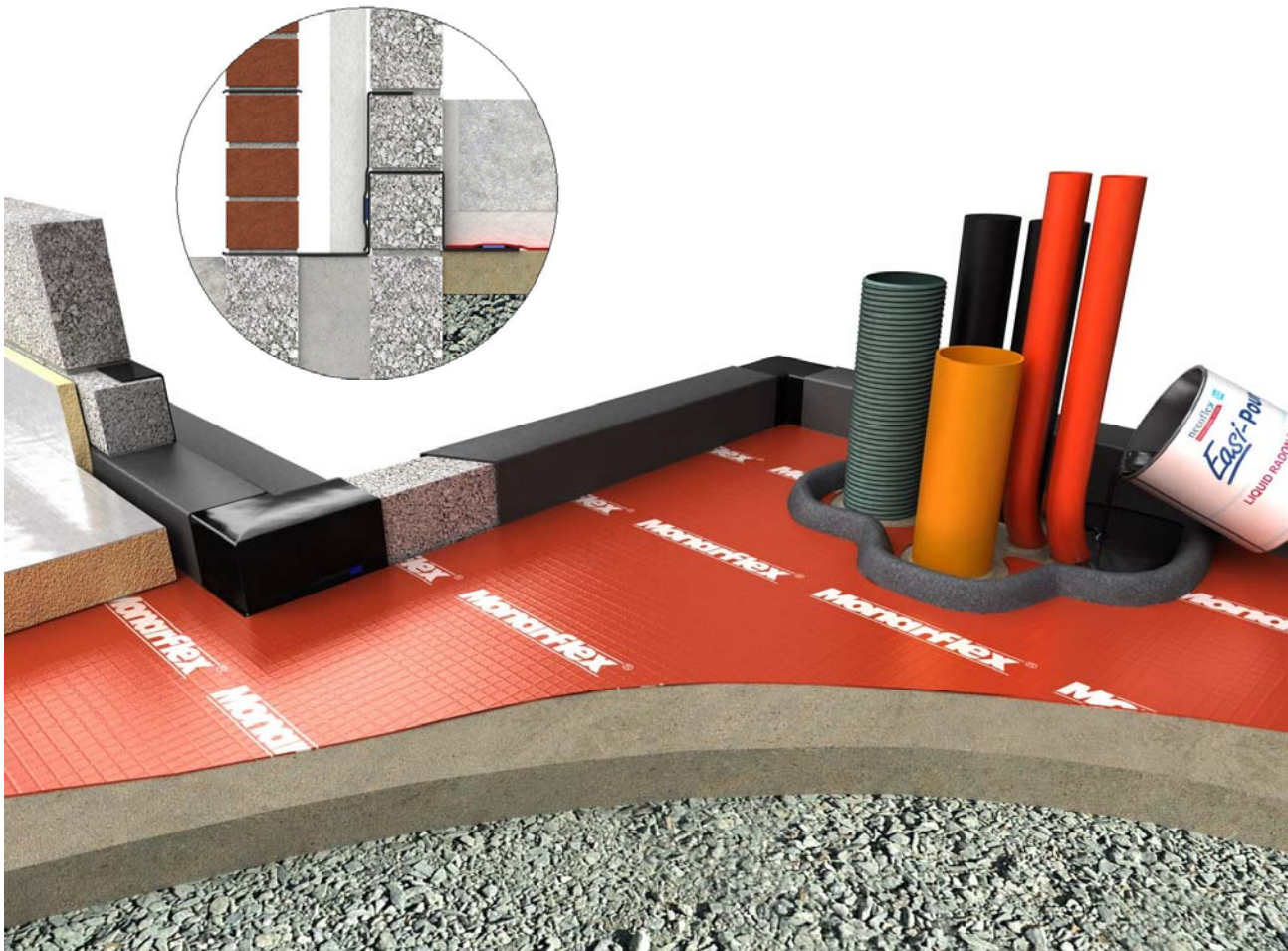
Necoflex Ltd., Unit 3, Orion Business Campus,
Northwest Business Park, Blanchardstown, Dublin 15.
T: +353 (0)1 802 3333
F: +353 (0)1 803 6060
E: necoflexsupport@icopal.com
W: www.necoflex.ie

Necoflex RAM™ Radon, Air & Moisture Protection System

**Le système de protection pour le radon, l'air et l'humidité (F)
Schutzsystem für Radon, Luft und Feuchtigkeit (D)**

NSAI Agrément (Irish Agrément Board) is designated by Government to issue European Technical Approvals.

NSAI Agrément Certificates establish proof that the certified products are '**proper materials**' suitable for their intended use under Irish site conditions, and in accordance with the **Building Regulations 1997 to 2009**.



PRODUCT DESCRIPTION:

This Certificate relates to the Necoflex RAM™ – Radon, Air and Moisture Protection System for ground floors in buildings. It is used to seal floors, walls and service penetrations, thereby ensuring the necessary degree of separation between the interior spaces of a building and the underlying soil.

Detail Sheet 1 relates to the *Easi-Sump*® and *Easi-Sump*® *Cap-Link*®.

This Certificate certifies compliance with the requirements of the Building Regulations 1997 to 2009.

USE:

Radon (incl. Rn-222, Rn-220, RnD) is a naturally occurring radioactive gas which enters buildings from the underlying soil. The gas can accumulate within a building to such a concentration as to constitute a health hazard.

Radon is excluded from buildings using passive and active systems. The provision of a suitable protection system, designed and installed by competent personnel will substantially reduce the risk of a building having radon activity above a recommended target health level of 10-40 Bq/m³ (USA).

Air tightness of ground floors in buildings is necessary in order to prevent air entering from the soil below. Uncontrolled air movement will negatively affect the heating and ventilation performance of a building. This is particularly important in circumstances where a sub-floor Radon Soil Gas Control System (radon sump) is activated. Depressurisation of the sub-floor could potentially affect certain types of heating appliance causing dangerous combustion leakage. It may also increase heat losses from the building. The provision of a suitable passive ground floor sealing system will reduce the risk of a building being negatively affected by uncontrolled air movement.

Moisture and water ingress from the exterior of a building can lead to the deterioration of the fabric of the building and encourages the growth of mould which is harmful to human health. Ground water can penetrate from below, rising vertically by capillary action. The provision of a suitable sealing system in the foundation walls, ground floors and around service and structural penetrations will reduce the risk of moisture and water ingress.

A passive radon, air and moisture protection system effectively deals with the three critical areas of ground floor sealing: Walls; Floors; Penetrations (Service and Structural):

1. Perimeter and internal walls, including designed cavities require suitable radon resisting damp proof courses (DPCs), cavity trays and pre-formed corner sections.

2. Floor areas require a loose-laid radon membrane properly sealed and joined to the perimeter and internal wall sections.
3. Service and structural penetrations require pre-formed collars where appropriate, adhesive flashing and a self-levelling liquid radon sealant to deal with irregular shapes and/or multiple service pipes.

Passive control systems should also incorporate an underfloor sump or sumps (see Detail Sheet 1), which can be subsequently converted into an active control system by the use of suitable ventilation fans.

MANUFACTURE AND MARKETING:

The products are supplied and marketed by:

Necoflex Ltd.,
Unit 3 Orion Business Campus,
Northwest Business Park,
Blanchardstown,
Dublin 15.
T: +353 (0)1 802 3333
F: +353 (0)1 803 6060
E: necoflexsupport@icopal.com
W: www.necoflex.ie

The products are manufactured by the Icopal Group at the following locations:

Icopal B.V.,
PO Box 2301,
Hoendiep 316,
9704 CH Groningen,
Holland.

Monarflex s. r. o.,
Továrenská,
943 03 Štúrovo,
Slovakia.

1.1 ASSESSMENT

In the opinion of NSAI Agrément, the Necoflex RAM™ - Radon, Air and Moisture Protection System, if used in accordance with this Certificate can meet the requirements of the Building Regulations 1997 - 2009 as indicated in Section 1.2 of this Certificate.

1.2 BUILDING REGULATIONS 1997 to 2009

REQUIREMENT:

Part D – Materials and Workmanship

D3 – The Necoflex RAM™ System, as certified in this NSAI Agrément Certificate is comprised of proper materials fit for their intended use (see Part 4 of this Certificate).

D1 – The Necoflex RAM™ System, as certified in this Certificate, meets the requirements for workmanship.

Part A – Structure

A1 – Loading

The Necoflex RAM™ System, installed in accordance with this Certificate, will not adversely affect the designed safety and deflection characteristics of a building.

Part B – Fire Safety

B3 – Internal Fire Spread (Structure)

The Necoflex RAM™ System, installed in accordance with this Certificate, will not adversely affect the control of fire and smoke within concealed spaces in the structure or fabric of a properly designed building.

Part C – Site Preparation and Resistance to Moisture

C3 – Dangerous Substances

The Necoflex RAM™ System will meet this requirement with respect to radon gas.

C4 – Resistance to Weather and Ground Moisture
The Necoflex RAM™ System, when used in accordance with Part 3 of this Certificate, will meet this requirement.

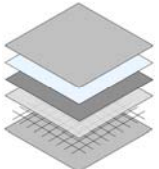
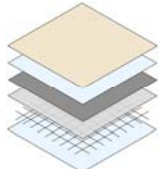
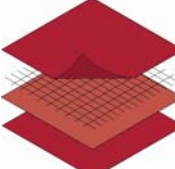
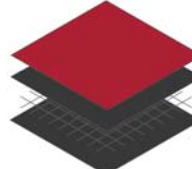

Part F – Ventilation

F1 – Means of Ventilation

Air leakage can provide background ventilation, however this is uncontrolled ventilation and can cause discomfort to occupants as well as potential structural damage. Air tightness should form part of a balanced package of insulation and ventilation measures. The Necoflex RAM™ System in conjunction with trickle vents, passive ventilation and mechanical ventilation systems, can minimise background air leakage (uncontrollable ventilation) and provide controllable ventilation through use of trickle vents etc.

Part L – Conservation of Fuel and Energy
L1 – Conservation of Fuel and Energy

The Necoflex RAM™ System, when installed and used in accordance with this Certificate, can meet this requirement and contribute to less air leakage in the building and therefore less heat loss. A key parameter for achieving an efficient Building Energy Rating (BER) is that the building envelope is designed and insulated to a high level and the fabric air tightness is to a high standard.

Test (units)	Monarflex® Radon, Air & Moisture Protection Membranes				
	 RAC	 Reflex Super	 RMB400	 RMB350	 Necoseal
Tensile Strength (N/50mm)	MD 870, CD 830	MD 710, CD 640	MD 600, CD 740	MD 480, CD 450	MD 345, CD 345
Elongation (%)	MD 29, CD 15	MD 26, CD 14	MD 19, CD 14	MD 19, CD 13	MD 690, CD 780
Tear Resistance (N)	MD 744, CD 712	MD 495, CD 480	MD 475, CD 425	MD 405, CD 425	MD 190, CD 190
Moisture Vapour Transmission Rate (g/m ² /day)	< 0.03	< 0.03	< 0.2	< 0.3	< 0.21
Water Vapour Resistance (MNs/g)	> 4100	> 4100	> 1025	> 680	> 990
Radon Transmittance (10 ⁻⁹ m/s)	1	1	17	16	15
Radon Permeability (10 ⁻¹² m ² /s)	0.4	0.4	7	5.6	4.5
Standard Roll Specification					
Roll Size (m)	2 x 25	2 x 25, 2 x 50	2 x 25, 4 x 25	2 x 25, 4 x 25	4 x 20
Colour	Grey	Sand/Aluminium-Clear (upper/lower)	Red	Red/Black (upper/lower)	Black
Nominal Weight per Unit Area (g/m ²)	813	461	407	355	270
Nominal Thickness (microns)	810	430	410	355	300
Materials	Virgin Polyethylene blend and Aluminium	Virgin Polyethylene blend and Aluminium	Virgin Polyethylene blend	Virgin Polyethylene blend	Virgin Polyethylene blend
Reinforcement (mm)	12 x 12 Multi-filament Polyester 1670 dtex	12 x 12 Multi-filament Polyester 1670 dtex	9 x 12 Multi-filament Polyester 1670 dtex	12 x 12 Multi-filament Polyester 1100 dtex	None

2.1 PRODUCT DESCRIPTION

This Certificate relates to the Necoflex RAM™ - Radon, Air and Moisture Protection System. Using the following components it combines polymer DPC technology and radon sealing techniques to enable building designers select the most appropriate solution for each of the three critical areas of ground floor sealing: Walls, Floors and Penetrations (Service and Structural).

2.1.1 Walls

Easi-Load™ Radon DPC has been developed using multi-layer polymer technology to give robust protection where a radon, air and moisture seal must pass through masonry walls. It is particularly suitable for cavity wall construction and can be used at all floor/wall junctions. As well as offering high radon, air and moisture vapour resistance, Easi-Load™ Radon DPC also has a high tear strength, will not extrude under load and provides excellent mortar adhesion. It is available in various widths ranging from 100 to 1000mm, and rolls are 20m in length. Ends should be overlapped by 100mm and sealed using a single strip of Monobond RT™ 30mm tape.

Easi-Load™ Radon Corner Assembly (patent pending) has been developed to provide a fast and effective radon, air and moisture seal in traditionally difficult to seal corners. The assembly comprises 3 pieces, each carefully pre-formed from Low Density Polyethylene (LDPE), without seams or joints, in factory controlled conditions. Its unique design makes it suitable for sealing various upstand heights ranging from 100 to 225mm, and a specially developed, pre-applied sealant strip, provides radon, air and moisture protection while accommodating construction settlement up to 8mm (see Construction Detailing – Provision for Settlement in Part 2 of this Certificate).

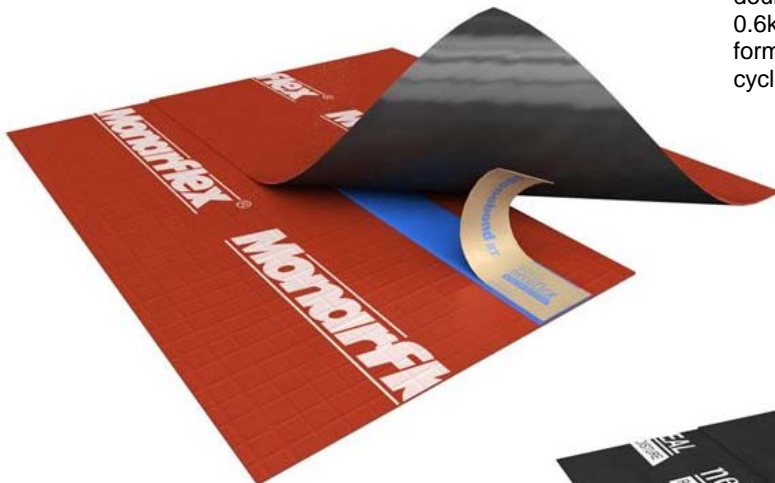


Figure 1: Overlap sealing of RMB350 with Monobond RT™ tape

2.1.2 Floors

RAC, Reflex Super, RMB400, RMB350 and Necoseal are loose-laid radon resisting membranes made from blends of virgin low density polyethylene (LDPE). When used in a new building as part of the Necoflex RAM™ system, they provide an effective barrier to the passage of radon, air and moisture from the underlying soil. RAC and Reflex Super can also be used to exclude volatile organic compounds (VOCs) from underground storage tanks, or the range of gases from landfill sites such as methane and CO₂. RAC, Reflex Super, RMB400 and RMB350 have multi-filament polyester reinforcement. RAC and Reflex Super have an additional layer of aluminium foil.

Necobond™ is a double-sided radon resisting butyl sealant tape designed for sealing joints in Necoseal radon resisting membrane. It can also be used to bond Necoseal to Easi-Load™ Radon DPC. Rolls are 30mm x 30m, are buff/orange in colour with white release paper.

Monobond RT™ is a double-sided radon resisting butyl sealant tape designed for sealing joints in RAC, Reflex Super, RMB400, RMB350 radon resisting membranes, and Easi-Load™ Radon DPC. It can also be used to bond Necoseal joints if desired and is suitable for bonding any of these membranes to Easi-Load™ Radon DPC. Rolls are 30mm x 30m, are blue in colour with light brown release paper which bears the product name.

2.1.3 Service Penetrations

Easi-Pour™ Liquid Radon Sealant is a two-component bitumen and polyurethane based liquid sealant. It is pourable, self-levelling and provides effective radon, air and moisture sealing around service penetrations, structural columns and irregular profiles of any shape or diameter. Easi-Pour™ is supplied in a special 10 litre double-lid bucket and contains 5.4kg of sealant and 0.6kg of hardener. Once cured, a custom-made seal is formed. Easi-Pour™ will remain flexible and has a life-cycle of at least 50 years.

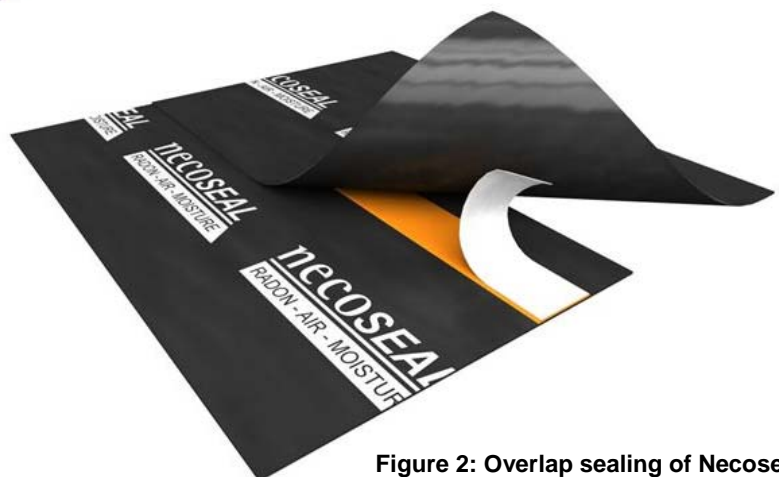


Figure 2: Overlap sealing of Necoseal with Necobond™ tape

Easi-Flash™ Self-Adhesive Radon Flashing is a multi-purpose radon, air and moisture sealing tape designed for use around thresholds, door end stops, services, structural penetrations and can also be used to carry out fast and effective radon membrane repairs. It has a bituminous self-adhesive layer on one side and a polyethylene backing on the other. Easi-Flash™ has excellent initial grab (tack) and is highly malleable making it particularly suitable for a wide range of difficult sealing requirements. Rolls are 1.5mm x 300mm x 10m, and have a permanent backing with Easi-Flash™ logo.

Monarflex® Top-Hat is a one-piece, vacuum-formed LDPE collar designed to seal 110mm diameter pipes. In some circumstances it may not be possible to fit the collar over a pipe, if for example there is a socket or bend at the critical point where the pipe penetrates the radon membrane. In these situations, Easi-Pour™ Liquid Radon Sealant should be used.

2.2 MANUFACTURE

RAC, Reflex Super, RMB400, RMB350 and Necoseal radon resisting membranes and Easi-Load™ Radon DPC are manufactured using an extrusion process.

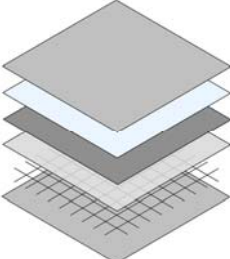
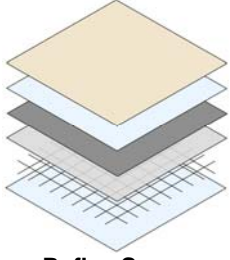
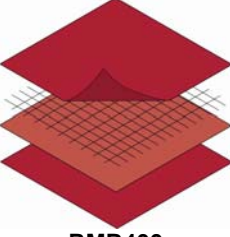
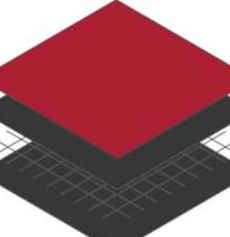
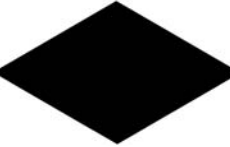
Monarflex® Radon, Air & Moisture Protection Membranes	Application Guidance
 <p style="text-align: center;">RAC</p>	<ul style="list-style-type: none"> • Heavy-duty reinforced LDPE membrane incorporating 6 layers (including reinforcement and aluminium foil layer). • Very high resistance to radon gas. • Suitable for contaminated sites where volatile organic compounds (VOCs) and landfill gases exist e.g. methane and CO₂ – contact supplier for specific guidance. • Can handle heavy foot traffic and certain site machinery. • Suitable for use under heavily reinforced concrete slabs, ground beams and pile-caps where an increased risk of damage exists.
 <p style="text-align: center;">Reflex Super</p>	<ul style="list-style-type: none"> • Robust reinforced membrane incorporating 6 layers (including reinforcement and aluminium foil layer). • Very high resistance to radon gas. • Suitable for contaminated sites where volatile organic compounds (VOCs) and landfill gases exist e.g. methane and CO₂ – contact supplier for specific guidance. • Can handle moderate to heavy foot traffic – both outer layers made from blown LDPE blend which gives excellent resistance to abrasion. • Particularly suitable for medium to large floor areas where an increased risk of damage exists. • Protective layer advised before concrete pour.
 <p style="text-align: center;">RMB400</p>	<ul style="list-style-type: none"> • Robust extra reinforced membrane incorporating 4 layers. • High resistance to radon gas. • Can handle moderate to heavy foot traffic – both outer layers made from blown LDPE blend which gives excellent resistance to abrasion. • Particularly suitable for medium to large floor areas where an increased risk of damage exists. • Protective layer advised before concrete pour.
 <p style="text-align: center;">RMB350</p>	<ul style="list-style-type: none"> • Reinforced membrane incorporating 4 layers. • High resistance to radon gas. • Can handle moderate foot traffic – lower outer layer of blown LDPE blend. • Particularly suitable for small to medium floor areas where insulation or other protective layer is placed shortly after membrane is fitted. • Protective layer required before concrete pour.
 <p style="text-align: center;">Necoseal</p>	<ul style="list-style-type: none"> • Single layer of virgin-blend LDPE. • High resistance to radon gas. • Can handle light foot traffic (as required for installation). • Particularly suitable for buildings with small footprints where insulation or other protective layer is placed immediately after membrane is fitted – the risk of damage is therefore reduced.

Table 2: Application Guidance for Monarflex Radon, Air and Moisture Protection Membranes

Easi-Load™ Radon Corner Assembly and Monarflex® Top-Hats are manufactured using a vacuum-forming process.

2.2.1 Product Quality Control

Quality control checks are carried out on the raw material, during and at the end of production. Checks on the final product include dimensions, tensile strength, tear strength, and elongation.

The management systems of the manufacturer have been assessed and registered as meeting the requirements of EN ISO 9001:2000 by Det Norske Veritas, registration number 2001-ABG-AQ-05710.

2.3 DELIVERY, STORAGE AND MARKING

System components are supplied individually or on pallets in wrappers bearing the manufacturer's name and product description, NSAI Agrément identification mark, NSAI Agrément Certificate number and essential instructions for storage and installation.

2.4 INSTALLATION

2.4.1 General

The Necoflex RAM™ System offers robust detailing solutions for a wide range of ground floor and foundation designs. It facilitates a hybrid approach which combines Easi-Load™ Radon DPC with any one of 5 radon resisting membrane specifications. Building designers can select the best combination for their project, taking into account the following variables:

- Probability of having elevated indoor radon levels;
- Building use and occupancy rate;
- Number of storeys;
- Floor area and risk of membrane damage when large sections are installed in a single phase;
- Type of floor construction and quality of substrate finish;
- Level of supervision and technical control on site;
- Types of activities being carried out, e.g. placement of steel;

- Levels of activity on membrane after it has been fitted and before insulation or other protective layer is placed.

Traditional methods of using a radon resisting membrane as a DPC may be acceptable, depending on membrane type. The Certificate holder should be contacted for project specific design guidance.

Guidance on the design of radon protection systems for new and existing buildings is given in the DoEHLG document *Radon in Buildings*, 1995. It is essential that the radon membranes covered by this Certificate are laid in accordance with the recommendations of IS 325-2:1995 *Code of practice for use of masonry*, BS 8102:1990 *Code of practice for protection of buildings against water from the ground*, and with this Certificate.

2.4.2 New Work

The Necoflex RAM™ System can be used in most common ground floor constructions. Some elements of the system are installed in a similar way to damp proof membranes **but with much greater attention to detailing and workmanship**. This system will also perform the same function as DPCs and membranes (see Construction Detailing figures).

To be fully effective, a radon, air and moisture sealing system must bridge cavities in walls and in doing so should form a cavity tray. Easi-Load™ Radon DPC should be used to seal walls and cavities. All designed cavities must be properly closed.

To avoid creating slip planes in masonry walls, do not place a radon resisting DPC in direct contact with a membrane (see the recommendations in IS 325-2:1995). Consideration must be given to the positioning of radon resisting DPCs and membranes in relation to thermal insulation. The recommendations contained in IS 325-2:1995 should be followed.

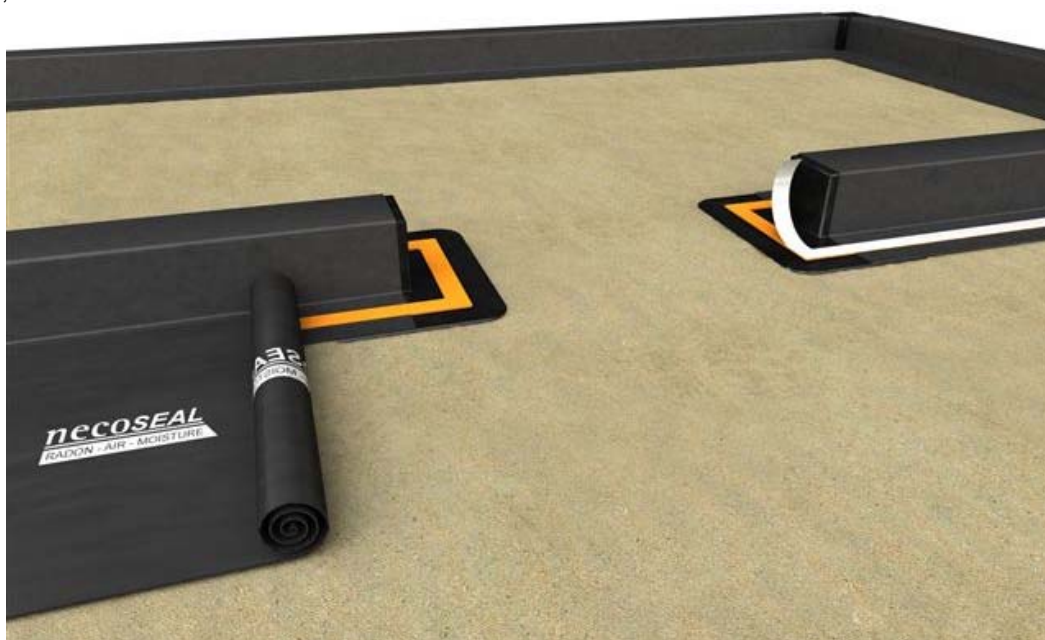


Figure 3: Sealing internal wall using Easi-Load™ Radon DPC

The integrity of a radon, air and moisture sealing system must be maintained during installation. The risk of damage will vary depending on several factors as outlined above. For these reasons, the radon resisting membrane element of the system should be carefully chosen based on the guidance outlined in Table 2. RAC, Reflex Super, RMB400, RMB350 and Necoseal have different levels of resistance to damage. Where damage occurs this must be repaired by covering with a second layer of membrane sealed to the original using either Necobond™ or Monobond RT™ sealant tape, depending on membrane type. Easi-Flash™ can also be used to carry out fast and effective membrane repairs.

Installation of the Necoflex RAM™ System must be in accordance with the recommendations of IS 325-2:1995, BS 8102:1990, and the requirements of this Certificate. Additional guidance on the use of damp proof membrane materials is given in BS 8000:Part 4:1989 *Workmanship on building sites – Code of practice for waterproofing*.

A surface blinding of soft sand (50mm min. thickness) or geo-textile should be used to prevent puncture of the membrane during installation. A further protection over the membrane is afforded by using high density insulation (25 kg/m³). Sheets must be clean and free from dirt and grease before application, and in view of the difficulty of achieving gas tight seals under wet or dirty site conditions it is recommended that special care is taken with this aspect of the installation.

2.4.3 System Installation Procedures

Task 1 – Seal Walls and Designed Cavities

Seal all corners using Easi-Load™ Radon Corner Assembly kits. The standard kit includes 1 internal section, 1 external section and 1 corner cap section. Kits are also available to suit T-shaped junctions. The internal and external sections should be trimmed if necessary to suit the height of the block or upstand.



Once these are in position, slide the corner cap down fully over the top of the block, ensuring both edges are lapped to the outside of the internal and external sections. Remove the release paper from the settlement sealant strips which are pre-applied to the inner walls of the corner cap. Apply firm pressure along the entire length of the sealant strips to ensure a complete seal has been achieved.

(iii)

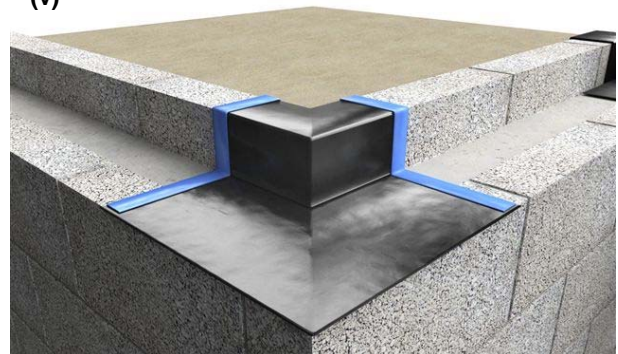


Remove all the release paper tabs from the settlement joints and angle fillets. Apply two strips of Monobond RT™ radon resisting tape across the entire assembly. Ensure each strip is placed across the angle fillets and settlement joint. Both strips should lap fully at the point where they meet (on the base of the internal corner section). Leave backing paper in place for the time being.

(iv)

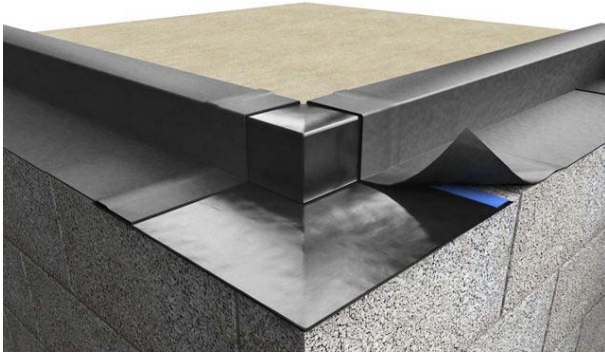


(v)



Easi-Load™ Radon DPC should be placed along the entire length of each wall. It should be dressed down to meet the sand-blinding/substrate and return horizontally a minimum of 100mm to facilitate lapping and sealing with the Monarflex radon, air and moisture protection membrane. When used to seal external cavity walls, Easi-Load™ Radon DPC should cross the entire cavity and full width of the outer leaf.

(vi)



All radon DPCs should exit above external ground level. Where the length of radon DPC downstand in the cavity is deemed insufficient, an additional stepped DPC should be added (see Figure 10).

To seal the Easi-Load™ Radon DPC to the Easi-Load™ Radon Corner Assembly, remove the backing paper from the previously applied radon resisting sealant tape and carefully position the Easi-Load™ Radon DPC, ensuring full coverage of each strip. Using a hand roller, apply firm pressure over both joints and ensure there are no gaps.

(vii)



Task 2 – Seal Floor Areas

Unroll one width of the Monarflex radon, air and moisture protection membrane after determining the most effective method of covering the area. RMB350 is laid with the red side facing upwards. Reflex Super is laid with the sand-coloured side facing upwards. Apply the appropriate 30mm double-sided sealant strip (Necobond™ when sealing Necoseal radon membrane, or Monobond RT™ when sealing RAC, Reflex Super, RMB400 or RMB350). Leaving the backing paper on, lay the next width of membrane overlapping the first by 150mm. Remove the backing paper from the sealant tape and join the top sheet to the bottom sheet by applying pressure with a hand roller. When the weather is cold keep the tape in a warm place until needed, and if necessary apply a little hot air but never use a naked flame.

It is preferable that membranes are protected as soon as possible after installation to reduce the risk of damage that may be caused by following trades and/or during the concrete pour. The degree of risk will vary depending on the construction method being used and the level of supervision and technical control on site. General guidance on membrane selection can be found in Table 2.

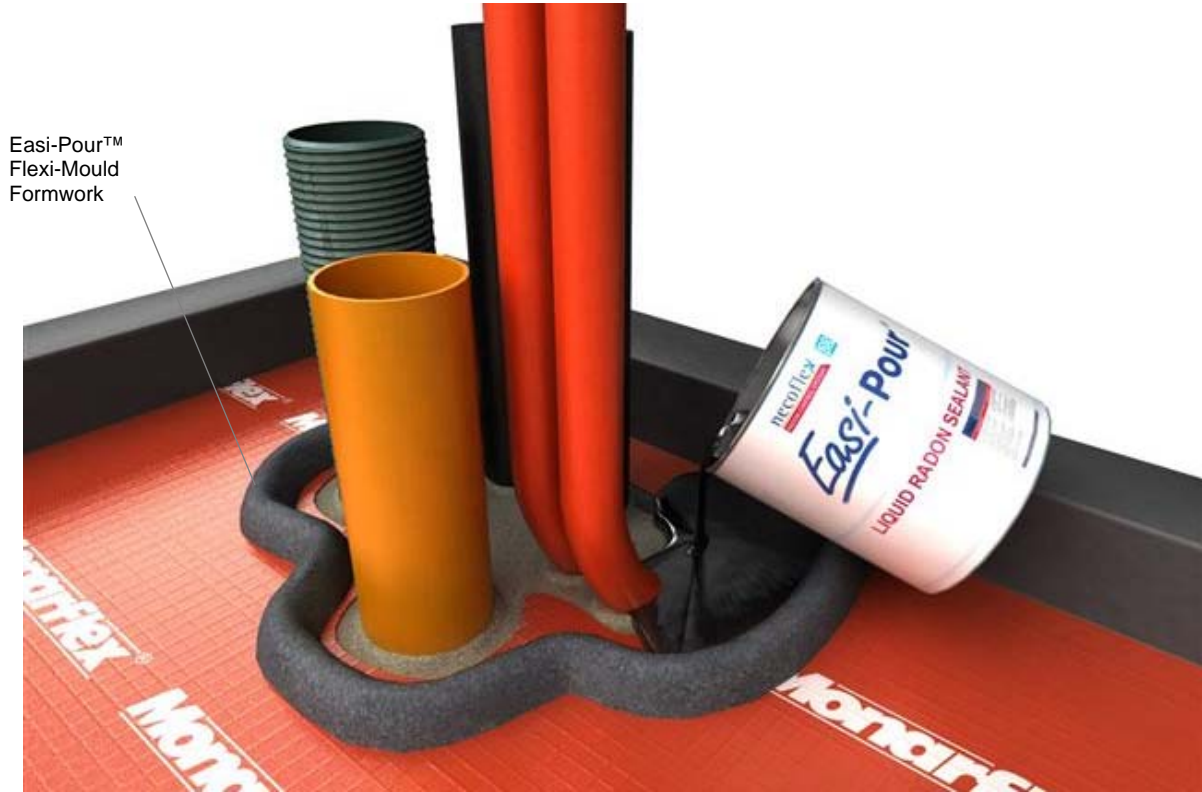
(viii)



Task 3 – Seal Service and Structural Penetrations

Seal all service and structural penetrations using the most appropriate method as outlined below:

- (a) Monarflex Top-Hat units with retention clips are available to seal 110mm diameter pipes and ducts. Radon, air and moisture resistant joints are effected using Monobond RT™ or Necobond™ sealant tape.
- (b) Easi-Flash™ Self-Adhesive Radon Flashing can be used for a wide range of sealing applications. Prepare steel and concrete substrates using Siplast Primer. Cut sections of Easi-Flash™ Self-Adhesive Radon Flashing to the required length. Remove the protective release film and apply the self-adhesive side onto the prepared surface. Lap 150mm to the Monarflex membrane and the remaining 150mm to the steel or concrete (roll width is 300mm). The laps should be well rolled with a firm pressure to ensure complete adhesion and continuity.
- (c) Easi-Pour™ Liquid Radon Sealant is recommended for sealing service penetrations, structural columns and irregular profiles of any shape or diameter. It is particularly suitable for multiple pipe penetrations, corrugated twin-wall ducts, and long radius bends.
 - (i) Ensure that the substrate has been well compacted before dressing the Monarflex radon, air and moisture protection membrane around the penetration(s) to be sealed. A 30mm space should be left between penetrations. Where possible, cut the membrane close to the penetration to help contain the sealant until it has cured. Gaps can be closed if required using Easi-Flash™ Self-Adhesive Radon Flashing.
 - (ii) Remove any moisture or dirt from the surface of the membrane and penetrations before sticking the Easi-Pour™ Flexi-Mould formwork in place. The formwork is flexible and has a pre-applied self-adhesive tape to facilitate bonding to the top of the radon membrane. Carefully position the formwork around the services, maintaining uniform spacing and ensuring at least 30mm of radon membrane will be covered by the Easi-Pour™ Liquid Radon Sealant.
 - (iii) After preparing all services and penetrations in advance, mix the Easi-Pour™ Liquid Radon Sealant as directed on the container and fill the formwork to a depth of at least 30mm. No trowelling is required as the sealant will flow around the penetration and find its own level. Working time is approximately 15 minutes. Curing time is approximately 24 hours at 20°C ambient temperature. The sealant should be protected from rain until it has cured and should always be covered by a concrete or screed layer. The Flexi-Mould formwork is permanent.



Easi-Pour™
Flexi-Mould
Formwork

Figure 4: Sealing of pipes and ducts using Easi-Pour™ Liquid Radon Sealant



Figure 5: Top Hat detail



Figure 6: Easi-Load™ Radon Corner Cap (90°)
(patent pending)

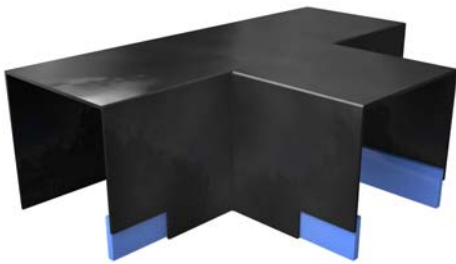


Figure 7: Easi-Load™ Radon Corner Cap (T)
(patent pending)

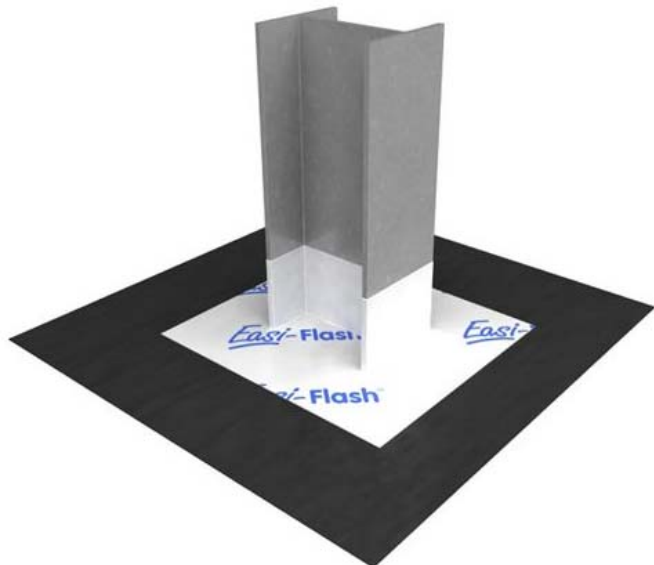


Figure 8: Easi-Flash™ Self-Adhesive Radon Flashing (Easi-Pour™
Liquid Radon Sealant may also be used in this application)

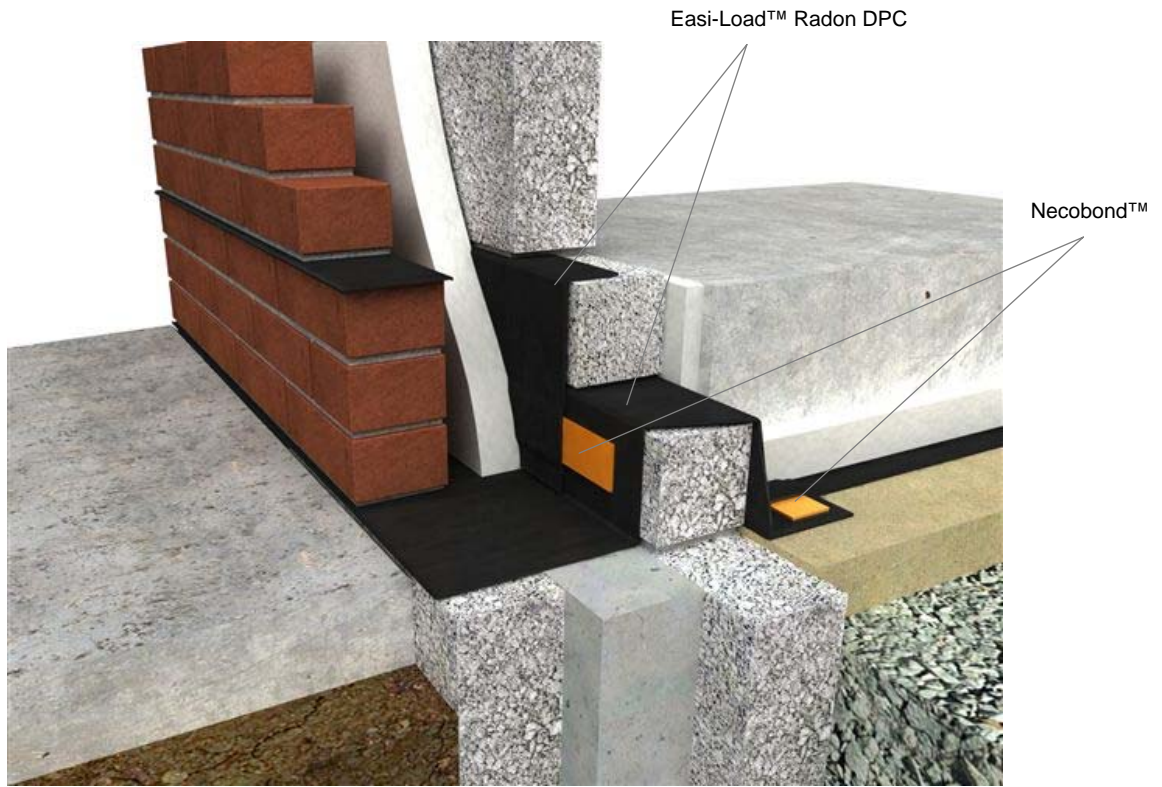


Figure 9: Detail showing Monarflex® membrane (Necoseal shown) and Easi- Load™ under floating slab



Figure 10: Detail showing floating slab

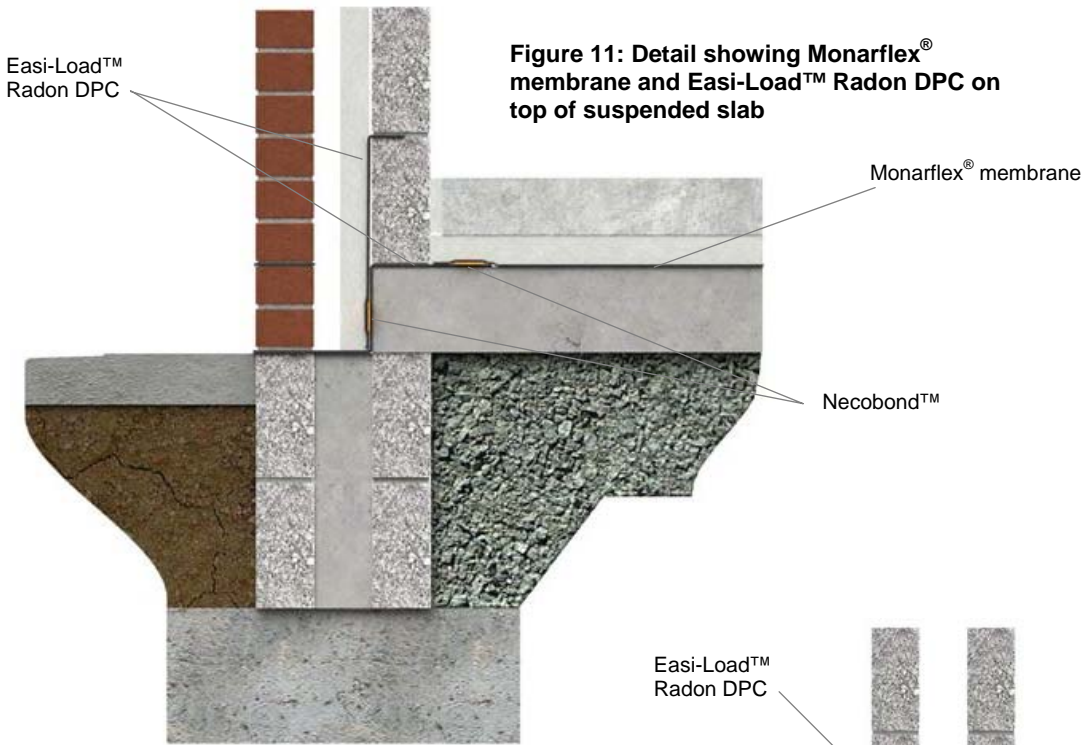


Figure 11: Detail showing Monarflex® membrane and Easi-Load™ Radon DPC on top of suspended slab

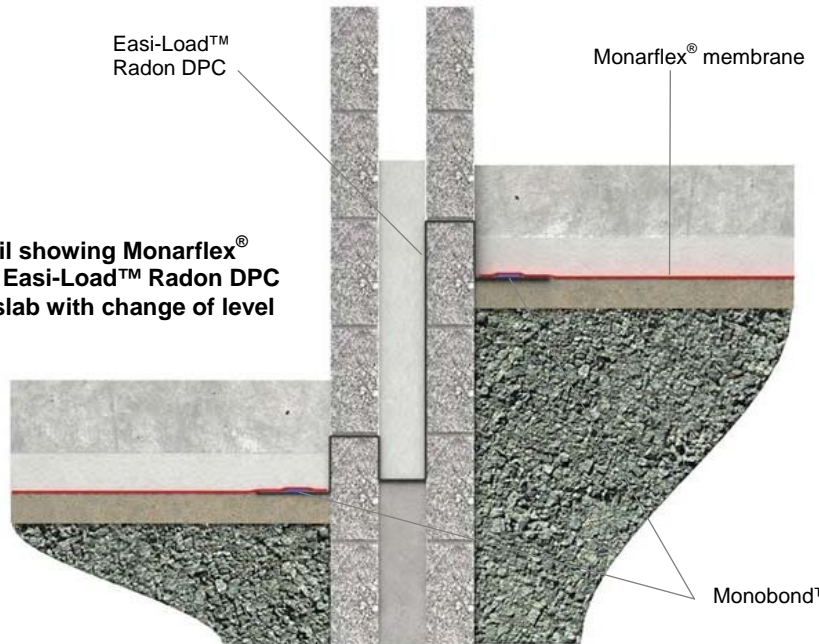


Figure 12: Detail showing Monarflex® membrane and Easi-Load™ Radon DPC under floating slab with change of level

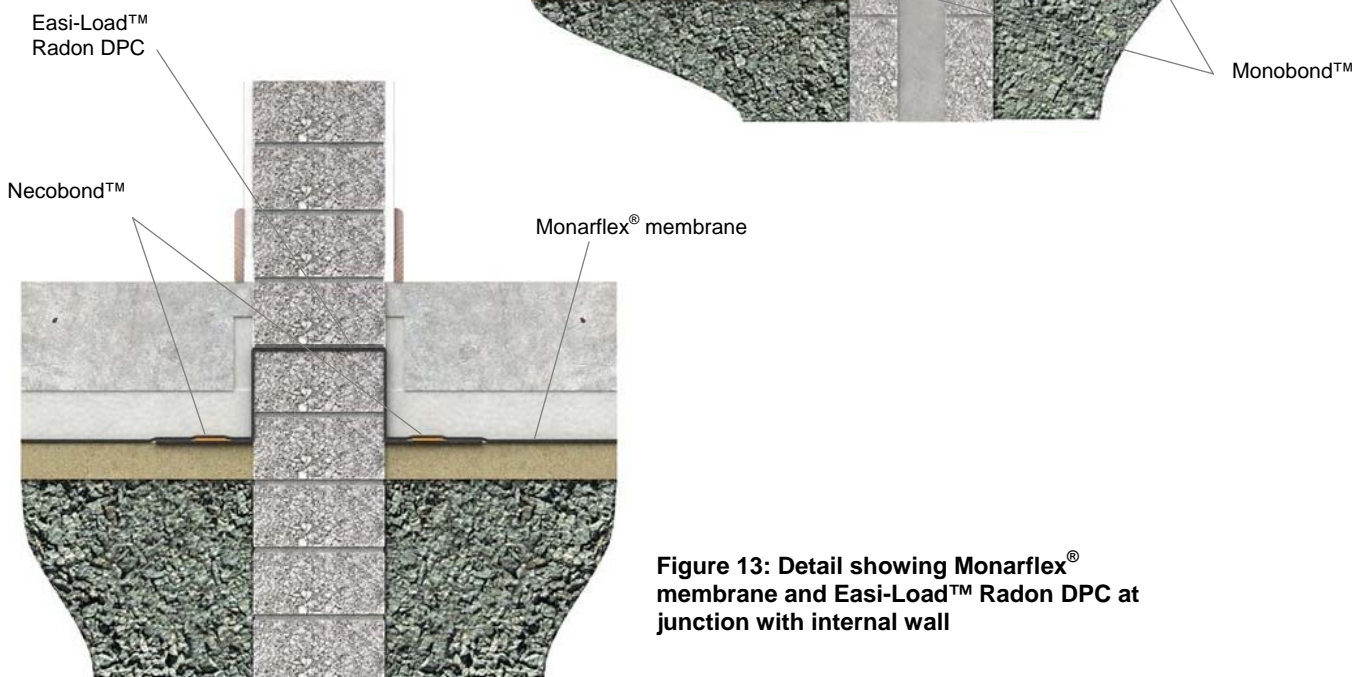
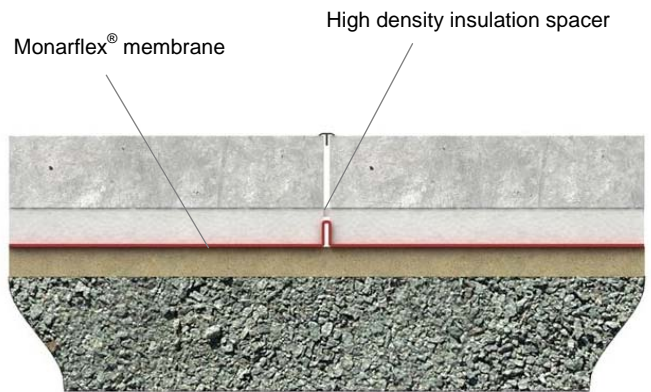
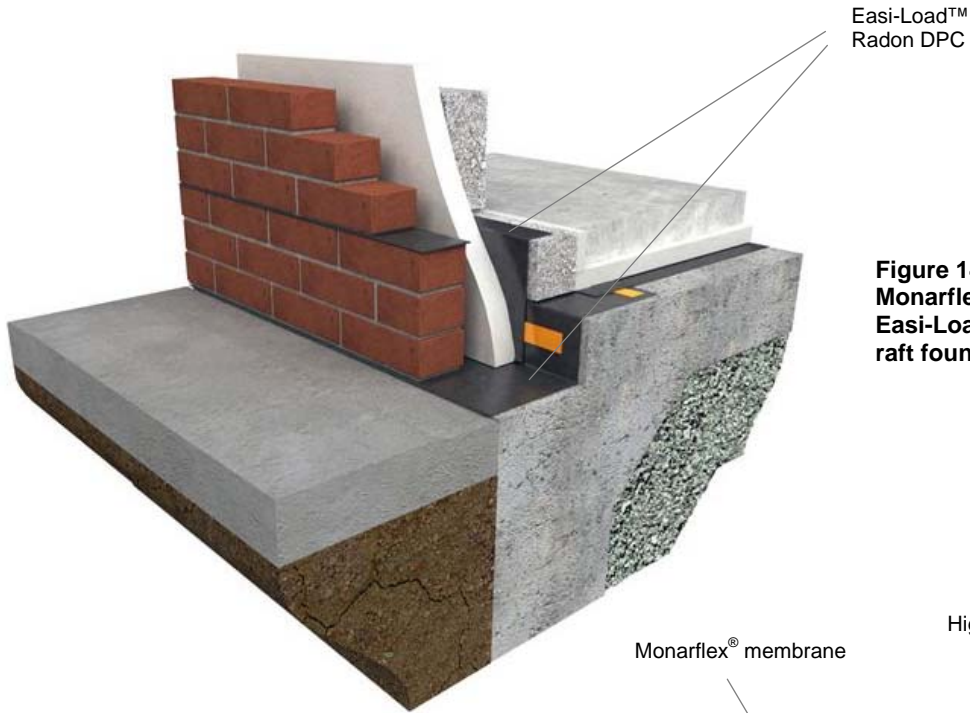
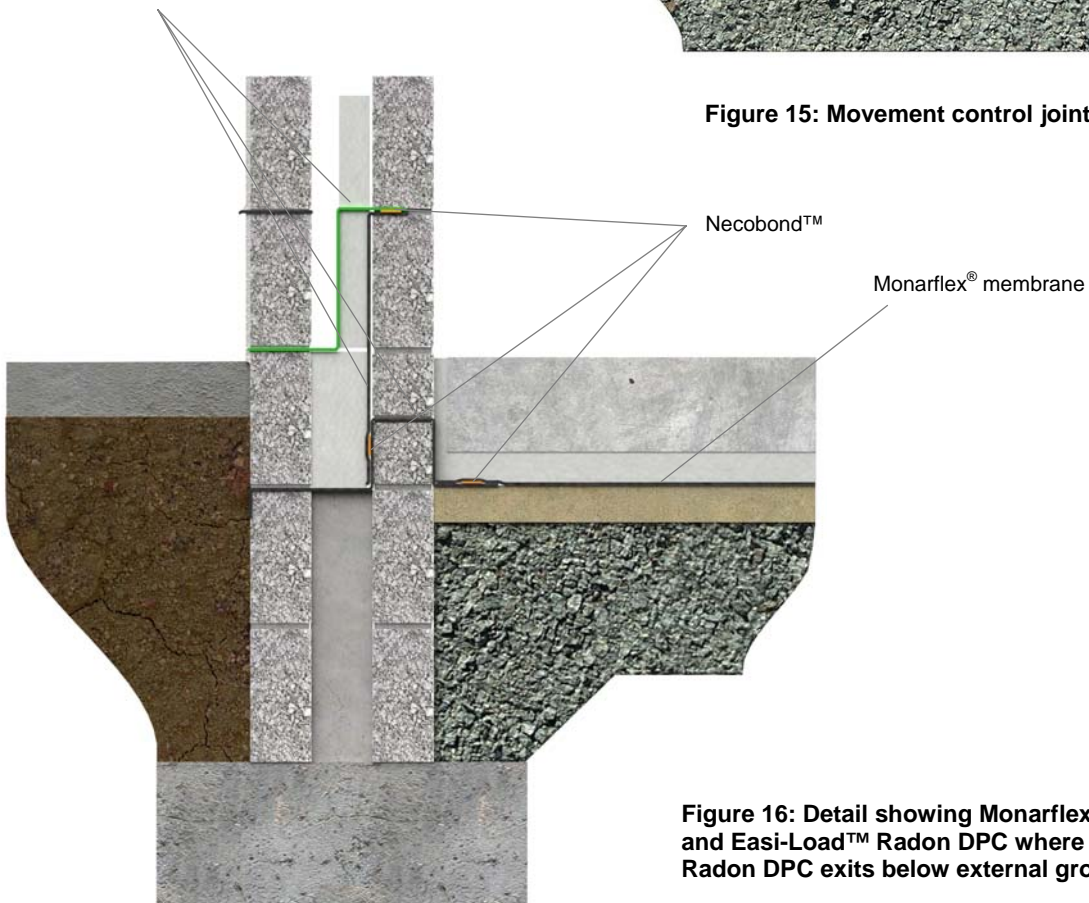


Figure 13: Detail showing Monarflex® membrane and Easi-Load™ Radon DPC at junction with internal wall



Easi-Load™ Radon DPC (one shown in green for clarity)



3.1 GENERAL

The Necoflex RAM™ - Radon, Air and Moisture Protection System is suitable for use in concrete floors not subject to hydrostatic pressure, in accordance with the relevant clauses of IS 325-2:1995 and BS 8102:1990.

The membranes can be installed either between a blinded hardcore bed and the base concrete, or between the base concrete and screed. RAC can be installed below ground beams and pile-caps.

3.1.1 Resistance to water and water vapour

The membranes and the methods of jointing provide an effective barrier to the passage of radon gas, air, liquid water and water vapour from the ground.

3.1.2 Resistance to tear

The Necoflex RAM™ System provides a high level of resistance to tear and can be adapted to suit a wide range of site conditions. Care should be taken during installation, particularly when handling building materials and equipment over the surface and when placing concrete or screeds, since the membranes can be punctured by sharp objects. High density insulation (25kg/m³) is an effective protection after laying.

3.1.3 Site conditions

The system may be installed in all conditions normal to ground floor slab construction. Where there is a risk of ground becoming waterlogged, sub-soil drainage must be provided in accordance with IS 325-2:1995 and BS 8102:1990.

3.1.4 Underfloor heating

When used in accordance with the conditions set out in this Certificate, there will be no adverse effect on the membranes from underfloor heating under normal conditions. The Certificate holder's advice should also be sought for project specific details.

3.2 CONSTRUCTION DETAILING

To reduce radon, air and moisture ingress into buildings the following guidelines should be followed:

- design for controlled movement of construction (see IS 325-2:1995);
- ensure that all designed cavities are effectively closed to interior spaces;
- design for grouping of services with effective gas seal of ground slab openings and penetrations.

3.3 CONSTRUCTION SETTLEMENT

Consideration should be given to differential and/or relative settlement of ground floor construction during the full life cycle of the building. Where special installation detailing is introduced, i.e. folding of a radon resisting membrane at critical construction points, an elongation capability for the membrane itself may not be required. Where high concentrations of radon are likely and where a building is properly designed, detailed and constructed to take account of settlement, the installation of the Necoflex RAM™ System offers an effective measure against radon health hazards. It is important to note that following any elongation in a membrane, a reduction in its radon gas resistance performance will occur.

CONSTRUCTION DETAILING – PROVISION FOR SETTLEMENT

Situation A:

If it can be predicted with certainty that there will be no actual/real relative or differential settlement during the entire cycle of a building, Easi-Load™ Radon DPC, RAC, Reflex Super, RMB400 and RMB350 may be installed as shown:



Situation B:

If it can be predicted with certainty that the actual/real relative or differential settlement during the entire life cycle of a building will not exceed 8mm, Easi-Load™ Radon DPC, RMB400 and RMB350 may be installed with an upstand as shown:



Situation C:

If it cannot be predicted with certainty what the actual/real relative or differential settlement will be during the entire life cycle of a building, Easi-Load™ Radon DPC, RAC, Reflex Super, RMB400 and RMB350 should be installed with folds as shown:



4.1 TESTS / ASSESSMENTS

Various technical investigations were carried out on the Necoflex RAM™ - Radon, Air and Moisture Protection System. Typical results are shown in Table 1.

4.2 DURABILITY

When installed in accordance with this Certificate and subject to normal conditions of use, the system will provide an effective barrier which will be substantially impervious to the transmission of radon gas, air, liquid water and water vapour for the life of the building. Long periods of exposure to UV light can reduce the effectiveness of a membrane. However, during storage, and when installed in accordance with this Certificate, the membranes will be protected from such exposure.

It is important to note that alterations to the building structure subsequent to the installation of a radon protection system must take into account the integrity of the system.

4.3 OTHER INVESTIGATIONS

(i) Existing data on product properties in relation to fire, toxicity and environmental impact were assessed. When stored with normal care on site prior to installation these membranes do not present a significant fire or health hazard.

(ii) The manufacturing process was examined including the methods adopted for quality control, and details were obtained of the quality and composition of the materials used.

5.1 National Standards Authority of Ireland ("NSAI") following consultation with NSAI Agrément has assessed the performance and method of installation of the product/process and the quality of the materials used in its manufacture and certifies the product/process to be fit for the use for which it is certified provided that it is manufactured, installed, used and maintained in accordance with the descriptions and specifications set out in this Certificate and in accordance with the manufacturer's instructions and usual trade practice. This Certificate shall remain valid for five years from date of issue so long as:

- (a) the specification of the product is unchanged.
- (b) the Building Regulations 1997 to 2009 and any other regulation or standard applicable to the product/process, its use or installation remains unchanged.
- (c) the product continues to be assessed for the quality of its manufacture and marking by NSAI.
- (d) no new information becomes available which in the opinion of the NSAI, would preclude the granting of the Certificate.
- (e) the product or process continues to be manufactured, installed, used and maintained in accordance with the description, specifications and safety recommendations set out in this certificate.
- (f) the registration and/or surveillance fees due to NSAI Agrément are paid.

5.2 The NSAI Agrément mark and certification number may only be used on or in relation to product/processes in respect of which a valid Certificate exists. If the Certificate becomes invalid the Certificate holder must not use the NSAI Agrément mark and certification number and must remove them from the products already marked.

5.3 In granting Certification, the NSAI makes no representation as to;

- (a) the absence or presence of patent rights subsisting in the product/process; or
- (b) the legal right of the Certificate holder to market, install or maintain the product/process; or
- (c) whether individual products have been manufactured or installed by the Certificate holder in accordance with the descriptions and specifications set out in this Certificate.

5.4 This Certificate does not comprise installation instructions and does not replace the manufacturer's directions or any professional or trade advice relating to use and installation which may be appropriate.

5.5 Any recommendations contained in this Certificate relating to the safe use of the certified product/process are preconditions to the validity of the Certificate. However the NSAI does not certify that the manufacture or installation of the certified product or process in accordance with the descriptions and specifications set out in this Certificate will satisfy the requirements of the Safety, Health and Welfare at Work Act 2005, or of any other current or future common law duty of care owed by the manufacturer or by the Certificate holder.

5.6 The NSAI is not responsible to any person or body for loss or damage including personal injury arising as a direct or indirect result of the use of this product or process.

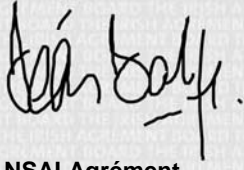
5.7 Where reference is made in this Certificate to any Act of the Oireachtas, Regulation made thereunder, Statutory Instrument, Code of Practice, National Standards, manufacturer's instructions, or similar publication, it shall be construed as reference to such publication in the form in which it is in force at the date of this Certification.

NSAI Agrément

This Certificate No. **09/0328** is accordingly granted by the NSAI to **Necoflex Ltd.** on behalf of NSAI Agrément.

Date of Issue: **March 2009**

Signed



Seán Balfe
Director of NSAI Agrément

Readers may check that the status of this Certificate has not changed by contacting NSAI Agrément, NSAI, 1 Swift Square, Northwood, Santry, Dublin 9, Ireland. Telephone: (01) 807 3800. Fax: (01) 807 3842. www.n sai.ie

Revisions: November 2009

- Addition of Detail Sheet 1.



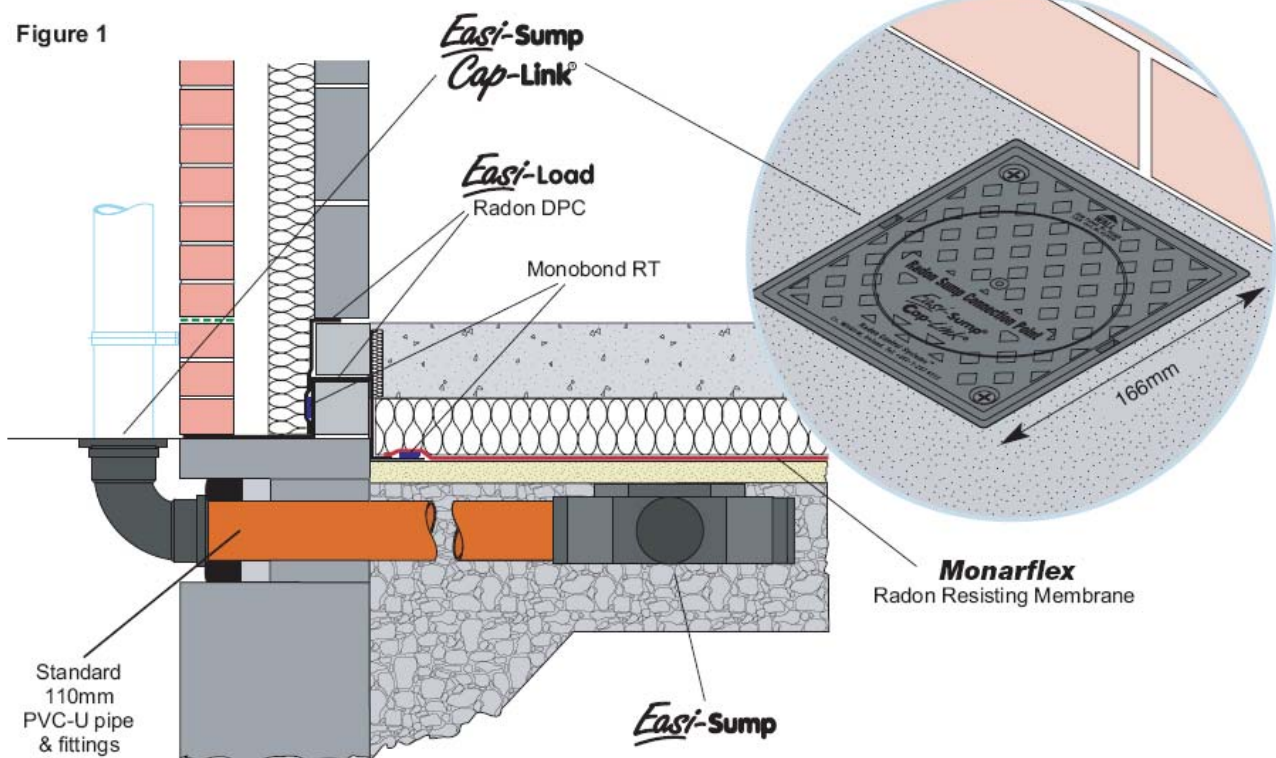
NSAI

Agrément

CERTIFICATE NO. 09/0328
DETAIL SHEET 1

Easi-Sump® & Easi-Sump® Cap-Link®

Figure 1



PRODUCT & ASSEMBLY DESCRIPTION:

This Detail Sheet relates to the *Easi-Sump*® and *Easi-Sump*® *Cap-Link*®. Both products, when assembled, are used as part of a radon protection measure in buildings and enable sub-floor depressurisation or pressurisation to be introduced with ease, if required at a later date.

This Detail Sheet replaces NSAI Certificate No.01/0130.

SUPPLY, MANUFACTURE & MARKETING:

Both products are supplied and marketed by:
**Necoflex Ltd., Unit 3 Orion Business Campus,
Northwest Business Park, Blanchardstown,
Dublin 15.**

T: +353 (0)1 802 3333, F: +353 (0)1 803 6060

Easi-Sump® is manufactured under contract by:
Titan Environmental Limited.

Easi-Sump® *Cap-Link*® is manufactured under contract by:
MFP Plastics Ltd., Lucan, Co. Dublin.

INTENDED USE:

Radon (incl. Rn-222, Rn-220, RnD) is a naturally occurring radioactive gas which enters buildings from the underlying soil. The gas can accumulate within a building to such a concentration as to constitute a health hazard.

Radon is excluded from buildings using passive and active systems. The provision of an active sub-floor radon soil gas control system, designed and installed by competent personnel, will further reduce the risk of a building having radon activity above a recommended target health level of 10-40 Bq/m³ (USA).

All new buildings should be designed and constructed with features which facilitate post-construction radon removal from interior spaces and superstructure construction cavities (see Figure 1). Should radon levels increase, because of time-dependent or other factors during the lifecycle of a building, the *Easi-Sump* and *Easi-Sump Cap-Link* Assembly is specifically designed to be converted, with ease, into an active protection measure.

The most important passive radon protection measure consists of a properly installed radon resisting membrane extending across the whole of a building, including the ground floor and all walls. This measure also ensures a necessary degree of separation in a floor construction, so that:

- prior to activation of the sub-floor radon soil gas control system, the likelihood of radon entry into the building is not increased due to the presence of a gas permeable layer at foundation level;

- b) in the event that the control system is activated, there will be no effects on heat producing appliances or the patterns of natural ventilation in interior spaces, and heat losses will not be increased.

The *Easi-Sump* and *Easi-Sump Cap-Link* Assembly is not intended to deal with:

- (i) soil gases other than radon, e.g. volatile organic compounds from underground storage tanks, or the range of gases from landfill sites;
- (ii) radon activity in a building which is caused by radon emissions from the building's water supply, or from construction products used in the building's superstructure.

1.1 ASSESSMENT

In the opinion of NSAI Agrément, the *Easi-Sump* and *Easi-Sump Cap-Link* Assembly is suitable, and fit, for the intended use defined above. It meets the requirements of the Building Regulations 1997 - 2009 as indicated in Section 1.2 of this Detail Sheet. When activated, the Assembly also meets the relevant requirements of Health & Safety Legislation 1989 to 2006.

1.3 BUILDING REGULATIONS 1997 to 2009 REQUIREMENT:

Part D – Materials and Workmanship

D3 – The *Easi-Sump* and *Easi-Sump Cap-Link* Assembly, as certified in this Detail Sheet is comprised of 'proper materials' which (as an assembly) are fit for their intended use in Ireland.

D1 – The *Easi-Sump* and *Easi-Sump Cap-Link* Assembly, as certified in this Detail Sheet, meets the requirements of the Building Regulations for the use of 'proper materials'. The Certificate contains guidance on proper workmanship.

Part A – Structure

A1 – Loading

The *Easi-Sump* and *Easi-Sump Cap-Link* Assembly when installed as shown in this Detail Sheet, has adequate strength and robustness to withstand normal construction loading.

A2 – Ground Movement

The *Easi-Sump* and *Easi-Sump Cap-Link* Assembly, when installed as shown in this Detail Sheet, will accommodate a limited degree of the normal ground movement to be expected over the lifecycle of a building.

Part B – Fire Safety

B2, B3 & B4 – Internal & External Fire Spread

The *Easi-Sump* and *Easi-Sump Cap-Link* Assembly, when installed as shown in this Detail Sheet, is completely separated from the internal spaces, superstructure construction cavities and the external surfaces of a building; it therefore meets these requirements of the Building Regulations. As a precaution against tampering and unauthorised interference, the cover of the *Easi-Sump Cap-Link* is secured with stainless steel screw fixings.

Part C – Site Preparation and Resistance to Moisture C3 – Dangerous Substances

The *Easi-Sump* and *Easi-Sump Cap-Link* Assembly, when installed as shown in this Detail Sheet, is a necessary and reasonable precaution to be taken in order to avoid the risk of danger to human health caused by radon soil gas; it therefore meets this requirement of the Building Regulations.

C4 – Resistance to Weather and Ground Moisture

The *Easi-Sump* and *Easi-Sump Cap-Link* Assembly, when installed as shown in this Detail Sheet, does not penetrate or interfere in any way with the radon resisting membrane or damp resisting membrane in a building.

Part F – Ventilation

F1 – Means of Ventilation

The *Easi-Sump* and *Easi-Sump Cap-Link* Assembly, when installed as shown in this Detail Sheet, is completely separated from interior spaces; it will therefore not affect the patterns of natural ventilation in a building.

Part J – Heat Producing Appliances

The *Easi-Sump* and *Easi-Sump Cap-Link* Assembly, when installed as shown in this Detail Sheet, is completely separated from the internal spaces of a building and will therefore not affect the operation of heat producing appliances; it will also not prejudice the fire protection of buildings local to fireplaces or flues.

Part L – Conservation of Fuel and Energy

The *Easi-Sump* and *Easi-Sump Cap-Link* Assembly, when installed as shown in this Detail Sheet, is completely separated from the internal spaces of a building; system activation will not result in increased heat losses.

Part M – Access for People with Disabilities

The *Easi-Sump* and *Easi-Sump Cap-Link* Assembly, when installed as shown in this Detail Sheet, will facilitate access to, and egress from, buildings; it therefore meets the requirements of this Part of the Building Regulations.

1.3 HEALTH & SAFETY LEGISLATION 1989-2006

When activated in an occupied building, the *Easi-Sump* and *Easi-Sump Cap-Link* Assembly, as certified in this Detail Sheet, meets the relevant requirements of the following legislation:

- Safety, Health & Welfare at Work Act, 1989;
- Regulations (1993-2006), made under the above 1989 Act – which implement the ‘safety at work’ European Directives;
- Radiological Protection Act, 1991 (Ionising Radiation) Order, 2000 – which implements European Council Directive 96/29/Euratom at national level.

2.1 PRODUCT DESCRIPTION

This Detail Sheet relates to the *Easi-Sump* and *Easi-Sump Cap-Link* Assembly. The *Easi-Sump* is a robust, medium density polyethylene product. The *Easi-Sump Cap-Link*, and standard drainage pipes and fittings, are all unplasticized polyvinyl chloride products. General descriptions of the *Easi-Sump*, the *Easi-Sump Cap-Link*, and drainage pipes and fittings are provided below.

The *Easi-Sump* is a three-dimensional, shallow, octagonal, and hollow product; it has a solid roof, with an upstand; it has solid sides, with projecting spigots from four opposing sides (each suitable for the insertion of 110mm diameter drainage pipe); and it has an open base. The *Easi-Sump* is supplied with one spigot open and three blanked-off, but a clearly visible groove in each spigot shaft guides cutting for easy removal of additional blanks on site, as required. See Figure 3.

The *Easi-Sump Cap-Link* is a compact product with two functions:

- it ‘caps’ the sub-floor network at an appropriate external location, facilitating a gas tight connection with a standard 100mm diameter pipe;
- it ‘links’ the *Easi-Sump* and *Easi-Sump Cap-Link* Assembly, with ease and convenience at any later time in the lifecycle of a building, to a system activation kit.

For security, the *Easi-Sump Cap-Link* cover is retained in position with stainless steel screw fixings.

Standard drainage pipe (PVC-U), which has a nominal diameter of 110mm, is used throughout. Standard pipe fittings complete the assembly.

Easi-Sump:

(See Figure 3 and Table 1 for more information)

Product Weight: 1.85 kg

Colour: black

Easi-Sump Cap-Link:

(See Figure 2 for a detailed specification)

Product Weight: ESCL01 0.61kg

ESCL02 0.92kg

Colour: black

Drainage Pipes and Fittings:

Underground, the drainage pipes and fittings used in this assembly must be manufactured in accordance with European Standard EN 1401-1:1998 *Plastics piping systems for non-pressure underground drainage and sewerage – Unplasticized polyvinyl chloride (PVC-U) – Part 1: Specifications for pipes, fittings and the system.*

Above ground, pipes and fittings used for system activation must be manufactured in accordance with European Standard EN 1329-1:1999 *Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure – Unplasticized polyvinyl chloride (PVC-U) – Part 1: Specifications for pipes, fittings and the system.*

2.2 MANUFACTURE

The *Easi-Sump* is manufactured by a rotational moulding process from medium density polyethylene.

The *Easi-Sump Cap-Link* is manufactured by an injection moulding process from unplasticized polyvinyl chloride (PVC-U).

2.2.1 Quality Assurance & Product Quality Control

Appropriate quality assurance procedures, which conform to EN ISO 9001:2000 *Quality management systems – Requirements*, are operated by both manufacturers.

Easi-Sump

Quality control checks are carried out on raw materials, during production, and on the final products where appearance, colour, dimensions, thickness, weight, and freedom from defects are continually checked.

Easi-Sump Cap-Link

Quality control checks are carried out on raw materials, during production, and on the final products where appearance, colour, dimensions, freedom from defects, impact strength, and water tightness are continually checked.

2.3 DELIVERY, STORAGE AND MARKING

The *Easi-Sump* is supplied on pallets. The product name, supplier's name, address and contact information, together

with the NSAI Agrément Certificate Number, recycle logo, material code and production batch code are moulded into the polyethylene. Each product is supplied with an installation instruction leaflet.

The *Easi-Sump Cap-Link* is supplied in boxes. The product name, supplier's name, address, and contact information, together with the NSAI Agrément Certificate Number are moulded into the cover. Each product is supplied with an installation instruction leaflet.

Standard drainage pipes and fittings are supplied from hardware suppliers and builders' merchants throughout Ireland.

Easi-Sump and *Easi-Sump Cap-Link* should be stored in clean, dry conditions, and within an ambient temperature range of -10°C to $+35^{\circ}\text{C}$. They should also be protected from extended exposure to ultraviolet light, i.e. sunlight.

2.4 ASSEMBLY INSTALLATION PROCEDURES

2.4.1 General

Installation of the *Easi-Sump* and *Easi-Sump Cap-Link* Assembly should be strictly in accordance with this Certificate, and with the supplier's instructions. The design and installation of a Radon Soil Gas Control System should be carried out, supervised and controlled by competent personnel only.

Installation should include the following tasks:

Task No.1: When deciding on an appropriate external location for an *Easi-Sump Cap-Link*, it is essential to avoid re-entry of radon gas into interior spaces should a Radon Vent Pipe (RVP) be installed at a later time in the building's lifecycle. The following constraints would apply when a Radon Soil Gas Control System is activated:

1. There should be no openings into a building, e.g. windows, vents, or vertical control joints, less than 300mm from any part of the RVP.
2. The terminal unit of the radon vent pipe should be positioned at least 300mm above the surface of the roof and 900mm above any window or other opening into the building. It should be located at least 3m away from any window or opening that is less than 900mm below the terminal unit. See Diagram 1.
3. All exposed and visible vertical radon vent pipes should be clearly identified.

Task No.2: The hardcore layer in the floor construction of a building should be clean, dry, well-compacted, and gas permeable (following the compaction process), i.e. suitable material (preferably of single size) should be used which is greater than 10mm and less than 50mm, with no fines (or to an equivalent specification which results in adequate permeability following compaction).

Easi-Sump Cap-Link

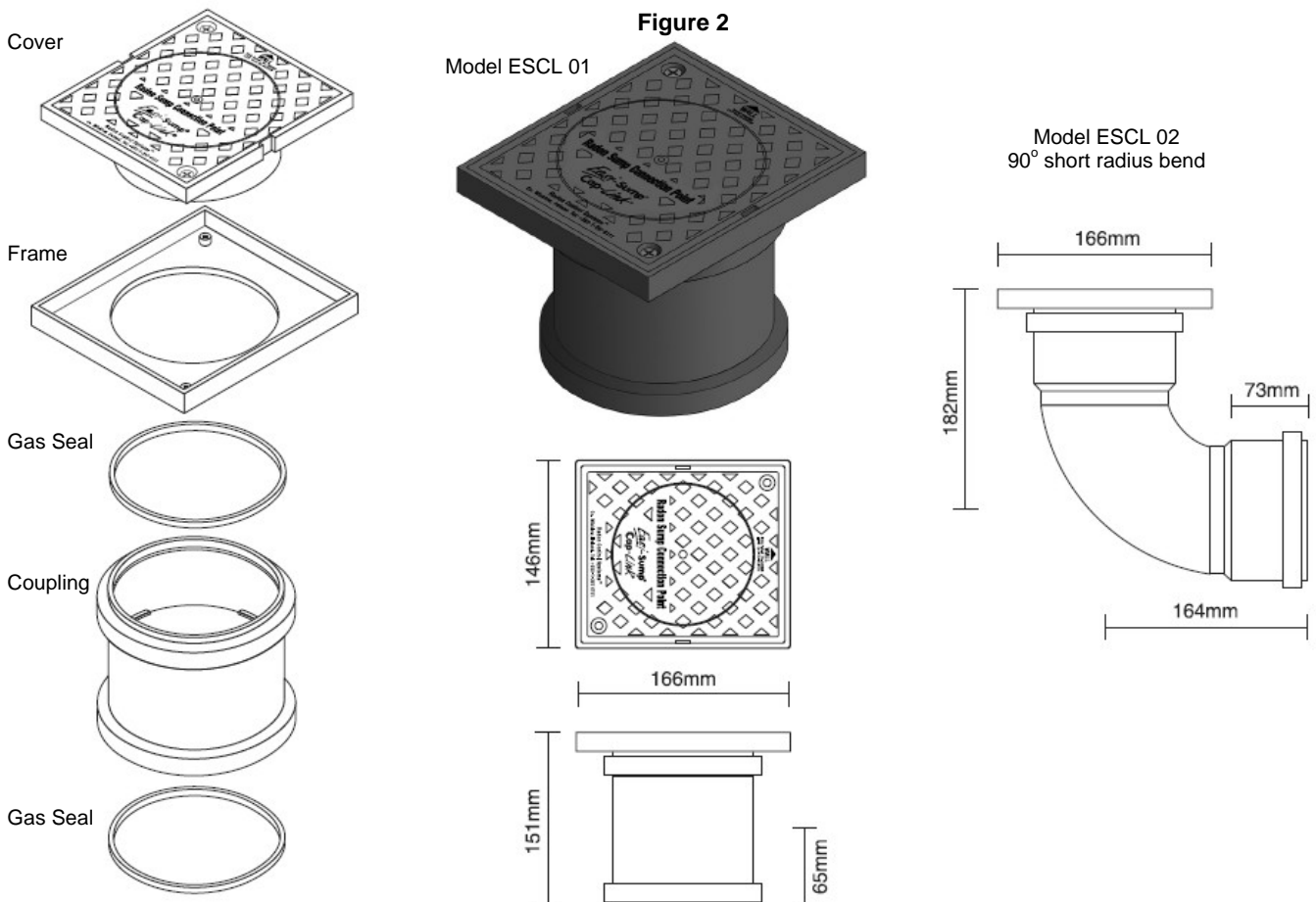
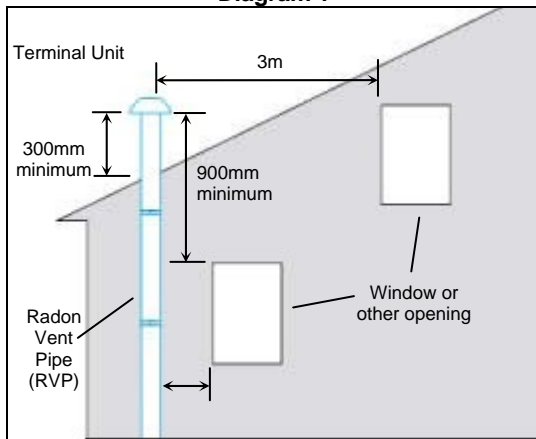


Diagram 1



The *Easi-Sump* is placed within this hardcore layer. See Figure 1 on the front cover of this Detail Sheet.

Each *Easi-Sump* should be placed centrally in an area of hardcore. In buildings where there may be many foundation compartments, a short length of 110mm diameter pipe (or a gap of similar size) should be inserted in all internal foundation rising walls, at centres not exceeding 1m and at approximately the same level as the *Easi-Sump*. This will ensure that the permeability of the hardcore layer remains effective throughout the extent of the building's foundations. See Figure 4.

In the event that a sub-floor radon soil gas control system is activated, it is important that heat producing appliances and the patterns of natural ventilation in interior building spaces should not be affected, or that heat losses be increased. To ensure a necessary degree of separation in the construction of a ground floor, a Radon Resisting Membrane should always be installed by competent personnel.

The *Easi-Sump* has four spigots, intended for the insertion of 110mm diameter drainage pipes. See Figure 3. Typically, one of these pipes should be laid, in accordance with standard drainage pipe installation procedures, to connect with the *Easi-Sump Cap-Link*, which is located just outside the external wall of the building. The other blanked-off spigots should be opened, as required, to accept pipe inserts coming from another part of the building's foundation, and/or another *Easi-Sump*. For reasons of condensation control, falls in pipework should be towards the *Easi-Sump*.

Depending on the quality of ground floor specification, whether or not it is accurately followed on site, the quality of workmanship, and level of technical control during this critical phase of construction, the effective pressure field of the *Easi-Sump* may extend well beyond an area of 250m², or fall below 50m².

As a general rule:

- with Category A Construction Execution, allow for one *Easi-Sump* to service an area not greater than 200m²;
- with Category B Construction Execution, allow for one *Easi-Sump* to service an area not greater than 100m²;
- with Category C Construction Execution, allow for one *Easi-Sump* to service an area not greater than 50m².

(See Clause 3.3 for classification of categories).

Extra *Easi-Sump*'s may be added, or interlinked, to a sub-floor network in order to service larger areas.

Task No.3: Before connecting the *Easi-Sump* to an *Easi-Sump Cap-Link*, however, a 110mm pipe exiting a building must be installed in a masonry opening which should:

- a) be of sufficient size – to accommodate any reasonable construction settlement during the building's lifecycle which might interfere with the pipe;
- b) have adequate structural support above the opening – in order to prevent any damage being caused to the pipe from masonry loading overhead;
- c) have an approved flexible seal between the pipe and masonry – in order to avoid the possibility of drawing in air from the exterior thereby reducing the effectiveness of an activated radon soil gas control system. Provide 50mm to 60mm clearance around the pipe to allow for sealing.

Beyond this exit point from the building, all pipework must be gastight.

Task No.4: Complete installation by connecting the *Easi-Sump Cap-Link* to the 110mm pipe leading from the *Easi-Sump*. The cover of the *Easi-Sump Cap-Link* is supplied already in position, with stainless steel screws pre-fixed. This is to prevent:

- (i) tampering and/or unauthorised interference;
- (ii) rain penetration and/or vermin entry into the sub-floor network of the building.

When a Radon Soil Gas Control System is being activated, a circular section of the cover is removed to install a Radon Vent Pipe. This section is of sufficient size to accept a 110mm PVC-U pipe, with a small clearance all around. A central drill locator mark in the cover facilitates removal on site.

Existing Buildings

Should the installation of an activated radon soil gas control system (with a resulting alteration to sub-floor pressure) ever be considered in an existing building, it must always be established, prior to the commencement of any works, that there is sufficient separation between the sub-floor construction and interior spaces and superstructure construction cavities. Depending on age, an existing building may or may not have a ground floor Radon Resisting Membrane, or a damp resisting membrane.

Easi-Sump

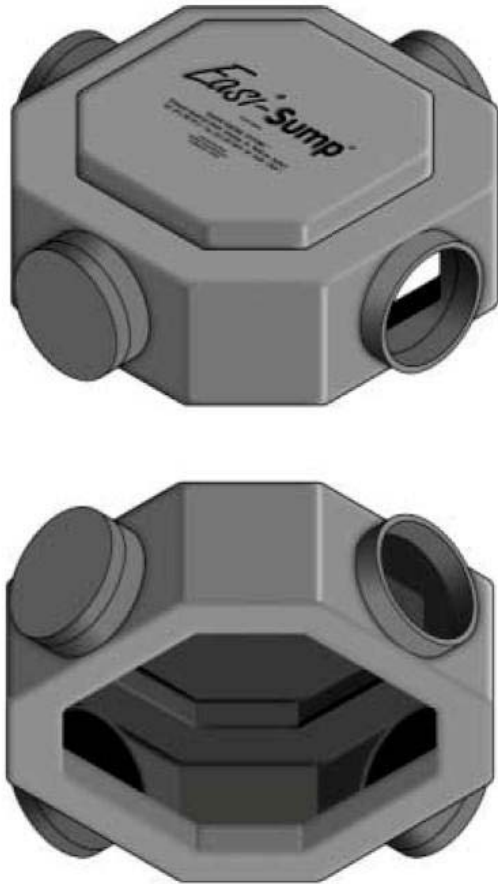
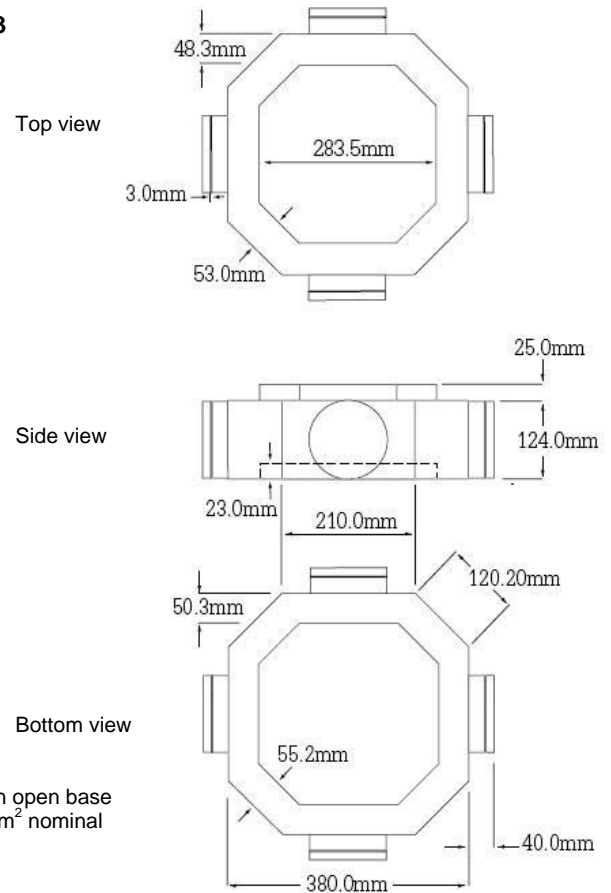


Figure 3



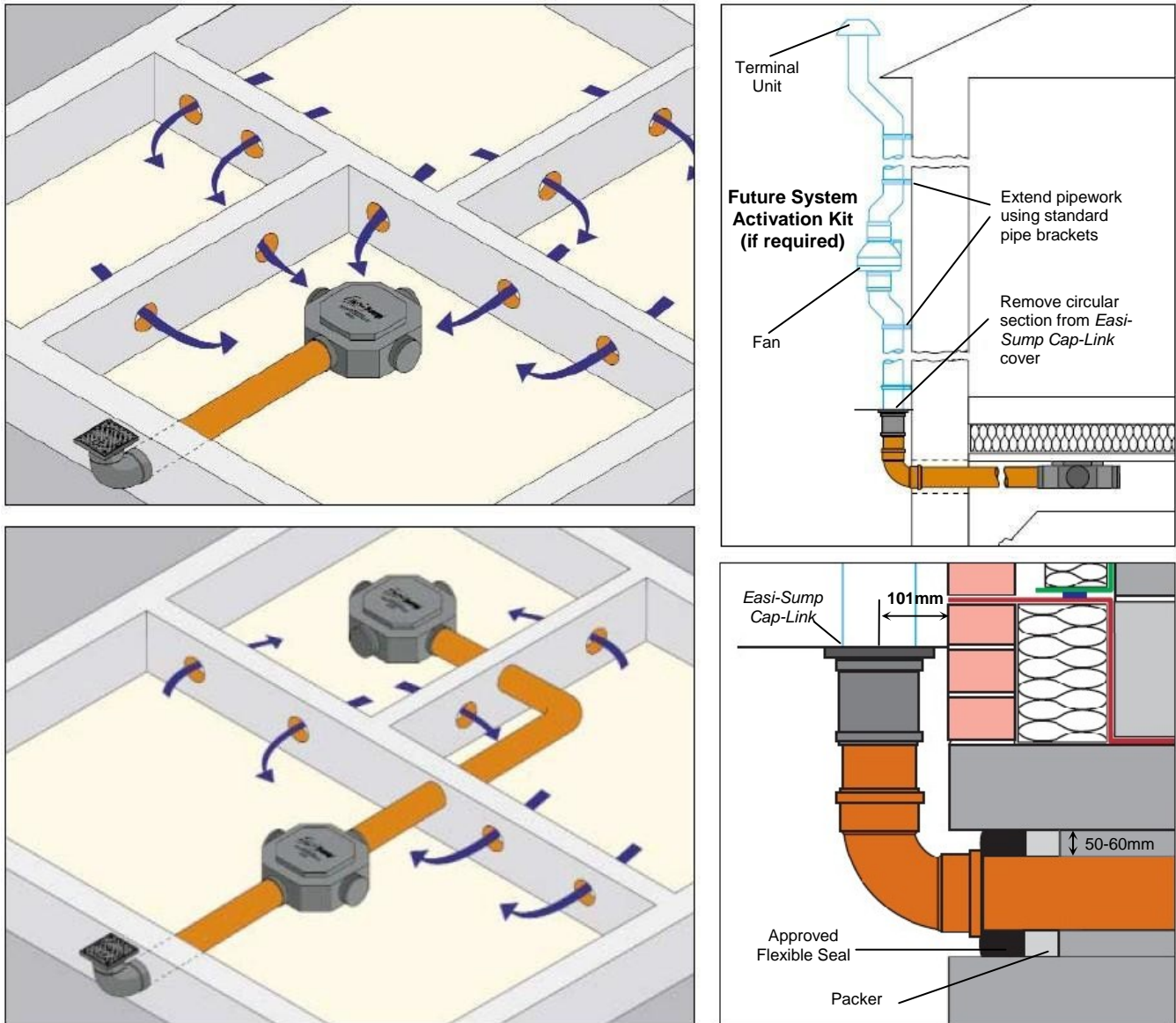
Easi-Sump has an open base area of 72,000mm² nominal

Table 1: Easi-Sump Technical Data

Test	Method	Results	Observations & Comments
Product Material Identification & Properties	Fourier Transform Infra-Red, in transmittance mode	Product matched to a polyethylene-based material	These materials have inherently good chemical resistance, and good low temperature toughness.
Product Relative Density	Density Gradient Column	Mean Density 0.944g/cm ³	Typical of a medium density polyethylene.
Product Weight	Calibrated Scales	Mean Weight 1856.8g	
Product Wall Thickness	Calibrated Ultrasonic Thickness Gauge	Mean Thickness 4.93mm	All wall thickness measurements above 4mm. Thickness variability typical of a rotationally moulded product.
Short Term Creep – 4 hrs (Compression Test No.5)	Lloyd LR50K Tensometer, using parallel plates	Mean Deflection at 480N (0.48kN/m ²) 6.96mm	480N, or 48kg, is equivalent to initial setting of 150mm concrete slab above product.
Compression Test No.2	Lloyd LR50K Tensometer, using parallel plates	Mean Deflection at 10,260N (10.26kN/m ²) 27.33mm	Up to 3,420N (3.42kN/m ²), there is approximate linear relationship between load and a deflection of 24mm. Above this load, the top section of the product is fully compressed into main body. A tripling of load results in only a further 3mm deflection.
Drop Tests	6 Metre Drop (2 storey height)	Some scratching, and denting (slight deformation of the product contour)	No failures or defects which might affect product performance.
Puncture Tests	Lloyd LR50K Tensometer, using (i) pointed, and (ii) blade type indentors	(i) Puncture at mean 486.5N, with mean deflection of 18.81mm; (ii) Puncture at mean 1899N, with mean deflection of 52.0mm	Product has very good resistance to puncture.

The complete test report may be inspected, upon request to the supplier

Figure 4



3.1 GENERAL

It is recommended that the design team of a building should develop a radon protection strategy which is specific to a particular construction site.

Resulting radon activity in the interior spaces and superstructure construction cavities of buildings, including dwellings and workplaces, depends principally on the following factors:-

1. Concentration and pressure of radon activity in the soil;
2. Soil permeability – including moisture conditions (radon is water soluble);
3. Source of hardcore used in building foundation construction;
4. Building design;
5. Quality of building construction;
6. Operation of the completed building by its users, e.g. heating of interiors which causes pressure difference with the exterior or whether or not there is adequate fresh air ventilation;
7. Time-dependent factors, e.g. changes in wind and atmospheric pressures.

There are so many variables, that one radon protection measure, on its own, may not entirely succeed in ensuring an adequate level of human health protection from the hazard of radon. A combination of measures will usually be required. It is for this reason that a

properly installed radon resisting membrane should always be considered.

Every new building should also be designed and constructed with features which facilitate further post-construction radon removal from interior spaces and superstructure construction cavities, in the event that radon levels increase at any period during its lifecycle. The *Easi-Sump* and *Easi-Sump Cap-Link* Assembly are specifically designed to be converted, with ease, into an active protection measure by installing a radon vent pipe and an electrically operated ventilation fan. One Radon Soil Gas Control System is recommended per building. 'Communal' or shared connection of systems from more than one property is not recommended.

3.2 SITE CONDITIONS

The *Easi-Sump* and *Easi-Sump Cap-Link* Assembly may be installed in all site conditions considered normal for Ireland. Should a building's foundations be continuously waterlogged for extended periods during the heating season, it may be necessary to install further radon protection measures.

3.3 CATEGORIES OF CONSTRUCTION EXECUTION

Category A

- (a) Supervision of the works is exercised by appropriately qualified and experienced personnel from the principal construction organisation.
- (b) Regular inspections, by appropriately qualified and experienced personnel familiar with the design and independent of the construction organisation(s), are carried out to verify that the works are being executed in accordance with the design.

Category B

Supervision of the works is exercised by appropriately qualified and experienced personnel from the principal construction organisation.

Category C

This level of construction execution is assumed when the requirements for Category A and Category B are not met.

3.4 POST-CONSTRUCTION TESTING FOR RADON

Upon completion of a building and again, at least, after a period of 12 months following completion, it is recommended that indoor radon levels be reliably tested in order to ensure the continued effectiveness of the radon protection strategy.

3.5 ACCESSIBILITY FOR PEOPLE WITH ACTIVITY LIMITATIONS

In detailing a ground floor construction for any building, special consideration should be given to accessibility (see Part M, Building Regulations 1997 to 2006) of entrances and fire exits for people with activity limitations. See Figure 1 on the front cover of this Detail Sheet.

4.1 TESTS / ASSESSMENTS

The following is a summary of the technical investigations carried out on the *Easi-Sump* and *Easi-Sump Cap-Link* Assembly. Detailed results from the *Easi-Sump* Test Programme are shown in Table 1.

4.2 MAINTENANCE

When installed in accordance with this Detail Sheet, no maintenance of the *Easi-Sump* and *Easi-Sump Cap-Link* Assembly is required.

4.3 DURABILITY

When installed in accordance with this Detail Sheet, the lifecycle of the *Easi-Sump* and *Easi-Sump Cap-Link* Assembly will match that of the building.

When installed in accordance with this Detail Sheet, the *Easi-Sump* and *Easi-Sump Cap-Link* Assembly is protected from ultraviolet light. The cover of the *Easi-Sump Cap-Link* is adequately resistant to ultraviolet light.

4.4 BEHAVIOUR IN FIRE

When installed in accordance with this Detail Sheet, the *Easi-Sump* and *Easi-Sump Cap-Link* Assembly is completely separated from the internal spaces, superstructure construction cavities and the external surfaces of a building; it will, therefore, not contribute to the growth and development stages of a fire, or present a smoke/toxic gas hazard. As a precaution against tampering and unauthorised interference, the cover of the *Easi-Sump Cap-Link* is secured with stainless steel screw fixings.

4.5 OTHER INVESTIGATIONS

- a) Date on properties of the Assembly's component products, in relation to strength and toxicity, were assessed;
- b) The manufacturing processes were examined, including the procedures adopted for quality assurance and control. Information was obtained on the quality and composition of product component materials.