KNAUF INSULATION

August 2008: Issue 1

Non - Residential New Build
4.5 Basements

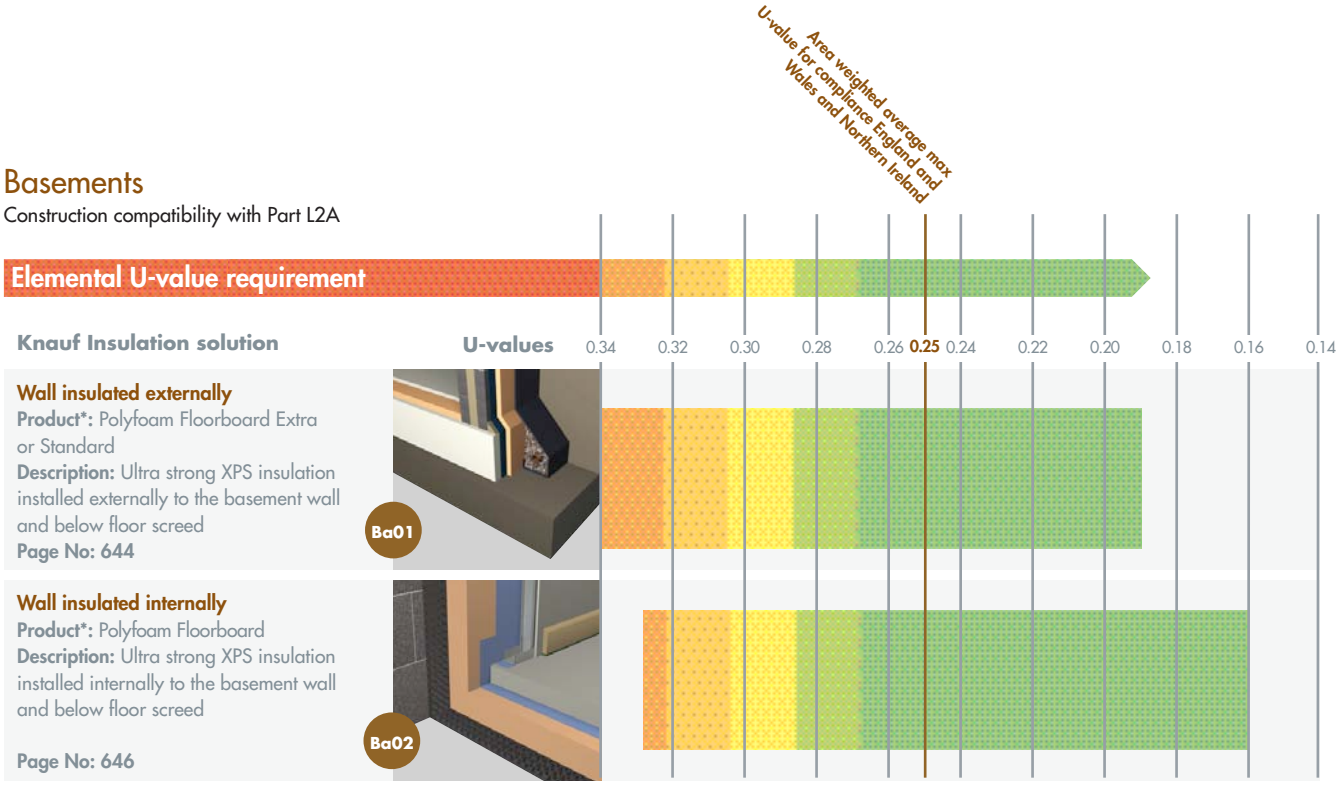
energy saving | warmth | quietness | fire protection | sustainability

Non-residential New Build

Basements Contents

Basements

Solution optimiser and pathfinder



The systems identified in this section offer maximum protection against possible damp problems as the insulation selected is closed cell and thus highly resistant to water in both liquid and vapour form. Other wall lining systems could be used for basement walls where the specifier is confident that damp penetration and condensation problems will not occur. Examples of these are detailed in the External Walls section.

Key

- U-values achievable by constructions within this document.
- * Recommended Knauf Insulation product(s). Other products may be applicable.
- Pb01 Find online. Visit www.knaufinsulation.co.uk and key in construction code to find the most up to date information on your chosen solution.

Calculating U-values for Basements

Heated basement

U-value calculations for basement floors are very similar to the method used for a concrete ground bearing slab plus an allowance for the average depth of the basement. The perimeter and area of the basement floor need to be taken into consideration as does the type of ground upon which the basement bears and the thickness and thermal performance of the basement wall.

When a basement floor is insulated it is possible that this will cause the U-value of the basement walls to increase. As heat flow through the insulated floor will decrease making the ground colder which results in an increase in the heat flow through the basement walls. It is therefore better to calculate the U-values for the basement floor and walls together and then assess the total heat loss from the basement.

Unheated basement

An unheated basement will usually have insulation installed within or above the floor deck which separates the heated areas from the basement.

The basement U-value will depend on the average depth of the basement, the perimeter and area of the basement floor, the height of the floor above ground level, and an allowance for the ventilation of the basement based on the number of air changes per hour. The overall calculation of the heat loss from the basement includes the U-value for the floor and walls, and the U-values for the walls are calculated in the same way as for a heated basement.

Basements

Basement design

Waterproofing

BS 8102: 1990 Code of practice for protection of structures against water from the ground, gives three categories of waterproofing for a basement:

Tanking

A continuous waterproof barrier is applied to the inside or outside of the basement structure.

Structurally integral protection

Usually water resistant concrete in combination with a waterproof membrane.

Drained cavity

Cavities are formed within the walls and floor to collect and drain away the ingress of water.

Heat loss

The pattern of heat loss from a basement wall is complex, with the rate of heat loss diminishing as the depth of the basement increases. This is due to the insulation value of the ground behind the basement wall.

A method for calculating U-values for basements is given in BS EN ISO 13370.

Position of insulation

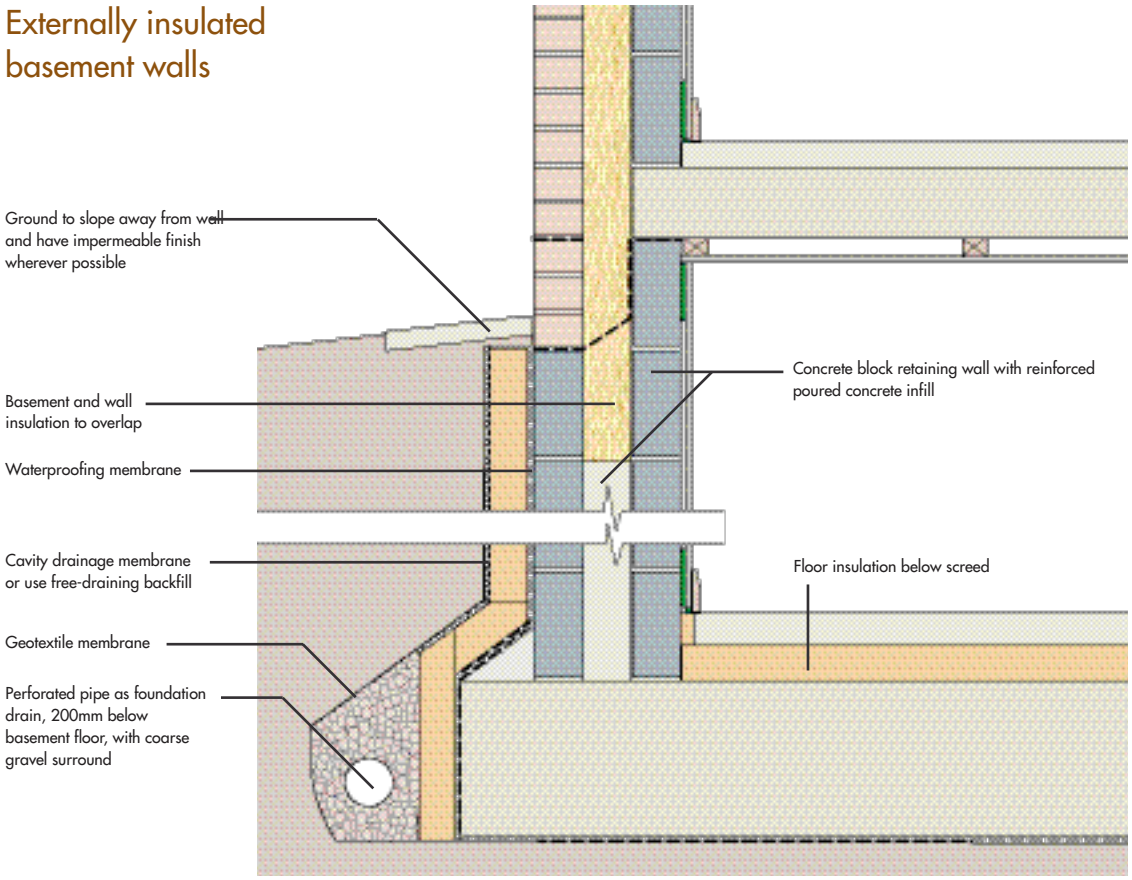
External rigid insulation is the preferred method for insulating new basement walls.

Externally insulated

External insulation is the preferred option for basements as the whole structure is kept warm, with negligible risk of condensation. The insulation should be placed up against the waterproofing membrane. Polyfoam extruded polystyrene is recommended because it has negligible moisture absorption and high compression resistance.

A drainage membrane or layer of washed no fines gravel should be placed adjacent to the insulation. This relieves hydrostatic pressure and channels water to the foundation drain. The membrane or gravel should be covered with a geotextile to prevent fines from blocking the drainage material.

Externally insulated basement walls



Internally insulated

Internal insulation of basement walls is only recommended for existing basements where it is not possible to insulate the basement externally. New basements should be insulated externally.

Any insulation system applied to the interior of the basement should have the following properties:

- It must allow the basement wall to dry out to the inside, for example by means of a cavity drainage system
- It must prevent warm moist air reaching the cold basement wall and condensing. A vapour control layer should always be installed on the warm side of the insulation, all joints and perforations should be well sealed
- Materials in contact with the basement wall and floor must be moisture tolerant

The detail below shows a solution for an existing basement with solid brick walls.

There is a drained cavity system directly behind the brickwork which drains to a sump.

The insulation should ideally be closed cell, such as Polyfoam. A vapour control layer should be provided to the face of the insulation to prevent moisture vapour from the basement rooms condensing on the cold cavity drainage system.

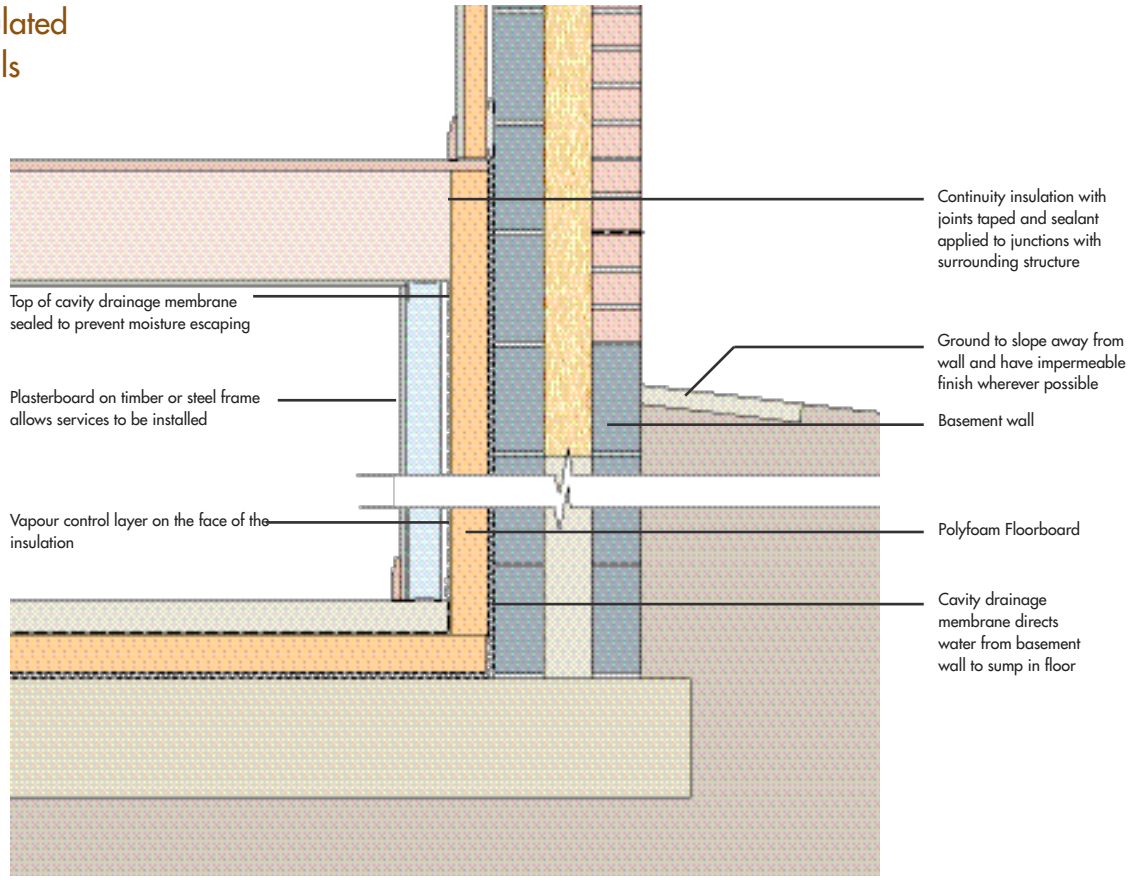
design detail finder
Knauf Insulation solutions for these types of construction can be found on pages 642-647

Other considerations

The land around the building should slope away from the basement walls. Ideally the area adjacent to the building should have an impermeable finish, such as paving.

For new basements, a drain should be located around the perimeter of the basement and positioned at least 200mm below the finished level of the basement floor. It should be bedded and surrounded in free draining aggregate and wrapped in a geotextile before backfilling, to prevent fines from blocking the drain.

Internally insulated basement walls



Basements

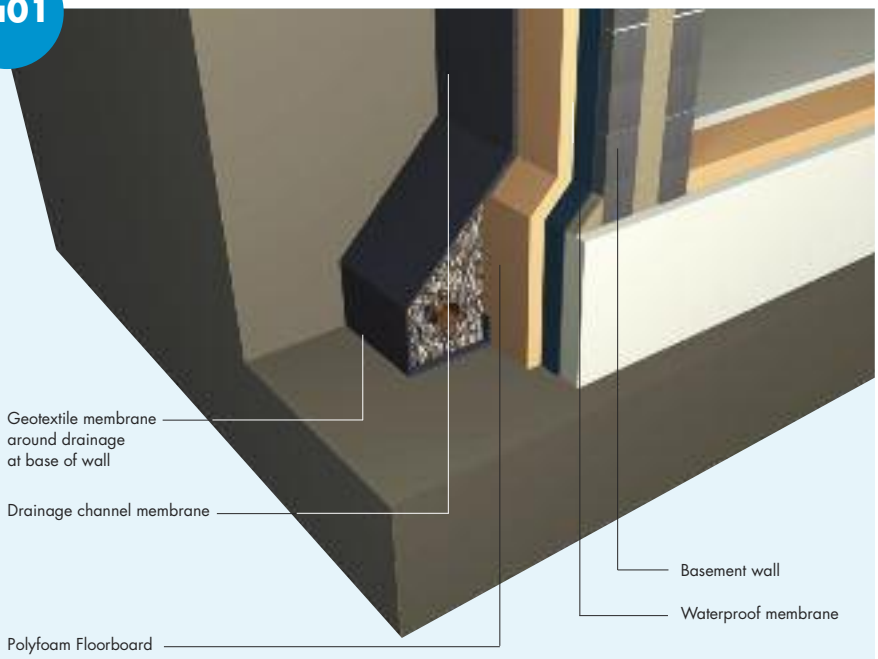
Wall insulated externally

Polyfoam Floorboard

Ba01

Advantages

- ✓ **Long term exposure to water has negligible impact on the thermal performance of Polyfoam**
- ✓ **Polyfoam is a very robust product, able to withstand the pressure exerted by backfill without compromising integrity or thermal performance**
- ✓ **The insulation layer separates and protects the waterproofing layer from the backfill**
- ✓ **Keeps the structure warm and creates a 'thermal store' in the walls**



Products

Polyfoam Floorboard is 100% ozone friendly, extruded polystyrene, rigid board insulation. It is lightweight, yet has excellent structural strength and long term effectiveness.

It is available in two grades that are suitable for this application:

Standard – domestic and light commercial loading

Extra – commercial, industrial flooring and cold storage

Polyfoam Floorboard Standard and Extra are square edged boards.

Typical construction

Masonry or in-situ concrete basement walls with Polyfoam Floorboard Standard placed against the tanking membrane. For basements between 2.5m and 5m deep, Polyfoam Floorboard Extra is recommended for its greater compressive strength.

The basement wall insulation is protected by a drainage cavity membrane which also reduces hydrostatic pressure and directs water to the foundation drain.

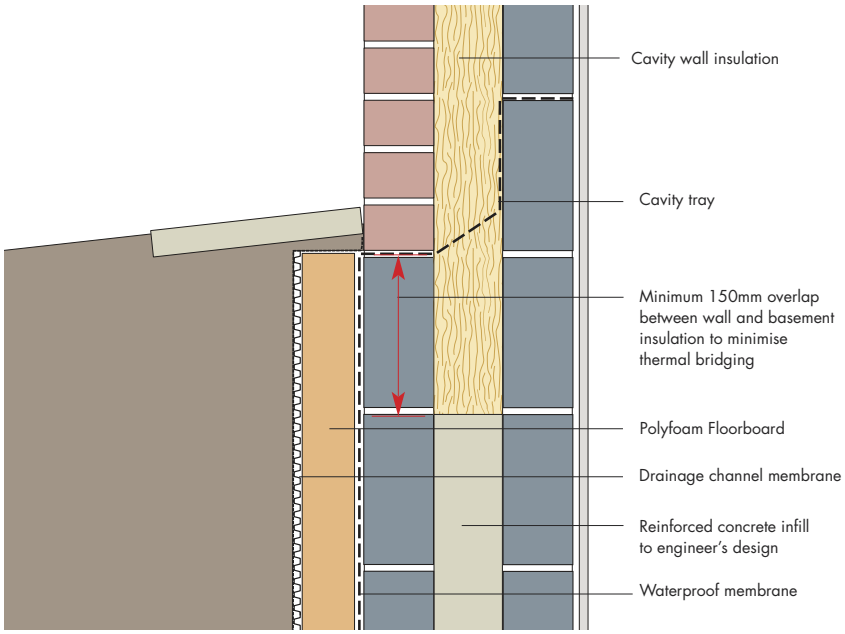
Installation

Polyfoam Floorboard is placed against the tanking membrane and is protected by a drainage cavity membrane.

Carefully backfill with free-draining granular material to hold the drainage cavity membrane and insulation in place.

Polyfoam boards projecting above the ground should be covered by a reflective or light coloured flashing, board or similar to prevent long term exposure of the insulation to UV light.

Junction of basement and external wall



Typical specification

Place Polyfoam Floorboard Standard*/ Extra*, ...mm thick, against the tanking membrane. Cover with a drainage cavity membrane, manufactured by ..... and carefully backfill to hold the insulation in place.

(*delete as appropriate)

NBSPlus Alternatively, refer to NBS clause: M10/40 or M10/290

Performance

Thermal insulation

The thermal conductivities of Polyfoam Floorboard products are as follows:-

Standard: 0.029 W/mK

Extra: 0.029 -0.034 W/mK

Table 82 shows the U-values for a typical basement wall insulated with Polyfoam Floorboard.

Compression resistance

Polyfoam Floorboard is highly resistant to compression and withstands both occasional and long term static loads.

Moisture resistance

Polyfoam Floorboard has negligible water absorption and is unaffected by standing in ground water.

Fire performance

In the construction shown above, Polyfoam Floorboard is completely enclosed by other materials and will not contribute to the development stages of a fire or present a smoke or toxic hazard.

Table 82: Typical U-values for basement walls insulated externally

	U-values (W/m²K) for basement depth (m) of:			
Thickness (mm)	2.0	2.5	3.0	3.5
Polyfoam Floorboard Standard				
85	0.20	0.19	n/a	n/a
75	0.22	0.20	n/a	n/a
65	0.24	0.22	n/a	n/a
50	0.28	0.26	n/a	n/a
35	0.34	0.31	n/a	n/a
Polyfoam Floorboard Extra				
75	n/a	n/a	0.20	0.19
65	n/a	n/a	0.22	0.20
50	n/a	n/a	0.24	0.23
35	n/a	n/a	0.29	0.27
25	n/a	n/a	0.33	0.31

Notes: The U-values have been derived from BS EN ISO 13370 and BCA/NHBC Approved Document Basement for Dwellings. The calculations assume that the basement floor has a U-value of 0.25 W/m²K.

Basements

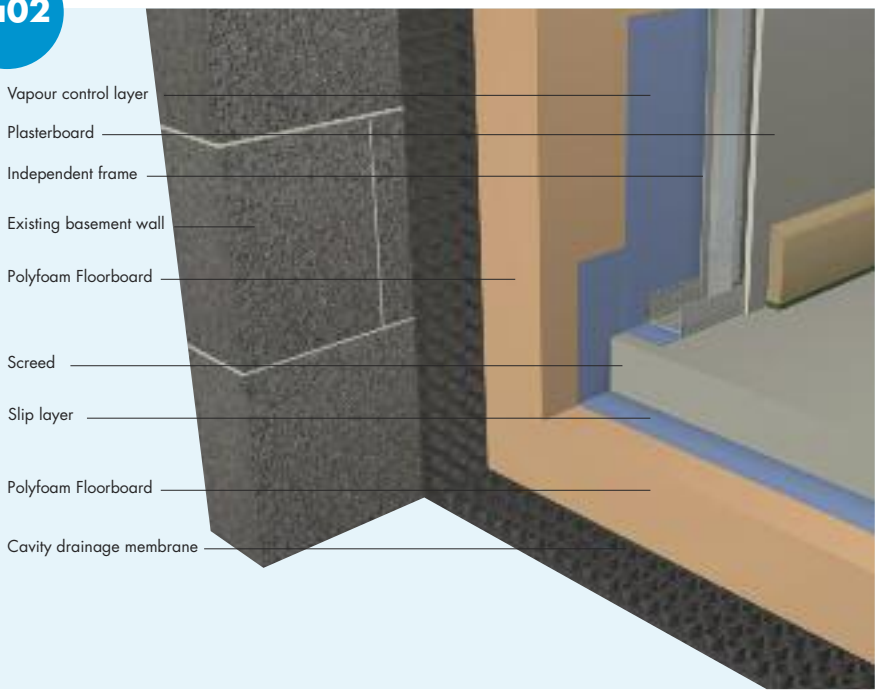
Wall insulated internally

Polyfoam Floorboard

Ba02

Advantages

- ✓ **The high compressive strength of Polyfoam makes it the ideal product for insulating under the floor screed**
- ✓ **Polyfoam is robust and lightweight, making it easy to handle on site and highly resistant to mechanical damage**
- ✓ **Polyfoam Floorboard is a strong and moisture resistant insulation board, its compressive strength accommodates the loads associated with the fit out of the basement**



Products

Polyfoam Floorboard is 100% ozone friendly extruded polystyrene rigid board insulation – it is lightweight yet has excellent structural strength and long term effectiveness

It is available in two grades suitable for this application:

Standard – domestic and light commercial loading

Extra – commercial, industrial flooring and cold storage

Typical Construction

Existing solid brick basement wall with new cavity drainage membrane, Polyfoam Floorboard insulation and Knauf I stud independent lining.

This system is most applicable for existing basement walls. The cavity drainage membrane collects any water that passes through the basement wall and drains it to a sump, from where it is pumped to a drain. Polyfoam Floorboard is fixed to the cavity drainage membrane using a non-solvent based adhesive. The internal lining allows services to be accommodated.

Installation

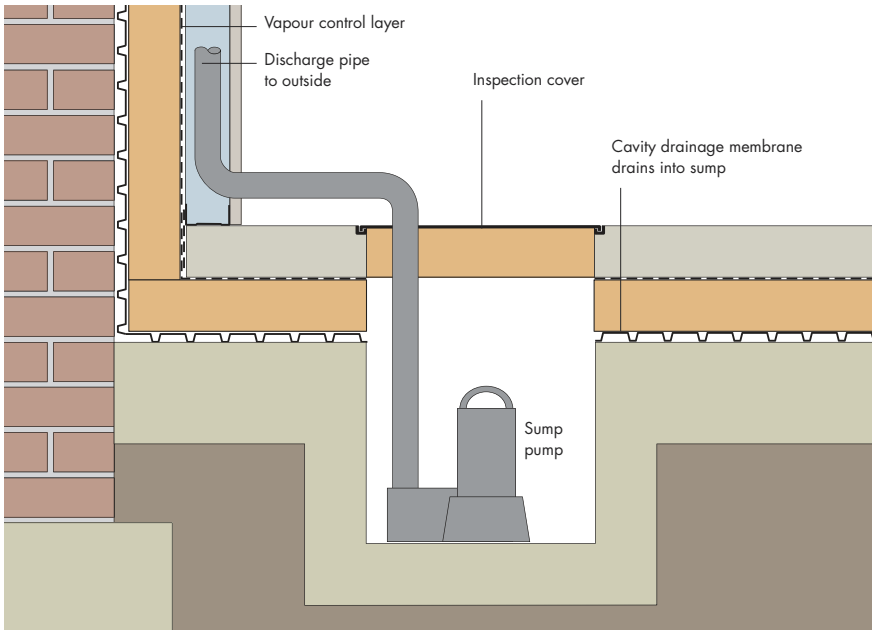
Insulate the basement walls by fixing Polyfoam Floorboard to the cavity drainage membrane using plaster adhesive dabs.

Ensure the floor and wall insulation are closely butt jointed.

It is best practice to include a vapour control layer on the warm side of the insulation. All joints to be adequately sealed. The wall vapour control layer should be sealed to the slip layer placed below the screed.

After the floor slab or screed has been laid, construct the Knauf I stud lining and line the steel studwork with plasterboard.

Sump in basement floor



Typical specification

Polyfoam Floorboard Standard*/Extra* .....mm thick, to be fixed directly against the drainage cavity membrane, by dabs of plaster adhesive.

Tape all joints with an aluminium faced self-adhesive tape. Seal the junction between the Polyfoam Floorboard and the surrounding construction with a water resistant, solvent-free silicone sealant.

NBSPlus Alternatively, refer to NBS clause: M10/40 or M10/290

Performance

Thermal insulation

The thermal conductivities of Polyfoam Floorboard products are as follows:-

Standard: 0.029 W/mK

Extra: 0.029 - 0.034 W/mK

Table 83 shows the U-values for a typical basement wall insulated with Polyfoam Floorboard.

Compression resistance

Polyfoam Floorboard is highly resistant to compression and withstands both occasional and long term static loads.

Moisture resistance

Polyfoam Floorboard has negligible water absorption and is unaffected by standing in ground water.

Fire performance

Polyfoam Floorboard is completely enclosed by other materials and will not contribute to the development stages of a fire.

Table 83: Typical U-values for basement walls insulated internally

	U-values (W/m²K) for basement depth (m) of:			
Thickness (mm)	2.0	2.5	3.0	3.5
Polyfoam Floorboard Standard				
85	0.19	0.18	0.17	0.16
75	0.21	0.20	0.18	0.17
65	0.23	0.21	0.20	0.19
50	0.27	0.25	0.23	0.22
35	0.33	0.30	0.28	0.26

Notes: The U-values have been derived from BS EN ISO 13370 and BCA/NHBC Approved Document Basement for Dwellings. The calculations assume that the basement floor has a U-value of 0.25 W/m²K.

Table 75: Compressive creep results for Polyfoam Floorboards

Product	Load applied (kPa)	Initial compression (%)	Further compression after 50 years (%)
Polyfoam Standard			
	60	2	1.5
Polyfoam Extra			
	120	2	1.5

KNAUF INSULATION

Ref: KB58408

August 2008: Issue 1

www.knaufinsulation.co.uk

www.thinkinsulation.com

2005-2008

thinkinsulation.com
it's time to save energy

Knauf Insulation Ltd.
PO Box 10
Stafford Road
St Helens
Merseyside
WA10 3NS

Customer Service (Sales)
Tel: 0844 800 0135
Fax: 01744 612 007
email: sales@knaufinsulation.com

Technical Advisory Centre (TAC)
Tel: 01744 766666
Fax: 01744 766667
email: tech@knaufinsulation.com

Literature
Tel: 08700 668 660
Fax: 0870 400 5797
email: info@knaufinsulation.com