

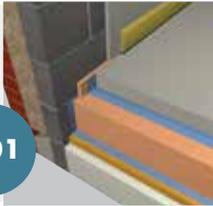
Section 4.1

Ground Floors

Below slab

Product: Polyfoam ECO Floorboard

Gf01



Above slab

Product: Earthwool Thermal Floor Slab Plus

Gf02



Above slab

Product: Polyfoam ECO Floorboard

Gf03



Suspended concrete floor

Product: Polyfoam ECO Floorboard

Gf04



Suspended concrete floor

Product: Earthwool Thermal Floor Slab Plus

Gf05



Suspended timber floor

Product: Earthwool Loft Roll 44 / 40

Gf06



Underfloor heating - Standard system

Product: Polyfoam ECO Floorboard

Gf07



Suspended timber floor

Product: Earthwool Flexible Slab

Gf08



Ground floors

Ground floor design

General

When designing a ground floor the following should be considered in addition to the achievement of the desired U-value.

- Applied floor loading
- Position of the insulation within the floor structure
- Minimising thermal bridging, air leakage and preventing condensation forming

Introduction

Ground bearing floors can include insulation either below or above the concrete slab, depending on the choice of the designer. If the insulation is installed below the slab, this increases the thermal capacity of the building, helping to maintain steady internal temperatures.

If insulation is installed above the slab, the building will respond much more quickly to the heating system.

Suspended floors are usually insulated in such a way that they offer reduced thermal mass and respond quickly to the heating system. In the case of suspended concrete, the insulation is installed above the deck, either under a screed or timber boarding. Suspended timber floors are normally insulated between the joists. Floor insulation is of particular importance if installing underfloor heating. The use of channelled rigid insulation boards can combine the function of floor insulation and housing for the heating pipes.

Applied floor loading

All materials are compressed under load. Insulation materials used under slabs, screeds and chipboard should be capable of accommodating the applied loads with the minimum of compression.

Standardised values are available to the designer for the dead loads applied by building components and the estimated active loads for various types of building use. These form the structural design requirements of the floor, but are of less value when considering the compression resistance requirements of the floor as the active loads are likely to be localised or point loads, not uniformly distributed loads.



Active and dead loads

The actual applied floor load acting on the insulation material has two components:

- The dead load, which is due to the weight of the materials laid on the insulant, and
- The design load associated with the use of the floor

For specific applications the guidance and recommendations contained in BS EN 1991-1-1:2002 and BS EN 1990:2002 +A1:2005 should be followed, and this will help the designer ensure that the strength of the floor will be sufficient to support any applied loads over the loaded area.

The designer must also consider the dynamic loads and how they are applied.

In reality the loads associated with the use of the floor will not be applied uniformly. In fact many loads are applied in a localised way or even as point loads so that whilst the overall load on a floor is in line with the relevant standards the localised loading may be many times higher. For example, a cupboard raised on feet has a significantly increased point loading compared to one sat on the whole base. This results in increased localised loading acting on the insulation.

Position of Insulation

As was previously stated, the position of the insulation in the floor has an influence over the thermal characteristics that the floor brings to the building, however it also has relevance when considering the active loads that apply due to the use of the floor. Obviously, in timber joist floors where the insulation material is placed between the joists the entire load is carried by the joists and there is no load on the insulation. However, where the insulation is below a slab, screed or timber boards the entire load is acting on the insulation.

Point loads are spread by the layers above the insulation so that the load acting on the insulation is lower than the load applied to the floor surface. The spread of a load is a function of the depth of the layer above the insulation. This means that a point load applied to a floor where the insulation is positioned below a thin screed will result in a higher applied load on the insulation than where the insulation was positioned below a thicker floor slab because the load is bearing on a smaller area of insulation under the screed. Of course the differing dead load applied by the screed and the floor slab should also be allowed for when calculating the total load applied to the insulation.

Compression resistance

The insulation material will be compressed by the total load applied to it. It is vitally important that the insulation material has sufficient compression resistance to restrict the effects of the compressive load. Compression resistance is measured in two ways, most commonly the immediate effect of compressive load is measured and this is quoted as a compression resistance in kPa. The applications section shows the compression resistance of individual insulation materials, this is useful in identifying the general suitability of a material for the application intended. The second measurement of compression resistance measures the long term effects of loading on a material and is described as compressive creep. Where higher loads are applied this figure has high relevance as long term loading will result in greater progressive compression of thickness in some insulation materials than others.

Compressive creep

Compressive creep is the measured value of the long term behaviour of a material under load. High resistance to compressive creep is critical for long-term structural performance. The ideal insulation material used in flooring needs to be strong without being brittle over the long term as this will minimise any building movement. A material with superior resistance to compressive creep enables designers to truly optimise their design to maximise the potential uses of the structure without the risk of failure in the medium to long term.

Compressive creep tests are necessarily long term projects as they predict the effect of loading over 50 years. Polyfoam ECO extruded polystyrene (XPS) insulation has been tested for compressive creep and achieved the results shown in Table 1.

Thermal Bridging and Air Leakage

Thermal bridges are a significant source of heat loss and they may also cause localised condensation and mould growth. The details on the following pages illustrate best practice.

Calculation of U-values

Unlike walls and roofs, the heat loss through a ground floor varies with its size and shape. The Building Regulations require that when ground floor U-values are calculated the methodology in BS EN ISO 13370: 1998 should be employed.

This standard uses the ratio of the exposed floor perimeter to the floor area to take account of the variation in heat loss due to floor size and shape.

The measurement of the perimeter and area should be to the finished inside surfaces of the perimeter walls that enclose the heated space. Projecting bays should be included, but unheated spaces such as porches or garages should be excluded.

When considering extensions to existing buildings the floor dimensions may be taken as those of the complete building including the extension.

Determining the U-value

The tables for each ground floor solution show typical U-values for a range of floor constructions, assuming a conductivity of 1.50 W/mK for the ground below the floor.

The high number of variables that have to be taken into account can significantly affect the U-value for a particular set of conditions. Project specific U-value calculations can be supplied by our Technical Advice and Support Centre.

Condensation

A vapour control layer is not normally required for most ground floor constructions. However, a vapour control layer is recommended between the insulation and a chipboard floor, especially if there is a risk of excessive moisture from the floor slab drying out.

Worked example

The following worked example illustrates how to establish the P/A ratio.

Example

A semi-detached house as shown below

$$\text{Perimeter (P)} = 8+4+3+6+5 = 26\text{m}$$

$$\text{Area (A)} = (10 \times 8) - (6 \times 3) = 62\text{m}^2$$

$$\text{Ratio (P/A)} = 26/62 = 0.42$$

A ground floor with a P/A ratio of 0.42 would achieve a U-value of 0.25 W/m²K if insulated with 75mm Polyfoam ECO Floorboard Standard in a ground bearing concrete slab.

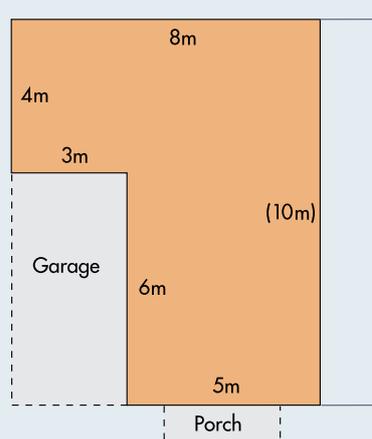
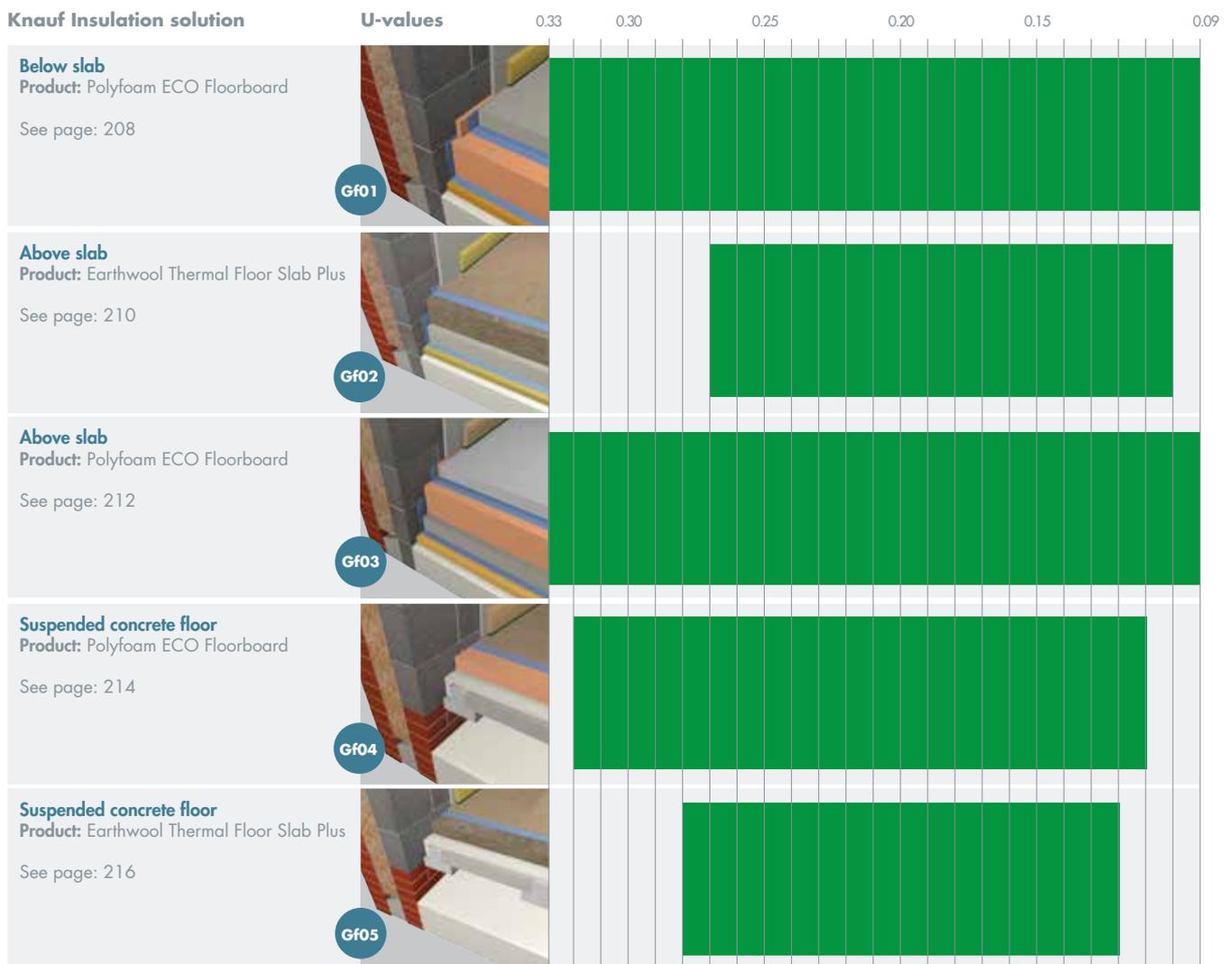


Table 1 - Compressive creep results for Polyfoam ECO Floorboards

Product	Load applied kPa	Initial compression %	Further compression after 50 years %
Polyfoam ECO Floorboard Standard	60	2	1.5
Polyfoam ECO Floorboard Extra	120	2	1.5
Polyfoam ECO Floorboard Super	175	2	1.5

Ground floors

Solution optimiser and pathfinder



Knauf Insulation solution

U-values

0.33 0.30 0.25 0.20 0.15 0.09

Suspended timber floor
Product: Earthwool Loft Roll 44 / 40
 See page: 218



Gf06

Underfloor heating - Standard system
Product: Polyfoam ECO Floorboard
 See page: 220

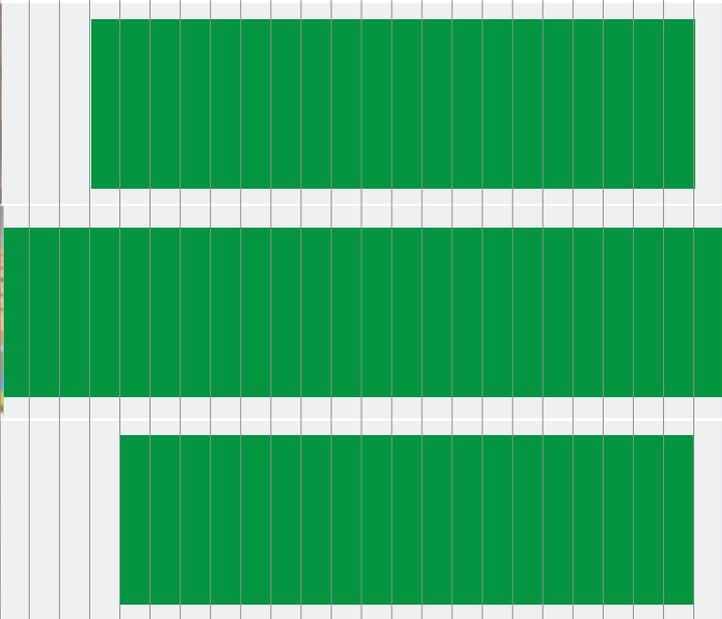


Gf07

Suspended timber floor
Product: Earthwool Flexible Slab
 See page: 218



Gf08



Key

- Thermal insulation achievable by constructions within this document.
- Pb01** Find online. Visit knaufinsulation.co.uk and key in construction code to find the most up to date information on your chosen solution.

Ground floors

Below slab

Polyfoam ECO Floorboard



Polyfoam ECO Floorboard

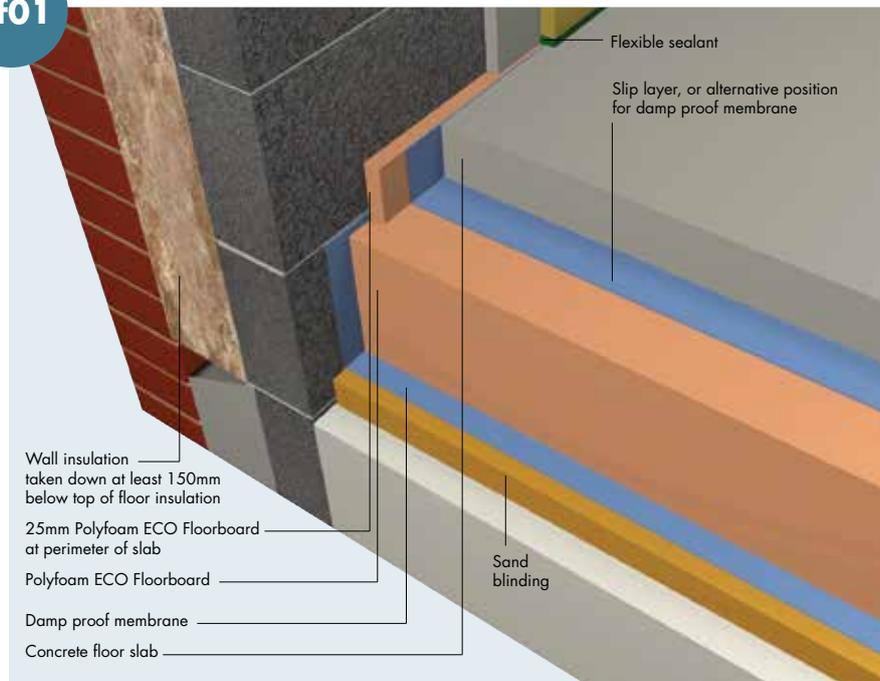


Gf01

- Moisture resistant - long term exposure to water has negligible impact on thermal performance
- High compressive strength - protects damp proof membrane from damage
- Robust and can tolerate traffic from following trades without damage prior to floor finish being laid

Polyfoam ECO Floorboard

- BBA certified
- Zero Ozone Depletion Potential (ODP)
- Global Warming Potential (GWP) <5



Products

Polyfoam ECO Floorboard is a range of rigid extruded polystyrene insulation boards.

They are lightweight, have excellent structural strength and long term effectiveness and are available in three grades:

Polyfoam ECO Floorboard Standard – domestic and light commercial loading

Polyfoam ECO Floorboard Extra – commercial, industrial flooring and cold storage

Polyfoam ECO Floorboard Super – very high load commercial, industrial and cold storage floors.

Typical construction

A solid concrete ground floor slab cast on insulation on a damp proof membrane (dpm) laid over blinded hardcore. Alternatively concrete floor slab cast on a damp proof membrane laid over the insulation. The wall insulation should start a minimum of 150mm below the top of the floor insulation. There should be a flexible sealant between the wall finish and the floor slab to minimise air leakage at this junction.

Installation

Level the sand blinding over the hardcore to receive the insulation.

Lay the Polyfoam ECO Floorboard directly on the sand blinding and then lay the dpm over the insulation and lap with the wall damp proof course. Alternatively, lay Polyfoam ECO Floorboard over the dpm in a stretcher brick bond pattern to cover the whole floor area. The joints should be tightly butted together. When installing the insulation boards in layers, stagger the layout of the boards to avoid coincident vertical joints running through the total insulation thickness. Use spreader boards, as necessary, to prevent point loads puncturing the dpm. A slip layer is required between the insulation and the concrete slab.

Place a strip of insulation, minimum 25mm thick, vertically at the slab perimeter to minimise thermal bridging. The height of the perimeter insulation to equal the slab thickness. Ensure the perimeter insulation boards are securely held in place to prevent dislodgement by following work, e.g. by taping them to the main floor insulation.

Lay the concrete slab. The concrete slab may be screeded or alternatively have a power float finish.

Performance

Thermal performance

The thermal conductivities of Polyfoam ECO Floorboard products are:-

Standard and Extra – 0.033 W/mK

Super – 0.034 - 0.036 W/mK

Unlike most other insulants, moisture has a negligible effect on thermal performance.

Fire performance

When Polyfoam ECO Floorboard is installed in a concrete floor construction, it will not contribute to the development stages of a fire.

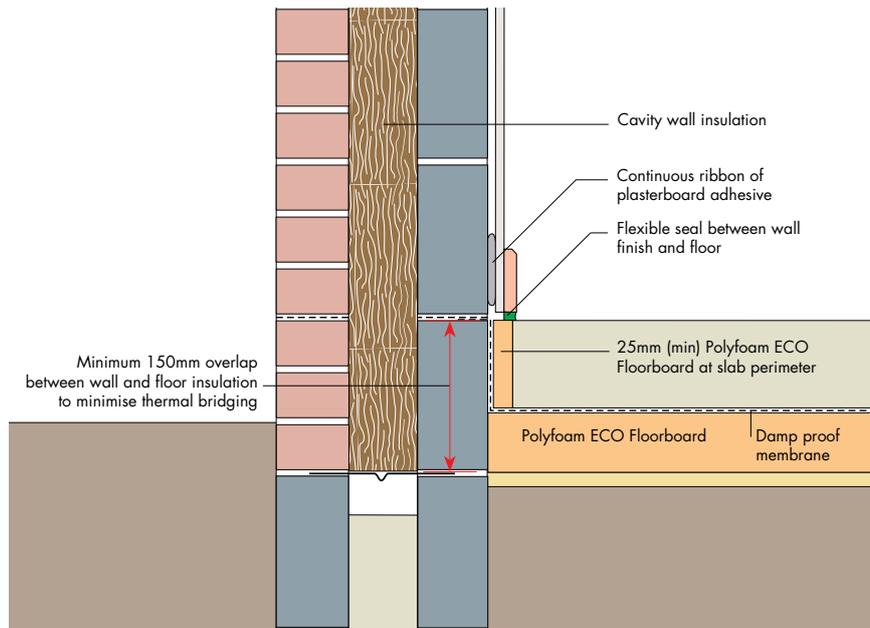
Moisture resistance

Moisture resistance of Polyfoam ECO Floorboard enables it to be laid exposed to ground water, with negligible impact on performance. The boards themselves do not perform the function of a damp proof membrane, but can be laid in damp conditions or up against wet concrete without compromising thermal performance.

Compression resistance

Polyfoam ECO Floorboard is highly resistant to compression and withstands both occasional and long term static loads. Load bearing construction elements should be designed to adequately support the combination of imposed and dead loads without creating excessive deflection.

Typical wall/floor junction



Typical specification

The whole of the ground floor area between brick, block or concrete walls to be insulated with Polyfoam ECO Floorboard Standard*/ Extra/*Super*mm thick and laid directly over blinded hardcore. Polyfoam ECO Floorboard Standard*/ Extra/*Super* at least 25mm thick, to be cut and placed vertically against the walls to the depth of the concrete slab.

The insulation to be laid above*/below* damp proof membrane, which should lap the perimeter wall damp proof course. Concrete slab and floor finish as specified by the designer.

(*delete as appropriate)



Alternatively, consult the National Building Specifications, Standard version clause/ clauses...E20/30 or

E20/200.....

Knauf Insulation specification clauses can be downloaded from knaufinsulation.co.uk/nbs

Table 2 - U-values for concrete ground floors insulated below slab

Thickness (mm)	U-values (W/m ² K)								
	Ratio of perimeter (m) to area (m ²)								
	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	
Polyfoam ECO Floorboard Standard and Extra									
165 (100+65)*	0.09	0.12	0.14	0.15	0.15	0.16	0.16	0.17	
150 (75+75)	0.10	0.13	0.15	0.16	0.17	0.18	0.18	0.18	
140 (75+65)	0.10	0.14	0.16	0.17	0.18	0.18	0.19	0.19	
125 (75+50)	0.11	0.15	0.17	0.18	0.19	0.20	0.20	0.21	
110 (75+35)	0.11	0.16	0.18	0.19	0.21	0.22	0.22	0.23	
100 (1x100)**	0.11	0.16	0.19	0.20	0.21	0.22	0.23	0.24	
90 (65+25)	0.12	0.17	0.20	0.22	0.24	0.25	0.26	0.26	
75 (1x75)	0.13	0.19	0.23	0.25	0.27	0.28	0.29	0.30	
65 (1x65)	0.13	0.20	0.24	0.27	0.29	0.30	0.32	0.33	



Note: The U-values have been calculated assuming a clay subsoil with a thermal conductivity of 1.50 W/mK.

U-values for Polyfoam ECO Floorboard Super available on request - contact Technical Advice and Support Centre

* Polyfoam ECO Floorboard Extra - 2x50+65

** Polyfoam Floorboard ECO Extra - 2x50

Table 3 - Compressive creep results for Polyfoam ECO Floorboards

Product	Load applied (kPa)	Initial compression (%)	Further compression after 50 years (%)
Polyfoam ECO Floorboard Standard	60	2	1.5
Polyfoam ECO Floorboard Extra	120	2	1.5
Polyfoam ECO Floorboard Super	175	2	1.5

Ground floors

Above slab

Earthwool Thermal Floor Slab Plus

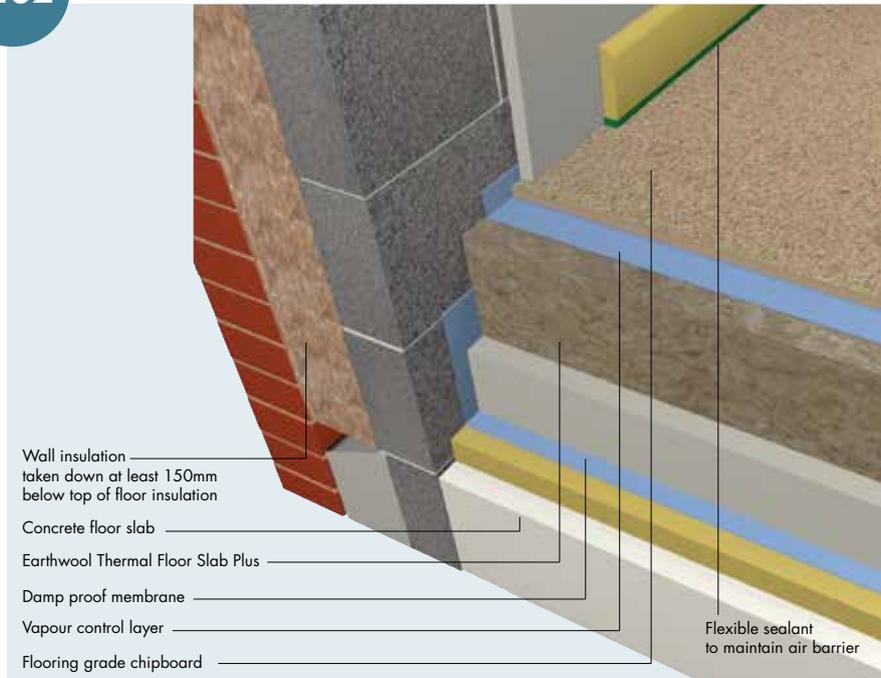


Gf02

- Tolerance friendly, accommodates slight imperfections in the sub-floor
- Product knits together and closes joints to ensure thermal performance is achieved avoiding localised cold spots

Earthwool Thermal Floor Slab Plus

- Non-combustible with a Euroclass A1 reaction to fire rating
- BBA certified
- Zero Ozone Depletion Potential (ODP)
- Zero Global Warming Potential (GWP)



Products

Earthwool Thermal Floor Slab Plus is a rigid, compression resistant slab of non-combustible rock mineral wool designed for use in domestic or domestic type applications.

Typical construction

A solid concrete ground floor slab on a damp proof membrane on blinded hardcore. Earthwool Thermal Floor Slab Plus is laid over the whole of the concrete floor slab and finished with either a screed or flooring grade chipboard.

Installation

Lay Earthwool Thermal Floor Slab Plus directly over the whole of the concrete floor, the surface of which to be smooth and flat to within 5mm when measured with a two metre straight-edge. The nature of Earthwool Thermal Floor Slab Plus enables small irregularities in the concrete slab surface to be accommodated. When installing the insulation slabs in layers, stagger the layout of the slabs to avoid coincident vertical joints running through the total insulation thickness.

Chipboard finish

Lay a vapour control layer (such as 1000 gauge polythene) between the insulation and the chipboard deck and turn it up at the junction with the walls.

Lay the chipboard in a staggered pattern and glue all joints using a waterproof PVA adhesive. Leave an expansion gap of at least 10mm or 2mm per metre run of floor at the room perimeter. At doorways, room perimeters and access traps to pipework runs, support the cut edges of chipboard on preservative treated battens. If in doubt refer to the chipboard manufacturer's instructions. Seal the gap between the floor finish and the slip layer with a flexible sealant to minimise air leakage.

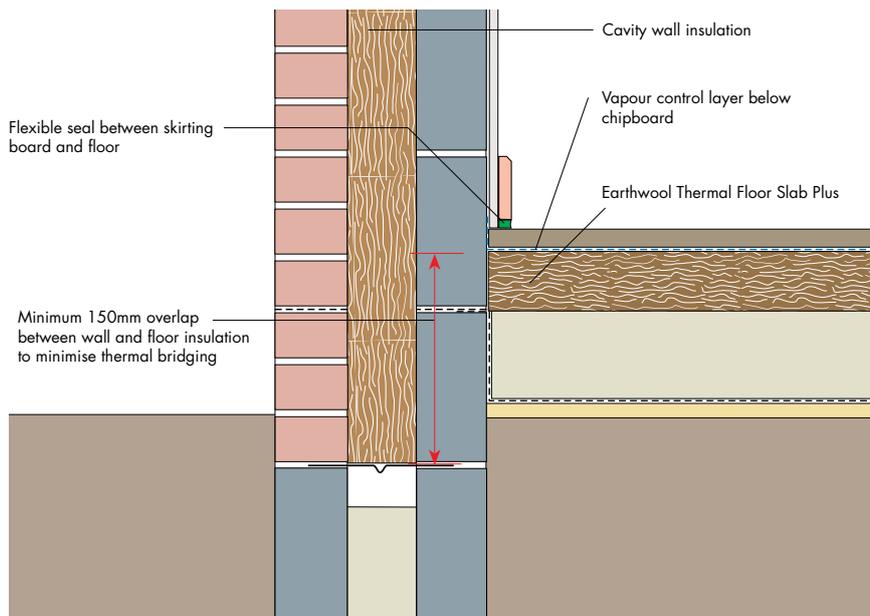
Screed finish

Place a minimum 30mm thick vertical piece of Earthwool Thermal Floor Slab Plus, to the full depth of the screed around the perimeter to minimise thermal bridging. Tape the perimeter insulation securely in place to prevent dislodgement by following work.

Lay the Earthwool Thermal Floor Slab Plus and cover with a vapour control/slip layer and turn up at the junction with the walls. If this is a refurbishment project and secondary damp proofing is required, use a suitable damp proof membrane that will also act as a slip layer.

Lay the screed, either reinforced sand/cement screed, minimum 65mm thick, or a proprietary screed, minimum 35mm thick. The sand/cement screed should be reinforced to BS 8204-1:2003 +A1:2009. It is important to compact the screed well to produce a durable floor surface.

Typical wall/floor junction



Performance

Thermal performance

Earthwool Thermal Floor Slab Plus has a thermal conductivity of 0.038 W/mK.

Fire performance

Earthwool Thermal Floor Slab Plus is classified as Euroclass A1 to BS EN 13501-1.

Table 4 - Earthwool Thermal Floor Slab Plus compressive strength

Thickness (mm)	Compressive strength (kPa)
60, 70	60
80, 90, 100	70

Table 5 - U-values for concrete ground floors, insulation below chipboard

Thickness (mm)	U-values (W/m ² K)							
	Ratio of perimeter (m) to area (m ²)							
	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
Earthwool Thermal Floor Slab Plus								
160 (2x80)	0.10	0.13	0.15	0.16	0.17	0.17	0.18	0.18
150 (80+70)	0.10	0.14	0.15	0.17	0.17	0.18	0.19	0.19
140 (2x70)	0.10	0.14	0.16	0.17	0.18	0.19	0.20	0.20
130 (70+60)	0.11	0.15	0.17	0.18	0.19	0.20	0.21	0.21
120 (2x60)	0.11	0.15	0.18	0.19	0.20	0.21	0.22	0.22
100	0.12	0.17	0.20	0.21	0.23	0.24	0.25	0.25
90	0.12	0.18	0.21	0.23	0.24	0.25	0.26	0.27

BBA Note: The U-values have been calculated assuming a clay subsoil with a thermal conductivity of 1.50 W/mK.
CERTIFICATE GB1901-2
 U Value Competency Scheme

Typical specification

Insulation below screed

Earthwool Thermal Floor Slab Plusmm thick, to be close butted and placed over the whole area of the floor. Earthwool Thermal Floor Slab Plus, 30mm thick, to be cut and placed to full depth of screed and floor insulation at the floor perimeter.

The insulation to be overlaid with 1000 gauge polythene, taken up and over the perimeter insulation. A 65mm thick sand/cement screed reinforced in accordance with BS 8204-1:2003 +A1:2009. Alternatively, install a proprietary liquid screed (minimum thickness 35mm) laid in accordance with manufacturers instructions. Floor finish as specified by the designer.

(* delete as appropriate)



Alternatively, consult the National Building Specifications, Standard version clause/clauses...
 M10/40 or
 M10/290.....

Knauf Insulation specification clauses can be downloaded from knaufinsulation.co.uk/nbs

Insulation below chipboard

The whole area of the concrete floor to be covered with Earthwool Thermal Floor Slab Plus,mm thick. All slabs to be close butted.



The insulation to be overlaid with a vapour control layer of 1000 gauge polythene and covered with 18mm t and g flooring grade chipboard.

Alternatively, consult the National Building Specifications, Standard version clause/clauses...K11/25 or K11/225.....

Knauf Insulation specification clauses can be downloaded from knaufinsulation.co.uk/nbs

Ground floors

Above slab

Polyfoam ECO Floorboard



Polyfoam ECO Floorboard

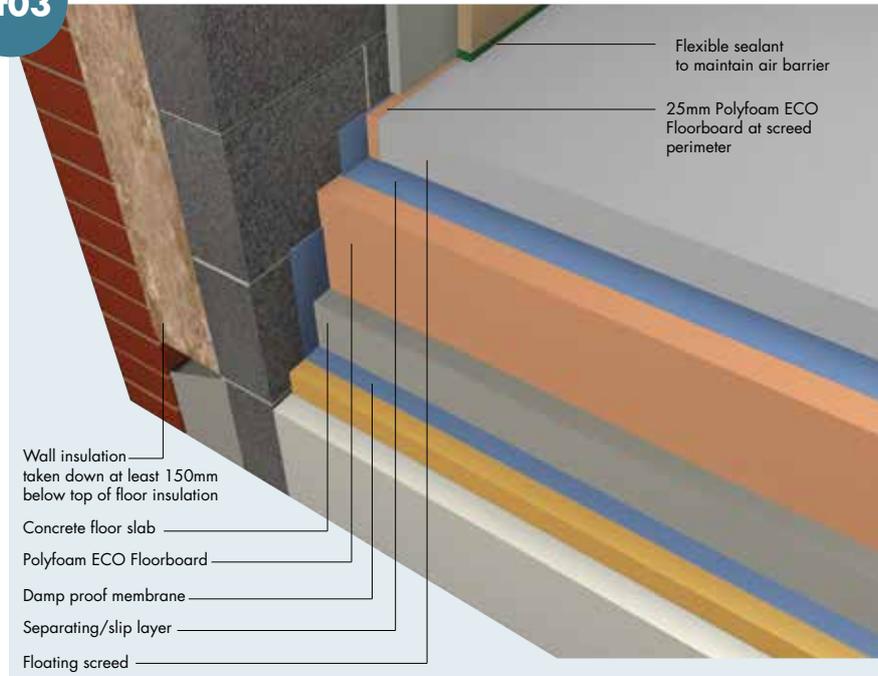


Gf03

- Moisture resistant - long term exposure to water has negligible impact on thermal performance
- Robust and can tolerate traffic from following trades without damage prior to floor finish being laid
- High compressive strength - protects damp proof membrane from damage

Polyfoam ECO Floorboard

- BBA certified
- Zero Ozone Depletion Potential (ODP)
- Global Warming Potential (GWP) <5



Products

Polyfoam ECO Floorboard is a range of rigid extruded polystyrene insulation boards.

They are lightweight, have excellent structural strength and long term effectiveness and are available in three grades:

Polyfoam ECO Floorboard Standard – domestic and light commercial loading

Polyfoam ECO Floorboard Extra – commercial, industrial flooring and cold storage

Polyfoam ECO Floorboard Super – very high load commercial, industrial and cold storage floors.

Typical construction

A solid concrete ground floor slab on a damp proof membrane on blinded hardcore. Polyfoam ECO Floorboards laid over the whole of the concrete floor slab and finished with either flooring grade chipboard or a floating screed, either sand/cement based, or a proprietary flowing screed.

Installation

Lay the Polyfoam ECO Floorboard directly over the whole of the concrete floor. The surface of the floor should be smooth and flat to within 5mm when measured with a 2 metre straight-edge. Irregularities greater than this must be levelled out. The joints should be tightly butted together. When installing the insulation boards in layers, stagger the layout of the

boards to avoid coincident vertical joints running through the total insulation thickness.

Screed finish

Place a minimum 25mm thick vertical piece of Polyfoam ECO Floorboard to the full depth of the screed around the perimeter to minimise thermal bridging. Tape the perimeter insulation boards securely in place to prevent dislodgement by following work.

Cover the Polyfoam ECO Floorboard with a separating/slip layer and turn up at the junction with the walls. If this is a refurbishment project and secondary damp proofing is required, use a suitable damp proof membrane that will also act as a slip layer.

Lay the screed, either reinforced sand/cement screed, minimum 65mm thick in dwellings and 75mm in other types of buildings, or a proprietary screed, minimum 35mm thick. The sand/cement screed should be reinforced in accordance with BS 8204-1:2003 +A1:2009. It is important to compact the screed well to produce a durable floor surface.

Chipboard finish

Lay a vapour control layer (such as 1000 gauge polythene) between the insulation and the chipboard deck and turn it up at the junction with the walls. Lay the chipboard in a staggered pattern and glue all joints using a waterproof

PVA adhesive. Leave an expansion gap of at least 10mm or 2mm per metre run of floor at the room perimeter. At doorways or access traps to pipework runs, support the cut edges of chipboard on preservative treated battens. If in doubt refer to the chipboard manufacturer's instructions. Seal between the wall and floor air barrier with a flexible sealant, or seal the space between the skirting board and the floor using a flexible sealant to minimise air leakage.

Performance

Thermal performance

The thermal conductivities of Polyfoam ECO Floorboard products are:-

Standard and Extra - 0.033 W/mK

Super - 0.034 - 0.036 W/mK

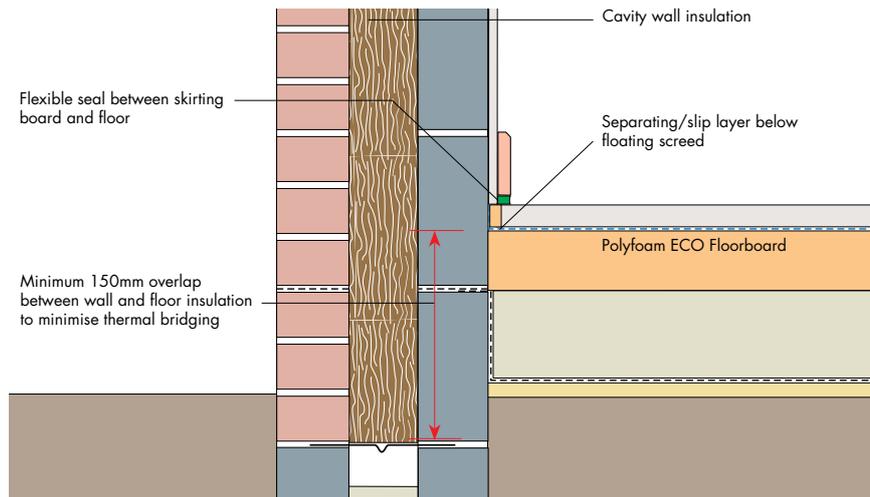
Fire performance

When Polyfoam ECO Floorboard is installed in a floor construction it will not contribute to the development stages of a fire.

Compression resistance

Polyfoam ECO Floorboard is highly resistant to compression and withstands both occasional and long term static loads. Load bearing construction elements should be designed to adequately support the combination of imposed and dead loads without creating excessive deflection.

Typical wall/floor junction



Typical specification

Insulation below screed

Polyfoam ECO Floorboard Standard*/Extramm thick, to be close butted and placed over the whole area of the floor. Polyfoam ECO Floorboard Standard*/ Extra, 25mm thick, to be cut and placed to full depth of screed at the floor perimeter.

The insulation to be overlaid with a separating layer*/1000 gauge polythene* taken up and over the perimeter insulation. A 65*/75*mm thick sand/cement screed reinforced in accordance with BS 8204-1:2003 +A1:2009. Alternatively install a proprietary liquid screed (minimum thickness 35mm) laid in accordance with manufacturers instructions.

(* delete as appropriate)



Alternatively, consult the National Building Specifications, Standard version clause/clauses... M10/40 or M10/290

Knauf Insulation specification clauses can be downloaded from knaufinsulation.co.uk/nbs

Insulation below chipboard

The whole area of the concrete floor to be lined with Polyfoam ECO Floorboard Standard*/Extramm thick. All boards to be close butted.

The insulation to be (overlaid with a vapour control layer of 1000 gauge polythene and)* covered with 18mm t and g flooring grade chipboard. (*delete as appropriate)



Alternatively, consult the National Building Specifications, Standard version clause/clauses...K11/25 or K11/225.....

Knauf Insulation specification clauses can be downloaded from knaufinsulation.co.uk/nbs

Table 6 - U-values for concrete ground floors insulated below slab

Thickness (mm)	U-values (W/m ² K)							
	Ratio of perimeter (m) to area (m ²)							
	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
Polyfoam ECO Floorboard Standard and Extra								
165 (100+65)*	0.09	0.12	0.14	0.15	0.15	0.16	0.16	0.17
150 (75+75)	0.10	0.13	0.15	0.16	0.17	0.18	0.18	0.18
140 (75+65)	0.10	0.14	0.16	0.17	0.18	0.18	0.19	0.19
125 (75+50)	0.11	0.15	0.17	0.18	0.19	0.20	0.20	0.21
110 (75+35)	0.11	0.16	0.18	0.19	0.21	0.22	0.22	0.23
100 (1x100)**	0.11	0.16	0.19	0.20	0.21	0.22	0.23	0.24
90 (65+25)	0.12	0.17	0.20	0.22	0.24	0.25	0.26	0.26
75 (1x75)	0.13	0.19	0.23	0.25	0.27	0.28	0.29	0.30
65 (1x65)	0.13	0.20	0.24	0.27	0.29	0.30	0.32	0.33



Note: The U-values have been calculated assuming a dry subsoil with a thermal conductivity of 1.50 W/mK.

U-values for Polyfoam ECO Floorboard Super available on request - contact Technical Advice and Support Centre

* Polyfoam ECO Floorboard Extra - 2x50+65

** Polyfoam Floorboard ECO Extra - 2x50

Table 7 - Compressive creep results for Polyfoam ECO Floorboards

Product	Load applied (kPa)	Initial compression (%)	Further compression after 50 years (%)
Polyfoam ECO Floorboard Standard	60	2	1.5
Polyfoam ECO Floorboard Extra	120	2	1.5
Polyfoam ECO Floorboard Super	175	2	1.5

Ground floors

Suspended concrete floor

Polyfoam ECO Floorboard



Polyfoam ECO Floorboard

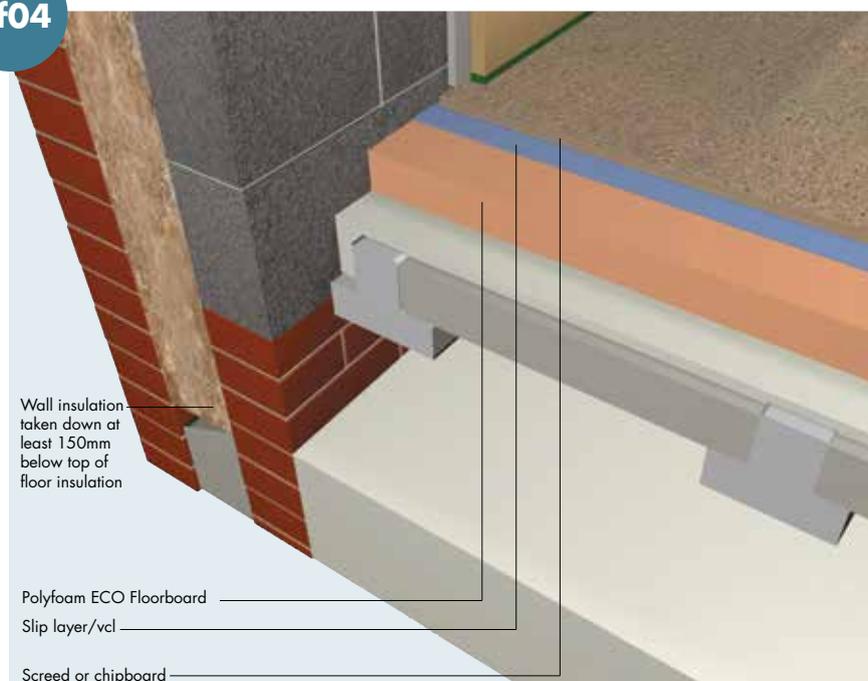


Gf04

- Moisture resistant - long term exposure to water has negligible impact on thermal performance
- Robust and can tolerate traffic from following trades without damage prior to floor finish being laid
- Lightweight, robust product, quick and easy to install

Polyfoam ECO Floorboard

- BBA certified
- Zero Ozone Depletion Potential (ODP)
- Global Warming Potential (GWP) <5



Products

Polyfoam ECO Floorboard is a range of rigid extruded polystyrene insulation boards.

They are lightweight, have excellent structural strength and long term effectiveness and are available in three grades:

Standard – domestic and light commercial loading

Extra – commercial, industrial flooring and cold storage

Super – very high load commercial, industrial and cold storage floors.

Typical construction

A suspended concrete floor of either beam and block construction or precast concrete planks, overlaid with Polyfoam ECO Floorboard and finished with either flooring grade chipboard or a floating screed, either sand/cement based, or a proprietary flowing screed.

Where a screed is used, a strip of Polyfoam ECO Floorboard insulation, minimum 25mm thick, should be placed vertically at the perimeter of the screed to minimise thermal bridging. A slip layer/vcl of 1000 gauge polythene sheet should be placed between the insulation and the screed.

The wall insulation should start a minimum of 150mm below the top of the floor insulation.

Installation

Polyfoam ECO Floorboards can be used on a beam and block suspended concrete floor that is the subject of a current British Board of Agreement Certificate and installed in accordance with, and within the limitations of, that certificate. The surface of any floor should be smooth and flat to within 5mm when measured with a 2 metre straight-edge.

Provided the surface is smooth and flat, the insulation may be laid directly onto the flooring system. Otherwise lay a thin levelling screed (this may be the grout with beam and block systems) prior to laying the insulation.

Irregularities greater than those detailed above must be removed. The joints should be tightly butted together. When installing the insulation in layers, stagger the layout of the boards to avoid coincident vertical joints running through the total insulation thickness.

Where a beam and block floor has a camber or uneven upper surface, a levelling screed is recommended.

Screeded finish

Place a minimum 25mm thick vertical piece of Polyfoam ECO Floorboard to the full depth of the screed, around the perimeter to minimise thermal bridging. Ensure these perimeter insulation boards are securely held in place to

prevent dislodgement by following work.

Lay the slip layer/vcl over the insulation and turn up at the junction with the walls.

Lay the screed, either reinforced sand/cement screed, minimum 65mm thick in dwellings and 75mm in other types of buildings, or a proprietary screed, minimum 35mm thick. The sand/cement screed should be reinforced in accordance with BS 8204-1:2003 +A1:2009. It is important to compact the screed well to produce a durable floor surface.

Chipboard finish

The insulation should be laid over the whole of the beam and block floor.

Lay the chipboard in a staggered pattern with all joints glued using a waterproof PVA adhesive. Leave an expansion gap of at least 10mm or 2mm per metre run of floor at the room perimeter. At doorways or access traps to pipework runs, support the cut edges of chipboard on preservative treated battens. If in doubt, refer to the chipboard manufacturer's instructions. Seal between the wall and floor air barrier with a flexible sealant, or seal the space between the skirting board and the floor using a flexible sealant to minimise air leakage.

Typical wall/floor junction

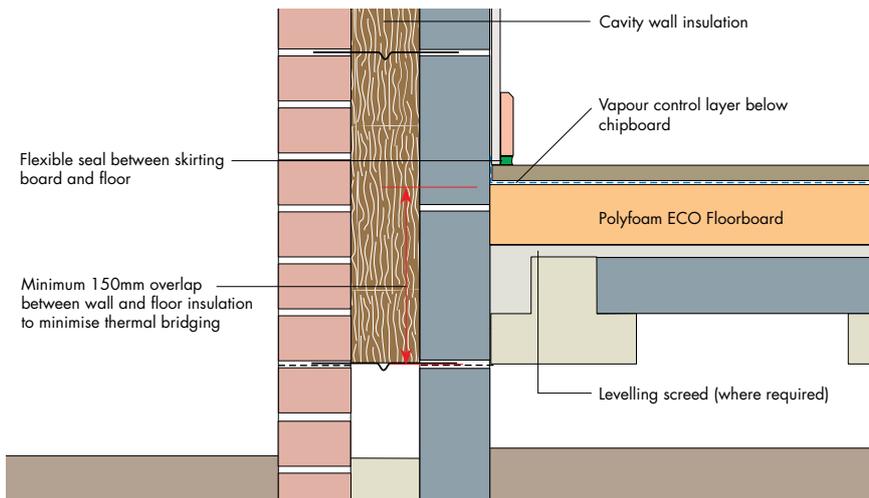


Table 8 - U-values for beam and block ground floors insulated below chipboard deck

Thickness (mm)	U-values (W/m ² K)							
	Ratio of perimeter (m) to area (m ²)							
	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
Polyfoam ECO Floorboard Standard and Extra								
165 (100+65)	0.11	0.13	0.14	0.15	0.15	0.16	0.16	0.16
150 (75+75)	0.12	0.15	0.16	0.17	0.17	0.17	0.18	0.18
140 (75+65)	0.12	0.15	0.17	0.17	0.18	0.18	0.19	0.19
125 (75+50)	0.13	0.16	0.18	0.18	0.19	0.20	0.20	0.20
110 (75+35)	0.14	0.17	0.19	0.20	0.21	0.22	0.22	0.22
100	0.14	0.18	0.20	0.21	0.22	0.22	0.23	0.23
90 (65+25)	0.15	0.19	0.21	0.23	0.24	0.25	0.25	0.26
75	0.16	0.21	0.24	0.26	0.27	0.28	0.29	0.29
65	0.17	0.22	0.26	0.28	0.29	0.30	0.31	0.32

BBA CERTIFICATE CB11001-2 U Value Competency Scheme
 Notes: The U-values have been calculated assuming a clay subsoil with a thermal conductivity of 1.50 W/mK. The thermal conductivity of concrete blocks – 1.13 W/mK. For project specific calculations contact our Technical Advice and Support Centre on 01744 766666.

Performance

Thermal performance

The thermal conductivities of Polyfoam ECO Floorboard products are:-

Standard and Extra - 0.033 W/mK

Super - 0.034 - 0.036 W/mK

Fire performance

When Polyfoam ECO Floorboard is installed in a floor construction it will not contribute to the development stages of a fire.

Compression resistance

Polyfoam ECO Floorboards is highly resistant to compression and withstands both occasional and long term static loads. Load bearing construction elements should be designed to adequately support the combination of imposed and dead loads without creating excessive deflection.

Typical specification

Insulation below screed

Polyfoam ECO Floorboard Standard*/Extra* Super*mm thick, to be close butted and placed over the whole area of the floor. Polyfoam ECO Floorboard Standard*/Extra*Super*mm thick, to be cut and placed to full depth of screed at the floor perimeter.

The insulation to be overlaid with 1000 gauge polythene, taken up and over the perimeter insulation. A 65*/75*mm thick sand/cement screed reinforced in accordance with BS 8204-1:2003 +A1:2009. Alternatively install a proprietary liquid screed (minimum thickness 35mm) laid in accordance with manufacturers instructions. Floor finish as specified by the designer. (* delete as appropriate)



Alternatively, consult the National Building Specifications, Standard version clause/clauses...M10/40 or M10/290.....

Knauf Insulation specification clauses can be downloaded from knaufinsulation.co.uk/nbs

Insulation below chipboard

The whole area of the concrete floor to be overlaid with Polyfoam ECO Floorboard Standard*/Extra,*/Super*mm thick. All boards to be close butted.

The insulation to be (overlaid with a vapour control layer of 1000 gauge polythene and)* covered with 18mm t and g flooring grade chipboard. (* delete as appropriate)

Alternatively, consult the National Building Specifications, Standard version clause/clauses...K11/25 or K11/225.....



Knauf Insulation specification clauses can be downloaded from knaufinsulation.co.uk/nbs

Table 9 - Compressive creep results for Polyfoam ECO Floorboards

Product	Load applied (kPa)	Initial compression (%)	Further compression after 50 years (%)
Polyfoam ECO Floorboard Standard	60	2	1.5
Polyfoam ECO Floorboard Extra	120	2	1.5
Polyfoam ECO Floorboard Super	175	2	1.5

Ground floors

Suspended concrete floor

Earthwool Thermal Floor Slab Plus

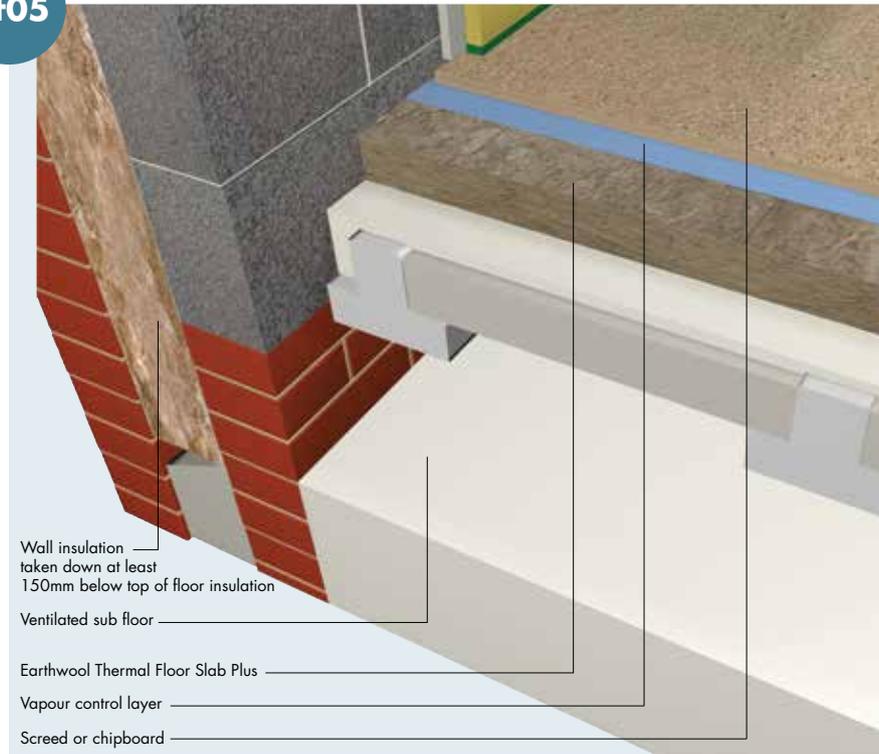


Gf05

- Tolerance friendly, accommodates slight imperfections in sub-floor
- Product knits together and closes joints to ensure thermal performance is achieved and avoid localised cold spots

Earthwool Thermal Floor Slab Plus

- Non-combustible with a Euroclass A1 reaction to fire rating
- BBA certified
- Zero Ozone Depletion Potential (ODP)
- Zero Global Warming Potential (GWP)



Products

Earthwool Thermal Floor Slab Plus is a rigid, compression resistant slab of non-combustible rock mineral wool designed for use in domestic or domestic type applications.

Typical construction

A suspended concrete floor of either beam and block construction or precast concrete planks, overlaid with Earthwool Thermal Floor Slab Plus and finished with either flooring grade chipboard or a floating screed, either sand/cement based, or a proprietary flowing screed.

A vapour control layer/slip layer of 1000 gauge polythene sheet should be placed between the insulation and the screed.

The wall insulation should start a minimum of 150mm below the top of the floor insulation.

Installation

Earthwool Thermal Floor Slab Plus may be laid directly onto the flooring system. The surface of any floor should be smooth and flat to within 5mm when measured with a 2 metre straight-edge. Irregularities greater than those detailed above must be removed.

The joints should be tightly butted together.

When installing the insulation in layers, stagger the layout of the slabs to avoid coincident vertical joints running through the total insulation thickness.

Screed finish

Place a minimum 30mm thick vertical piece of Earthwool Thermal Floor Slab Plus to the full depth of the screed, around the perimeter to minimise thermal bridging. Ensure the perimeter insulation is securely held in place to prevent dislodgement by following work.

Lay the vapour control layer/slip layer over the insulation and turn up at the junction with the walls.

Lay the screed, either reinforced sand/cement screed, minimum 65mm thick in dwellings and 75mm in other types of buildings, or a proprietary screed, minimum 35mm thick. The sand/cement screed should be reinforced in accordance with BS 8204-1:2003 +A1:2009. It is important to compact the screed well to produce a durable floor surface.

Chipboard finish

The insulation should be laid over the whole of the concrete floor.

Lay the chipboard in a staggered pattern with all joints glued using a waterproof PVA adhesive. Leave an expansion gap of at least 10mm or 2mm per metre run of floor at the room perimeter. At doorways, room perimeters and access traps to pipework, runs support the cut edges of chipboard on preservative treated battens. If in doubt, refer to the chipboard manufacturer's instructions. Seal between the wall and floor air barrier with a flexible sealant, and seal the space between the skirting board and the floor using a flexible sealant to minimise air leakage.

Performance

Thermal performance

Earthwool Thermal Floor Slab Plus has a thermal conductivity of 0.038 W/mK.

Fire performance

Earthwool Thermal Floor Slab Plus is classified as Euroclass A1 to BS EN 13501-1.

Typical wall/floor junction

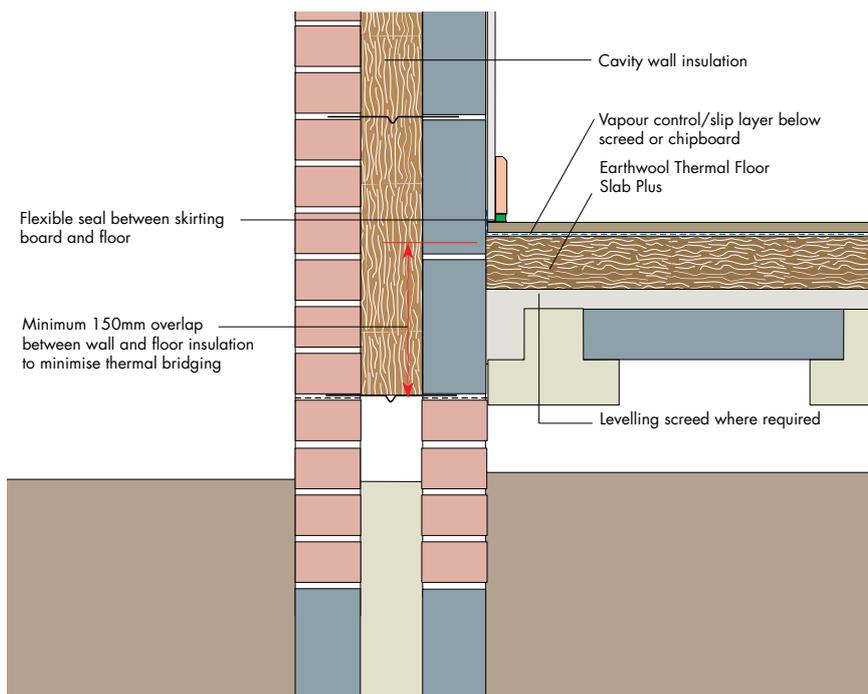


Table 10 - Earthwool Thermal Floor Slab Plus compressive strength

Thickness (mm)	Compressive strength (kPa)
60, 70	60
80, 90, 100	70

Table 11 - U-values for beam and block ground floors insulated below chipboard deck

Thickness (mm)	U-values (W/m ² K)							
	Ratio of perimeter (m) to area (m ²)							
	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
Earthwool Thermal Floor Slab Plus								
160 (2x80)	0.12	0.14	0.15	0.16	0.16	0.17	0.17	0.17
150 (80+70)	0.12	0.15	0.16	0.17	0.17	0.17	0.18	0.18
140 (2x70)	0.12	0.15	0.16	0.17	0.18	0.18	0.19	0.19
130 (70+60)	0.13	0.16	0.17	0.18	0.19	0.19	0.20	0.20
120 (2x60)	0.13	0.16	0.18	0.19	0.20	0.20	0.21	0.21
100	0.14	0.18	0.20	0.21	0.22	0.23	0.23	0.24
90	0.15	0.19	0.21	0.22	0.23	0.24	0.25	0.25
80	0.15	0.20	0.22	0.24	0.25	0.26	0.26	0.27

BBA Note: The U-values have been calculated assuming a 0.16 W/mK aircrete block between concrete beams.
CERTIFICATE CB1101-2
 U Value Competency Scheme

Typical specification

Insulation below screed

Earthwool Thermal Floor Slab Plusmm thick, to be close butted and placed over the whole area of the floor. Earthwool Thermal Floor Slab Plus, 30mm thick, to be cut and placed to full depth of screed at the floor perimeter.

The insulation to be overlaid with 1000 gauge polythene, taken up and over the perimeter insulation. A 65*/75*mm thick sand/cement screed reinforced in accordance with BS 8204-1:2003 +A1:2009. Alternatively install a proprietary liquid screed (minimum thickness 35mm) laid in accordance with manufacturers instructions. Floor finish as specified by the designer.

(* delete as appropriate)

nbsPlus

Alternatively, consult the National Building Specifications, Standard version clause/ clauses...M10/40 or M10/290.....

Knauf Insulation specification clauses can be downloaded from knaufinsulation.co.uk/nbs

Insulation below chipboard

The whole area of the concrete floor to be overlaid with Earthwool Thermal Floor Slab Plus,mm thick. All slabs to be close butted.

The insulation to be overlaid with a vapour control layer of 1000 gauge polythene and covered with 18mm t and g flooring grade chipboard.

nbsPlus

Alternatively, consult the National Building Specifications, Standard version clause/ clauses...K11/25 or K11/225.....

Knauf Insulation specification clauses can be downloaded from knaufinsulation.co.uk/nbs

Ground floors

Suspended timber floor

Earthwool Loft Roll or Earthwool Flexible Slab



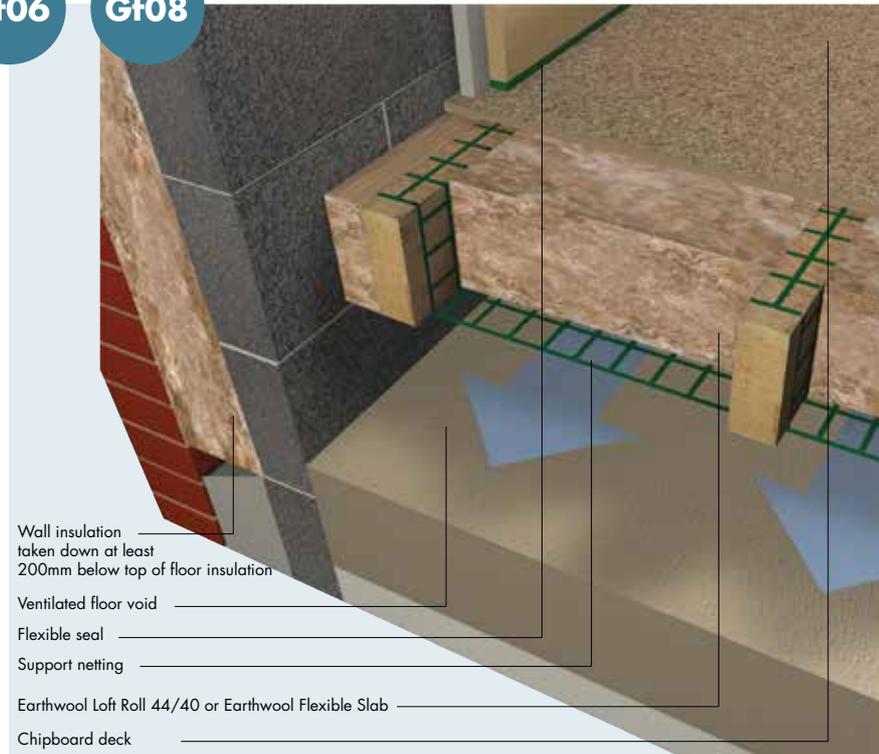
Gf06

Gf08

- Friction fitting between timber joists closes joints, preventing air movement and infiltration
- Flexible products which accommodates movements in floor ensuring all joints remain closed

Earthwool Loft Roll and Earthwool Flexible Slab

- Non-combustible with a Euroclass A1 reaction to fire rating
- A+ Generic BRE Green Guide Rating
- Zero Ozone Depletion Potential (ODP)
- Zero Global Warming Potential (GWP)



Products

Earthwool Loft Rolls 44 / 40 are made from glass mineral wool and formed into rolls which are lightweight, flexible, resilient and non-combustible.

Earthwool Flexible Slab is a multi-use, flexible, rock mineral wool slab designed for friction-fitting in a range of acoustic, thermal and fire resistant applications.

Typical construction

A suspended and ventilated timber ground floor. The insulation is placed between the joists and supported on polypropylene netting.

The netting should be positioned to support the insulation so that there is no gap between the insulation and the underside of the floor deck.

The floor joists running parallel with masonry walls should be spaced at least 35mm away from the wall to allow insulation to be placed next to the wall.

The wall insulation should start a minimum of 200mm below the top of the floor insulation to minimise thermal bridging.

Installation

If the insulation is the full depth of the floor joists, staple the support netting to the underside of the first joist and unroll the netting, stapling to the underside (or side) of each joist as the netting is unrolled.

Where the joist is deeper than the floor insulation, mark the depth of the insulation on the side of the joists. Staple the support netting along this line and pull taut to the adjacent joist and staple again. Pull the netting over the top of the joist and staple to the depth of the floor insulation. Repeat the process until there is netting support to the whole floor.

Install Earthwool Loft Roll 44/40 ensuring there are no air gaps between the insulation and the underside of the floor deck.

Fix the chipboard floor deck in the usual way, using waterproof PVA glue at the joints, and allow a minimum 10mm gap at the room perimeter. If in doubt refer to the chipboard manufacturers instructions.

When fixing the skirting board, apply a self-adhesive foam strip to the underside of the skirting and two beads of sealant to the back surface. Apply pressure to ensure the foam strip is compressed immediately before fixing the skirting in place.

Performance

Thermal performance

Earthwool Loft Roll 40 has a thermal conductivity of 0.040 W/mK.

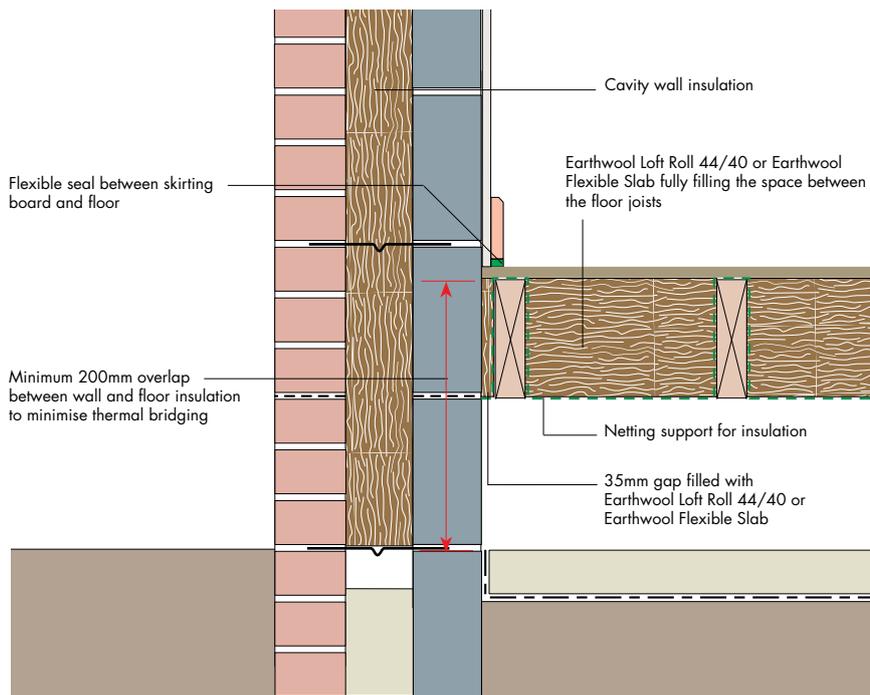
Earthwool Loft Roll 44 has a thermal conductivity of 0.044 W/mK.

Earthwool Flexible Slab has a thermal conductivity of 0.037 W/mK, except 140mm thickness which has a thermal conductivity of 0.035 W/mK.

Fire performance

Earthwool Loft Roll 44/40 and Earthwool Flexible Slab are classified as Euroclass A1 to BS EN 13501-1.

Typical wall/floor junction



Typical specification

Polypropylene netting to be (draped over and between the joists and stapled to the sides of each joist*/stapled to the underside of the joists*). (* delete as appropriate)

Earthwool Loft Roll 44*/40*/Earthwool Flexible Slab* ofmm thickness and of width to suit joist spacings, supported on the netting and to be in contact with the underside of the floor deck. Earthwool Loft Roll 44*/40*/Earthwool Flexible Slab* to be cut and placed to fully fill in the gap between the last joist and the perimeter wall. Flooring grade t and g chipboard to be fixed to the floor joists, all as specified by the designer.



Alternatively, consult the National Building Specifications, Standard version clause/ clauses...P10/250.....

Knauf Insulation specification clauses can be downloaded from knaufinsulation.co.uk/nbs

Table 12 - U-values of suspended timber ground floors insulated between joists

Thickness (mm)	Product combination	Product	U-values (W/m ² K)								
			Ratio of perimeter (m) to area (m ²)								
			0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	
Gf06	300	-	Earthwool Loft Roll 40	-	-	-	-	-	-	-	
		150+150	Earthwool Loft Roll 44	0.10	0.12	0.13	0.13	0.14	0.14	0.14	0.14
	250	150+100	Earthwool Loft Roll 40	0.10	0.13	0.14	0.14	0.15	0.15	0.15	0.15
			Earthwool Loft Roll 44	0.11	0.13	0.14	0.15	0.16	0.16	0.16	0.16
	200	1x200	Earthwool Loft Roll 40	0.12	0.15	0.16	0.17	0.17	0.18	0.18	0.18
			Earthwool Loft Roll 44	0.12	0.15	0.16	0.17	0.17	0.18	0.18	0.18
150	1x150	Earthwool Loft Roll 40	0.13	0.17	0.19	0.20	0.21	0.22	0.22	0.23	
		Earthwool Loft Roll 44	0.13	0.17	0.19	0.20	0.21	0.22	0.22	0.23	
100	1x100	Earthwool Loft Roll 40	0.16	0.21	0.24	0.26	0.27	0.28	0.29	0.30	
		Earthwool Loft Roll 44	0.16	0.21	0.24	0.26	0.27	0.28	0.29	0.30	
Gf08	250	100+90+60	Earthwool Flexible Slab	0.10	0.12	0.13	0.14	0.14	0.14	0.14	0.15
	200	100+100	Earthwool Flexible Slab	0.11	0.14	0.15	0.16	0.17	0.17	0.17	0.18
	140		Earthwool Flexible Slab	0.13	0.17	0.19	0.20	0.21	0.21	0.22	0.22
	100		Earthwool Flexible Slab	0.15	0.20	0.23	0.25	0.26	0.27	0.28	0.29

Note: The U-values have been calculated assuming that the timber joists are 48mm wide at 600mm centres.



Ground floors

Underfloor heating

Polyfoam ECO Floorboard Standard



Polyfoam ECO Floorboard

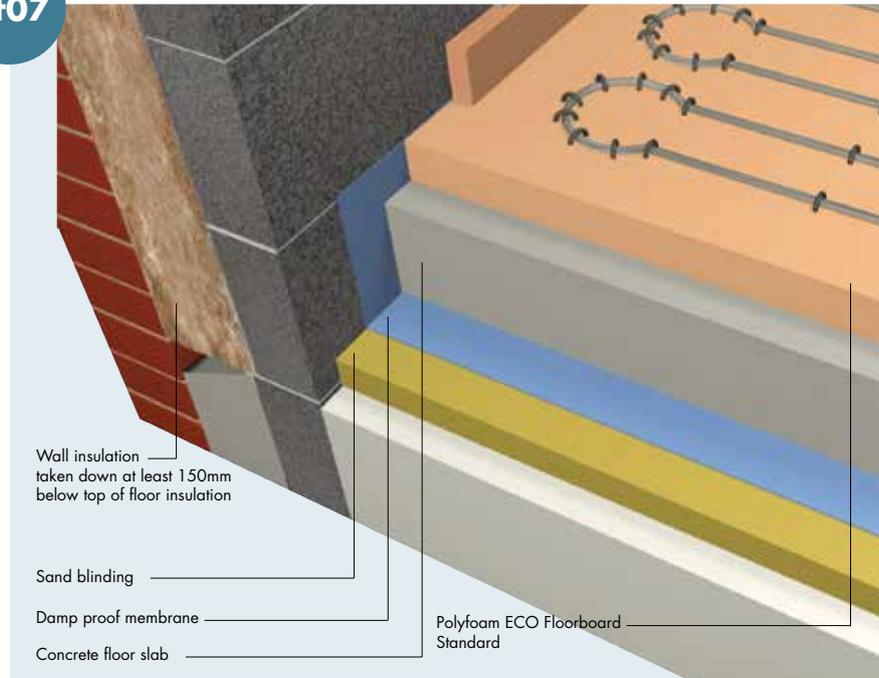


Gf07

- Moisture resistant - long term exposure to water has negligible impact on thermal performance
- Robust and can tolerate traffic from following trades without damage prior to floor finish being laid

Polyfoam ECO Floorboard

- BBA certified
- Zero Ozone Depletion Potential (ODP)
- Global Warming Potential (GWP) <5



Products

Polyfoam ECO Floorboard Standard is a rigid extruded polystyrene insulation board.

It is lightweight, and has excellent structural strength and long term effectiveness.

Polyfoam ECO Floorboard Standard is ideal for use with an underfloor heating system, using either clips, staples or a rail system, making it an ideal solution for use in a wide variety of floors.

Typical construction

A solid concrete ground floor slab on a damp proof membrane on blinded hardcore.

Polyfoam ECO Floorboard Standard is laid over the whole of the concrete floor slab, the heating pipes, using clips, staples or rails are installed and covered with either a liquid or traditional screed finish.

Installation

The concrete slab is cast in the normal manner, with the damp proof membrane below the slab. Starting from the corner furthest from the manifold outlet connection lay the Polyfoam ECO Floorboard Standard, ensuring the entire floor area is covered.

Starting from the manifold, lay the single run of pipe, fixing it firmly into the insulation boards. Ensure the pipes and pipe returns are installed at the required centres and are returned to the manifold system. Test the system before finishing the floor.

Lay the liquid or traditional cement/sand screed to the specified depth. Alternatively, the underfloor heating system is installed within the concrete floor slab which is laid on top of Polyfoam ECO Standard Floorboard. The joints should be tightly butted together. When installing the insulation in layers, stagger the layout of the boards to avoid coincident vertical joints running through the total insulation thickness.

Performance

Thermal performance

The thermal conductivity of Polyfoam ECO Floorboard Standard is 0.033 W/mK.

Fire performance

When Polyfoam ECO Floorboard Standard is installed below a screed it will not contribute to the development stages of a fire.

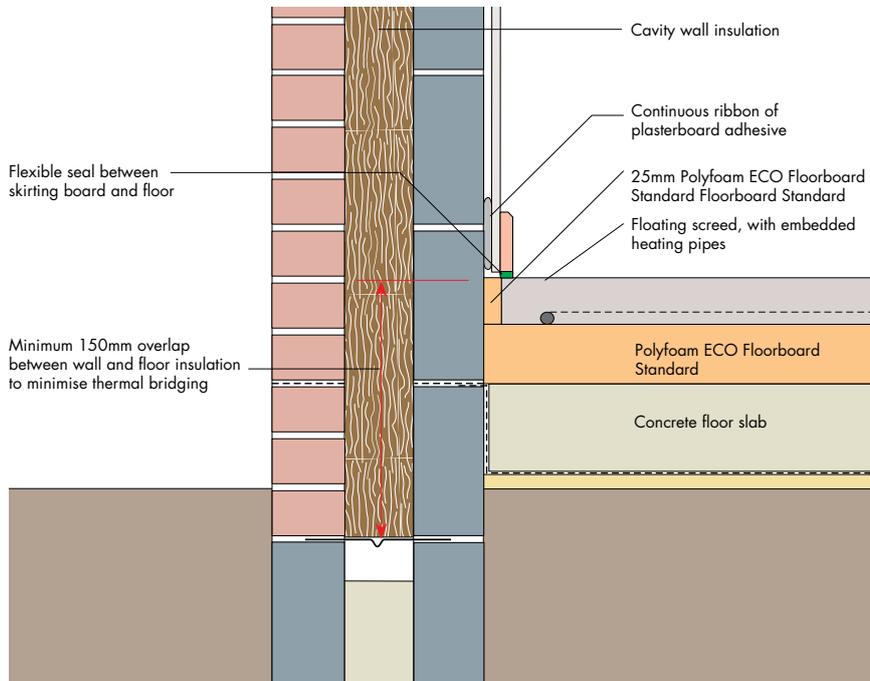
Compression resistance

Polyfoam ECO Floorboard Standard is highly resistant to compression and withstands both occasional and long term static loads. Load bearing construction elements should be designed to adequately support the combination of imposed and dead loads without creating excessive deflection.

Table 13 - Compressive creep results for Polyfoam ECO Floorboard Standard

Load applied (kPa)	Initial compression (%)	Further compression after 50 years (%)
Polyfoam ECO Floorboard Standard	2	1.5

Typical wall/floor junction



Typical specification

Polyfoam ECO Floorboard Standardmm thick, to be closely butted and placed over the whole area of the floor. Polyfoam ECO Floorboard Standard, at least 25mm thick, to be cut and placed to full depth of screed at the floor perimeter.

A single run of pipe to be fixed firmly into the insulation boards and returned to the manifold system. The pipes to be tested before the screed is laid.

A 65*/75*mm thick sand/cement screed reinforced in accordance with BS 8204-1:2003 +A1:2009. Alternatively install a proprietary liquid screed (minimum thickness 35mm) laid in accordance with manufacturers instructions. Floor finish as specified by the designer.

(* delete as appropriate)



Alternatively, consult the National Building Specifications, Standard version clause/ clauses...M10/40 or M10/290.....

Knauf Insulation specification clauses can be downloaded from knaufinsulation.co.uk/nbs

Table 14 - U-values for concrete ground floors insulated below slab

Thickness (mm)	U-values (W/m ² K)							
	Ratio of perimeter (m) to area (m ²)							
	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
Polyfoam ECO Floorboard Standard and Extra								
165 (100+65)*	0.09	0.12	0.14	0.15	0.15	0.16	0.16	0.17
150 (75+75)	0.10	0.13	0.15	0.16	0.17	0.18	0.18	0.18
140 (75+65)	0.10	0.14	0.16	0.17	0.18	0.18	0.19	0.19
125 (75+50)	0.11	0.15	0.17	0.18	0.19	0.20	0.20	0.21
110 (75+35)	0.11	0.16	0.18	0.19	0.21	0.22	0.22	0.23
100 (1x100)**	0.11	0.16	0.19	0.20	0.21	0.22	0.23	0.24
90 (65+25)	0.12	0.17	0.20	0.22	0.24	0.25	0.26	0.26
75 (1x75)	0.13	0.19	0.23	0.25	0.27	0.28	0.29	0.30
65 (1x65)	0.13	0.20	0.24	0.27	0.29	0.30	0.32	0.33

BBA CERTIFICATE CB1001-2 U Value Competency Scheme
 Note: The U-values have been calculated assuming a clay subsoil with a thermal conductivity of 1.50 W/mK. U-values for Polyfoam ECO Floorboard Super available on request - contact Technical Advice and Support Centre on 01744 766666
 * Polyfoam ECO Floorboard Extra - 2x50+65
 ** Polyfoam Floorboard ECO Extra - 2x50

Table 15 - U-values for beam and block ground floors insulated below chipboard deck

Thickness (mm)	U-values (W/m ² K)							
	Ratio of perimeter (m) to area (m ²)							
	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
Polyfoam ECO Floorboard Standard and Extra								
165 (100+65)	0.11	0.13	0.14	0.15	0.15	0.16	0.16	0.16
150 (75+75)	0.12	0.15	0.16	0.17	0.17	0.17	0.18	0.18
140 (75+65)	0.12	0.15	0.17	0.17	0.18	0.18	0.19	0.19
125 (75+50)	0.13	0.16	0.18	0.18	0.19	0.20	0.20	0.20
110 (75+35)	0.14	0.17	0.19	0.20	0.21	0.22	0.22	0.22
100	0.14	0.18	0.20	0.21	0.22	0.22	0.23	0.23
90 (65+25)	0.15	0.19	0.21	0.23	0.24	0.25	0.25	0.26
75	0.16	0.21	0.24	0.26	0.27	0.28	0.29	0.29
65	0.17	0.22	0.26	0.28	0.29	0.30	0.31	0.32

BBA CERTIFICATE CB1001-2 U Value Competency Scheme
 Notes: The U-values have been calculated assuming a clay subsoil with a thermal conductivity of 1.50W/mK. The thermal conductivity of concrete blocks – 1.13 W/mK. For project specific calculations contact our Technical Advice and Support Centre on 01744 766666.

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it's time to save energy