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May 2006

Dow - Building Solutions

Insulating floors with STYROFOAM

Insulating floors: basic principles

This section describes the thermal insulation of floors using STYROFOAM™ extruded polystyrene insulation from Dow. It covers the principles, design considerations and installation methods for groundbearing and suspended floors in new build and renovation projects.

STYROFOAM Solutions

The STYROFOAM Solution for insulating groundbearing and suspended floors in new build and renovation is FLOORMATE™ which includes the products: FLOORMATE 200-X, STYROFOAM SP-X, FLOORMATE 500-X and FLOORMATE 700-A.

Insulating floors

Floors are classified as:

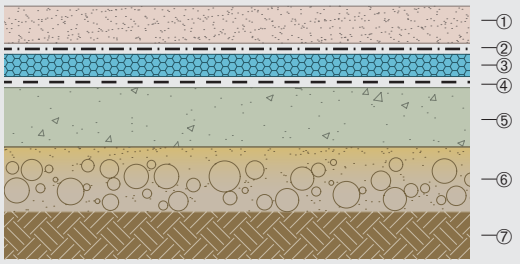
- ground floors, in contact directly, or indirectly with ground.
- exposed floors, forming lowest part of structure over un-enclosed airspace (e.g. balcony).
- semi-exposed floors, lowest part of a structure over an enclosed but unheated space (e.g. a floor over a garage).
- intermediate floors, having heated space above and below.

Ground floors may be groundbearing (figure 28) or suspended (figure 29): all other floors are, by definition, suspended.

The ground absorbs heat from floors close to or in contact with it, with high soil moisture content increasing the rate of loss. Those effects, when combined with the natural temperature gradient in buildings, can lead to uncomfortable internal environments, condensation at wall/floor junctions and higher than predicted energy usage. Exposed and semi-exposed floors, suffer heat loss to air, in the same wayother building elements.

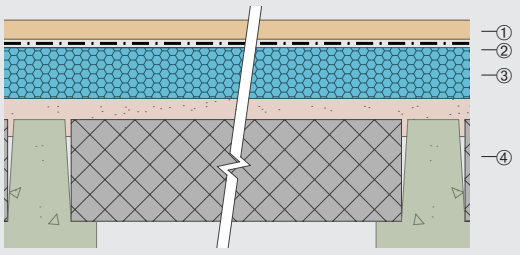
By including in the floor construction a layer of thermal insulation continuous with that in the rest of the building envelope, heat loss is reduced and thermal bridges at the junction of the floors and walls are avoided. However, thermal insulation incorporated in a floor must not compromise any of the functional requirements.

Agrément Certificate 92/2782 covers the use of FLOORMATE 200-X, STYROFOAM SP-X and FLOORMATE 500-X in groundbearing floors.



① screed with light mesh reinforcement
② vapour control layer (VCL)
③ FLOORMATE
④ damp proof membrane (DPM)
⑤ concrete slab
⑥ hardcore with sand blinding
⑦ ground

Figure 28 >> Groundbearing floor slab



① board or screed finish
② VCL/slip sheet (SS) 500 gauge polyethylene
③ FLOORMATE
④ beam and block floor with levelling topping

Figure 29 >> Suspended beam and block floor

Insulating floors: basic principles

Determining the floor construction

Floors must be designed as a whole element taking account of all the functional requirements. The position of the insulation is influenced by the type of construction, the predicted floor loading and the heating regime.

Buildings which are to be intermittently heated are usually designed with 'fast response' fabric with the thermal insulation on the inside of the structure. Heating systems which utilise the structure as a heat store require the thermal insulation to encompass as much of the structure as possible.

The design of foundations and groundbearing floors is influenced by the site on which the building is to be constructed. The load bearing capacity of the soil should be established before design work is undertaken.

Whilst a groundbearing floor is usually an effective construction for domestic and commercial buildings, a ground floor should be suspended in the following circumstances:

- domestic buildings on sloping sites where more than 600mm depth of infill would be required.
- where the bearing capacity and nature of the ground varies from one part to another.
- where the ground is of shrinkable clay, expansive material or other unstable soil type.

The site should be assessed for hazards likely to affect substructure and groundbearing floors such as chemicals (particularly sulphates), contaminated material above or in the ground and waterlogged ground. In some parts of the UK special precautions are necessary to reduce the entry of radon gas, details of those geographical areas may be obtained from the Department for Environment, Food and Rural Affairs (DEFRA).

Floors must be resistant to ground hazards as outlined in Building Regulations C1 + C2 (Standard 3.1 - 3.4 in Scotland).

Loadings

Floors should be designed to sustain safely the combined dead and imposed loads, without excessive deflection (Building Regulations 1991: Schedule 1 Requirement A1: Standard 1.1 in Scotland).

In self-contained dwellings FLOORMATE ™insulation can support the design load when:

- sited above a groundbearing slab and covered with suitable plywood, chipboard or screed.
- sited below a groundbearing slab and receiving the dead load of the slab and the loading transferred through the slab.
- laid on timber decking and covered with suitable plywood or chipboard.

Load bearing internal partitions must be built off the structural floor not the FLOORMATE insulation boards. Internal masonry walls must have their own foundations.

For buildings other than dwellings the correct grade of FLOORMATE insulation should be selected on the basis of an assessment of the loading by a structural engineer.

The maximum acceptable load on FLOORMATE insulation products is the design load together with a suitable safety factor. (The "design load" is that load on the insulation which will give a maximum compression of 2% after 50 years)

In the unlikely event of floor loadings being too high for an available grade of FLOORMATE board the material may be used as vertical edge insulation, which is not subject to loadings from the floor slab.

Insulating floors: basic principles

Thermal performance

Table 15 gives the thicknesses of FLOORMATE 200–X required to achieve a range of U-values for ground floors.

Refer to BS EN ISO 6946, BS EN 13370, CIBSE Guide A and BRE BR 443 'Conventions for U-value calculations' for the method of U-value calculation.

Heat loss from floors is concentrated at the perimeter. Whilst an uninsulated ground floor may achieve the required U-value the use of edge insulation will avoid thermal bridging at the floor perimeter. FLOORMATE boards may be installed as vertical or horizontal edge insulation depending on the application.When used as vertical edge insulation, FLOORMATE may be placed on the inside of the external walls (see figure 30), within a cavity or on the outside of the walls. Where horizontal edge insulation is used beneath the slab maintain the minimum slab thickness by setting the FLOORMATE boards into the sand blinding or by increasing the overall depth of the slab. Refer also to BRE document BR 262 'Thermal insulation: avoiding risks' and DEFRA/DTLR 'Robust Details'.

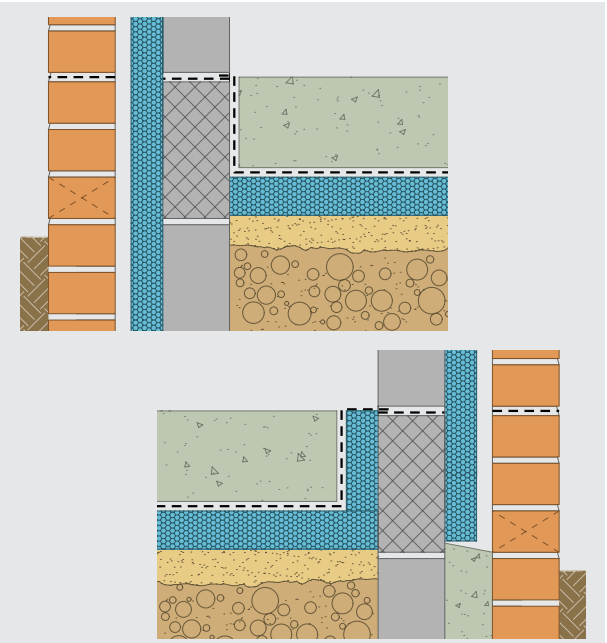


Figure 30 >> Horizontal edge insulation below concrete slab

Solid ground bearing floor											
	P/A	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00
U-values											
0.18		25	70	90	110	110	120	120	140	140	140
0.20		25	60	80	90	100	110	110	110	120	120
0.22		-	40	70	80	90	90	100	100	100	110
0.25		-	30	50	60	70	80	80	80	90	90
No insulation		0.21	0.36	0.48	0.58	0.67	0.75	0.82	0.89	0.95	1.00

65mm Screed

Suspended beam & block floor											
	P/A	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00
U-values											
0.18		50	90	110	120	120	120	140	140	140	140
0.20		30	80	90	100	100	110	110	110	110	120
0.22		25	60	80	90	90	90	100	100	100	100
0.25		25	50	60	70	80	80	80	80	90	90
No insulation		0.26	0.41	0.52	0.61	0.68	0.74	0.79	0.83	0.87	0.90

65mm Screed; block 100 x 440mm, (0.51 W/mK); beam 60mm, (1.13 W/mK)

Table 15 Thickness of FLOORMATE 200-X (mm) to meet U-values ($W/m^2.K$)

Insulating groundbearing floors: design

General description

In a groundbearing floor the ground is used to support the floor slab for the life of the building. The floor slab is formed:

- with reinforced or non-reinforced concrete poured within, but separate from the external walls, which are built off separate foundations.
- as a reinforced concrete raft combining both foundation and floor.

The FLOORMATE insulation can be installed:

- between the slab and a board finish (figure 31).
- between the slab and the screed (figure 32).
- below the slab (figure 33).

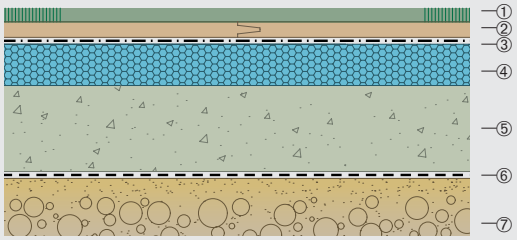
Positioning FLOORMATE insulation below the slab avoids any disruption to the construction sequence. In this position it supports the floor slab and it is essential the insulation have sufficient compressive strength: it must also be placed on well compacted level surface to avoid uneven settlement.

Because of the difficulty of providing edge insulation to a raft foundation, FLOORMATE insulation is not normally installed below the slab in raft constructions (figure 34).

FLOORMATE insulation is designed to give the maximum benefit in groundbearing floor construction:

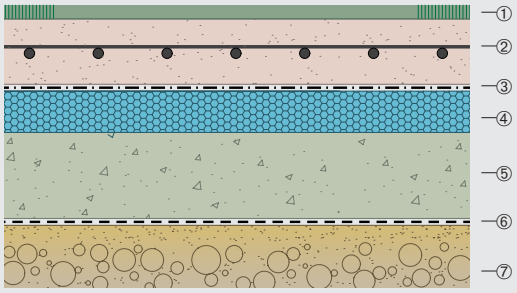
- a range of compressive strengths to match loading conditions.
- resistant to ground moisture.
- thicknesses from 25mm to 100mm allow thermal performance to be matched to project requirements.

Refer to Page 08 for the full physical and performance properties of FLOORMATE products.



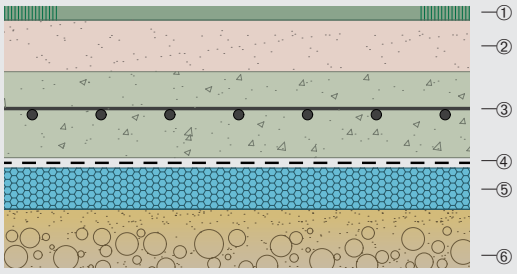
① floor finish e.g. carpet
② timber board
③ Vapour control layer (VCL)/Slip sheet (SS)
④ FLOORMATE
⑤ concrete slab
⑥ Damp proof membrane (DPM)
⑦ hardcore with sand blinding

Figure 31 >> Insulation between the slab and a board finish



① floor finish e.g. carpet
② screed with heating elements
③ VCL
④ FLOORMATE
⑤ concrete slab
⑥ DPM
⑦ hardcore with sand blinding

Figure 32 >> Insulation between the slab and the screed



① floor finish e.g. carpet
② screed
③ concrete slab incorporating heating elements
④ DPM
⑤ FLOORMATE
⑥ hardcore with sand blinding

Figure 33 >> Insulation below the slab

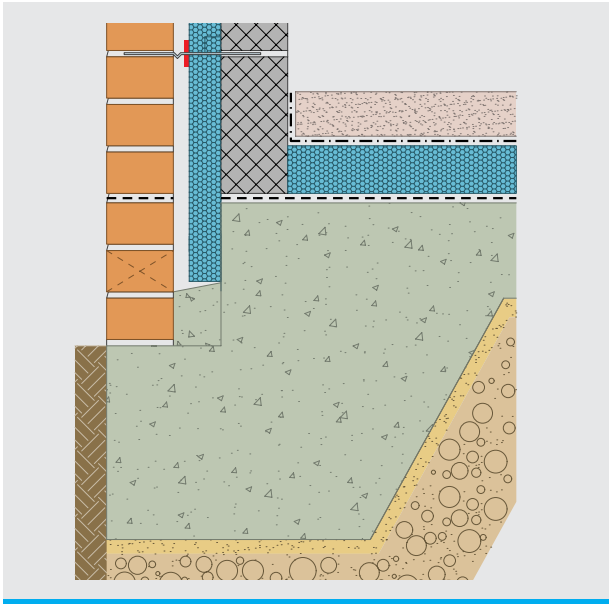


Figure 34 >> Insulation applied over a concrete raft

Site preparation

A bearing surface for the concrete slab should be prepared by removing all topsoil and vegetable matter and making up the level to the required height with inert, well graded fill. The fill, which should pass a 150mm by 100mm screen, should be laid and compacted in layers not exceeding 225mm to finished depths from 100mm to 600mm. Greater depths may be used for buildings other than dwellings in some circumstances.

The fill should be blinded with the minimum thickness necessary to give a suitable surface for the next layer of the construction and to protect it from being damaged by the hard core. Sand blinding is the most suitable to receive a sheet damp proof membrane (DPM) or FLOORMATE boards. Blinding to receive FLOORMATE boards should be flat and level so the boards can be laid accurately in a continuous layer without 'kicking up' or rocking.

Concrete slabs

Concrete slabs should be at least 100mm thick; the need for increased thickness and for reinforcement should be assessed in accordance with BS 8110: Pt 1. Movement joints in the slab should be aligned with movement joints in other elements in the structure. A slip sheet (SS) (which may be the DPM) must be incorporated between poured concrete and FLOORMATE insulation.

If FLOORMATE boards are to be installed over a slab the surface must be even (no more than 5mm deviation under a 3m straight edge) to prevent excessive deflection of the finished floor (refer to Agrément certificate 92/2782, BS 8203 and BS 8204: Part 1). FLOORMATE boards should only be laid over a slab once the building is weather tight and should be overlaid as soon as practicable to avoid damage from follow-on trades.

Screeds

Screeds must neither breakdown nor permit indentation of the floor finish.

Screeds which are not monolithic with the slab should be at least 65mm thick (75mm if heated or subject to higher loadings) to prevent cracking and curling. They should incorporate a light mesh (D49 to BS 4483) centrally positioned and passing through any joints in the screed.

An unbonded screed laid over FLOORMATE boards should be separated from the insulation by a slipsheet of 500 gauge polyethylene, well lapped and turned up at the floor edges. Floating screeds must not bridge gaps in the layer below.

Once laid, screeds should be covered immediately with a polyethylene sheet to ensure a slow cure and help avoid shrinkage cracks: the covering should be left in place for seven days (BRE Defect Action Sheet 52).

Where screeds are heated extra care must be taken on site to avoid failure of the heating elements and cracking of the screed. Electric heating elements may need to be separated from FLOORMATE products by a thickness of screed; check with the heating system manufacturer before specifying.

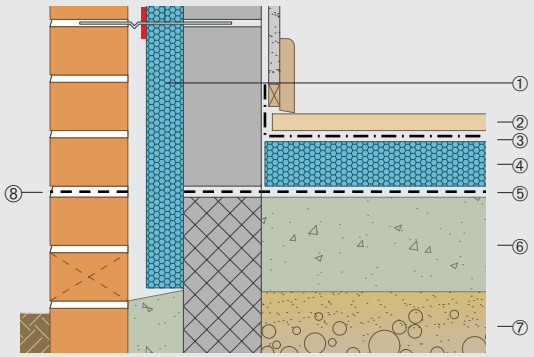
Curing/drying

Sufficient time should be allowed for the curing and drying out of concrete slabs and screeds. Guidance is given in BRE publication: 'Floors and Flooring' (Table1.3) and BS 8203.

Thermal bridging

To avoid a thermal bridge at the wall/ floor junction continue wall insulation down to the bottom of the concrete slab and install 25mm of FLOORMATE insulation vertically between the edge of the slab and the inner leaf. The exposed edge of the FLOORMATE board will normally be hidden by the internal plaster and skirting but at thresholds should be protected with a timber board. Alternatively, insulating blocks may be used for the inner leaf of the wall below floor level.

Doors in external walls require openings at floor level which need special attention to avoid thermal bridges (figures 35 to 37). Refer also to BRE document 'Thermal insulation: avoiding risks' and DEFRA/DTLR 'Robust Details'.



① WALLMATE CW-X
② floor finish
③ VCL/SS
④ FLOORMATE
⑤ DPM
⑥ concrete slab
⑦ hardcore with sand blinding
⑧ Damp proof course (DPC)

Figure 35 >> FLOORMATE boards above slab junction with WALLMATE CW-X

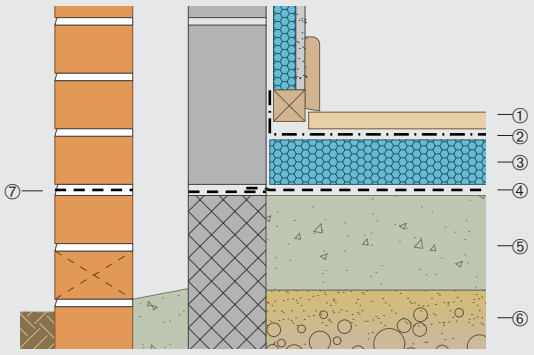
Moisture

Building Regulation C2 (Standard 3.4 in Scotland) requires floors to resist the passage of ground moisture into the building. Moisture can reach the interior of the building as either ground water rising through porous construction elements or construction water from concrete slabs or screeds. Specific guidance is given in Approved document C (Technical Handbook section 3.4 - Scotland).

A DPM placed above the slab and linked to the damp proof course (DPC) will exclude ground moisture and protect the finish against construction moisture. The vapour control layer (VCL) must be positioned on the warm side of the insulation.

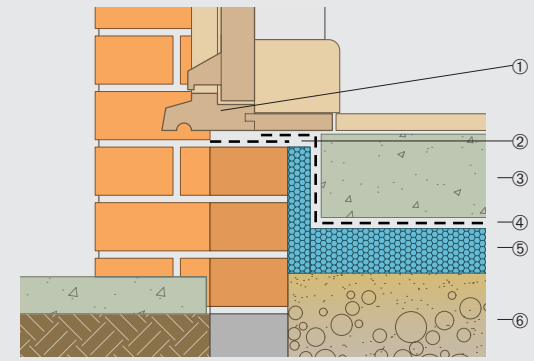
If the DPM is positioned below the slab a separate moisture barrier must be included above the slab to protect any moisture sensitive floor finishes; this additional moisture barrier will also assist the proper curing of the concrete.

When laying FLOORMATE boards over liquid applied DPMs ensure the DPM does not contain solvents incompatible with extruded polystyrene foam. Check with the DPM manufacturer.



① floor finish
② VCL/SS
③ FLOORMATE
④ DPM
⑤ concrete slab
⑥ hardcore with sand blinding
⑦ DPC

Figure 36 >> FLOORMATE boards above slab junction with STYROFOAM



① threshold
② DPC
③ concrete slab
④ DPM
⑤ FLOORMATE
⑥ hardcore with sand blinding

Figure 37 >> Avoiding thermal bridges at thresholds, typical solution

Surface water arising from conditions of use, e.g. water carried on footwear into entrance halls or spillages in kitchens and bathrooms can damage some flooring or flooring panels such as chipboard. Where surface water is likely to occur moisture resistant products or grades of product should be used throughout the floor construction. FLOORMATE insulation is resistant to moisture.

Services

Services such as gas and central heating pipes and electrical cables should be run in a duct set into the screed or the FLOORMATE boards to allow for access (figure 38). Services should not be embedded:

- faults are hard to find, and repair requires the floor finish to be taken up and the screed to be broken up, possibly damaging other services.
- the thickness of the screed is reduced over the service, increasing the risk of cracking.

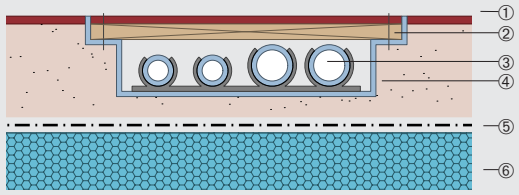
Electrical cables less than 50mm from the underside of the flooring panels should be protected from the floor panel's fixings by an earthed metallic sheath or earthed steel conduit.

PVC-covered cables likely to come into contact with FLOORMATE insulation should be protected by metal or uPVC conduit or trunking to avoid the risk of plasticiser migration from the PVC.

Water service pipes rising through a ground floor must be adequately insulated to prevent freezing (for guidance consult BRE document 'Thermal insulation: avoiding risks'). To avoid dampness entering the building the DPM must be sealed around pipes and ducts where they pass through the floor construction.

Underfloor heating systems

The use of warm water underfloor heating is on the increase, for guidance refer to BS EN 1264-4: 2001 and the Domestic Heating Compliance Guide.



① floor finish
② access cover
③ services
④ pre-formed channel set into screed
⑤ VCL
⑥ FLOORMATE

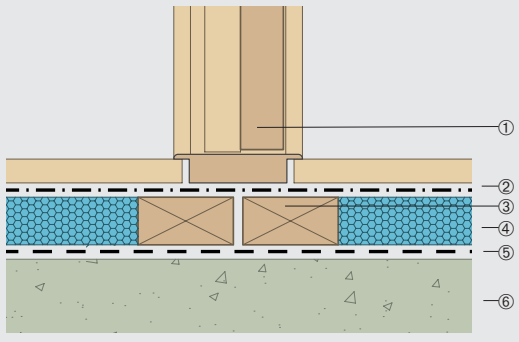
Figure 38 >> Typical service run in floor screed

Overlaying FLOORMATE with timber

As FLOORMATE boards do not provide a suitable surface for the direct application of a floor finish: they must be overlaid with a screed or with a timber based board.

When FLOORMATE insulation is overlaid with a board, there is a risk of the insulation being compressed where the floor is subjected to relatively high loads for extended periods, possibly leading to uneven floor surfaces. Check design load to ensure use of the correct FLOORMATE grade.

Before laying FLOORMATE boards battens should be positioned at doorways and the foot of stairs and to support partitions, kitchen fittings and sanitary fittings (figure 39). The battens should be preservative treated, in accordance with BS 5268: Part 5 (check compatibility of preservatives with FLOORMATE insulation), and fixed to the slab through the DPM. (Adequate time should be allowed for preservatives to fix and for solvents from solvent based preservatives to evaporate.)



① door opening
② VCL/SS
③ timber batten
④ FLOORMATE
⑤ DPM
⑥ floor slab

Figure 39 >> Additional support at thresholds

Moisture resistant overlays and finishes should only be placed once the building is weathertight. They must be protected from damage by residual moisture in screeds and slabs. A slipsheet (500 gauge polyethylene) should always be laid between FLOORMATE boards and the floor covering. A construction which is still damp when FLOORMATE insulation and a boarded finish are to be installed should be overlaid with an additional DPM of at least 1200 gauge polyethylene, well lapped, sealed at joints and turned up at edges behind skirting to protect the flooring from construction moisture in the wall.

Timber floor finishes should be applied in accordance with the recommendations of BS 8201. Chipboard should be to BS 5669 Type C4 18mm thick laid with staggered cross joints. All joints should be bonded with wood grade PVA adhesive to avoid their squeaking in use; check the compatibility of the adhesive with FLOORMATE insulation prior to laying. Wedge the panels temporarily at the perimeter until the adhesive has set.

Allow a gap of 10mm or 2mm per linear metre of flooring (whichever is the greater) between the chipboard and the perimeter wall. Proprietary expansion joints may be required for uninterrupted floor runs greater than 5 metres, the joints should allow for 2mm expansion per metre of floor.

Where there is a likelihood of regular water spillage (e.g. bathrooms and kitchens) the chipboard must be protected by a waterproof covering such as continuous sheet vinyl turned up at abutments.

For details of laying other timber overlays refer to BS 8203.

Specification

The following NBS clauses are relevant to the specification of FLOORMATE insulation:

E20 Formwork for in situ concrete

200 Underslab sheet insulation

- **Insulation:** extruded polystyrene boards
- **Thickness:** 25/30/35/40/50/60/70/75/80/90/100/120/140† mm
- **Manufacturer and reference:**

Dow Chemical Co. Ltd,
Building Solutions,
2 Heathrow Boulevard,
284 Bath Road, West Drayton, Middlesex, UB7 0DQ.
Tel: 020 8917 5050 - Fax: 020 8917 5413

FLOORMATE 200-X; STYROFOAM SP-X; FLOORMATE 500-X; FLOORMATE 700-A

Board sizes: 1250 x 600mm and 2500 x 600mm†
Edge profile: butt edge, ship lap
Compressive strength†: 200kN/m², 350kN/m², 500kN/m², 700kN/m²
Design loading† : 60kN/m², 110kN/m², 150kN/m², 250kN/m²
Fire classification: Reaction to fire: BS EN 13164 - Euro class E

- lay sheets on a level bed of sand, not less than 13mm thick.
- seal all joints by overlaying with 500 gauge polyethylene with lapped joints.
- ensure that insulation is covered with concrete blinding (see section E10) before fixing slab reinforcement.

† select appropriate values using STYROFOAM Solutions Product Data - See page 09

M10 Cement:sand/concrete screeds/toppings

290 Floating construction

- Insulation: *(as E20)*
- Thickness: *(as E20)*
- Manufacturer and reference: *(as E20)*

  FLOORMATE 200-X; STYROFOAM SP-X; FLOORMATE 500-X; FLOORMATE 700-A

  Board size: *(as E20)*

  Edge profile: *(as E20)*

  Compressive strength: *(as E20)*

  Design loading: *(as E20)*

  Fire classification: *(as E20)*

- lay insulation with tight butt joints and continue up at all abutments with walls, columns etc. for full depth of screed.
- lay separating layer of 500 gauge polyethylene sheet, lapping 100mm at joints.

Insulation below screed may also be specified with clause M13 - 260.

K11 Rigid sheet flooring ...

225 Particleboard floating floor

- Base: ...
- Preparation: ...
- Insulation: *(as E20)*
- Thickness: *(as E20)*
- Manufacturer and reference: *(as E20)*

  FLOORMATE 200-X; STYROFOAM SP-X; FLOORMATE 500-X; FLOORMATE 700-A

  Board size: *(as E20)*

  Edge profile: *(as E20)*

  Compressive strength: *(as E20)*

  Design loading: *(as E20)*

  Fire classification: *(as E20)*

- Vapour control layer: ...
- Flooring: particleboard to BS EN 312, Type P5

  Thickness: ...mm

  Edges: tongued and grooved all edges

  Fit boards together tightly with end joints staggered.

  Glue all joints.

Insulation below flooring may also be specified with:
K11 - 115/125/135/145/215/235/245,
K20 - 150/160, K21 - 120/130

Insulating groundbearing floors: installation

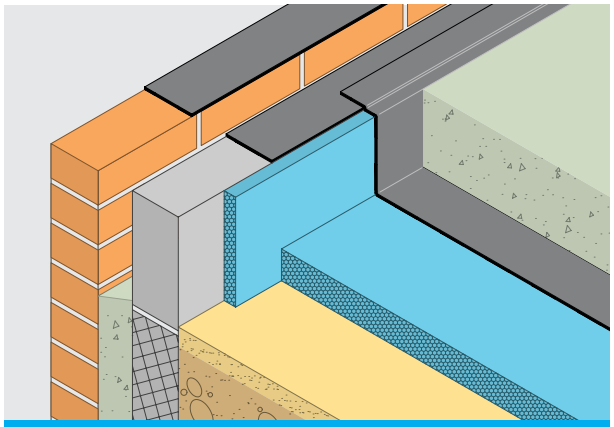


Figure 40 >> Floormate under slab

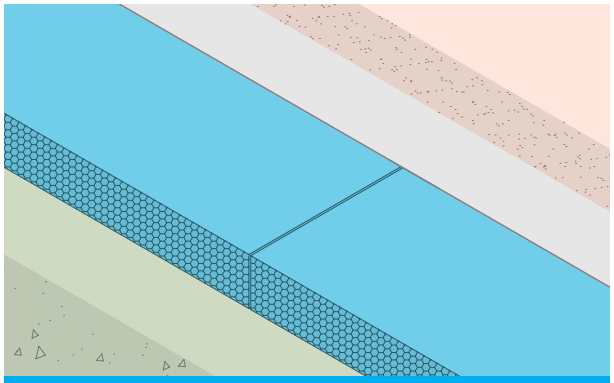


Figure 41 >> Floormate under screed

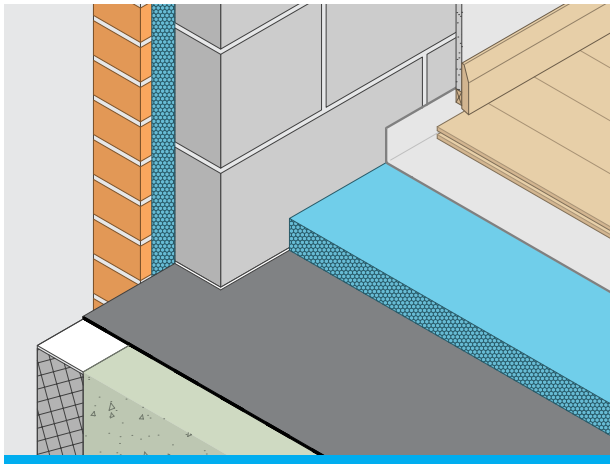


Figure 42 >> Floormate below timber

Installation sequence FLOORMATE under slab

(figure 40)

1. Compact fill and blind with sand.
2. Fit 25mm thick FLOORMATE boards vertically at the edges.
3. Lay FLOORMATE boards with edges tightly butted.
4. Overlay with the DPM, lapping and sealing joints. Turn up at edges ready to link into the DPC.
5. Lay the floor slab.

Installation sequence FLOORMATE under screed (figure 41)

1. When the concrete slab is sufficiently cured check the surface for trueness and, if necessary blind with sand.
2. Lay FLOORMATE boards with edges tightly butted.
3. Overlay with a slip sheet with edges lapped.
4. Lay screed and leave to cure for at least seven days.

Installation sequence FLOORMATE below timber (figure 42)

1. Lay DPM over the concrete slab.
2. Lay FLOORMATE board with edges tightly butted.
3. Overlay FLOORMATE with slipsheet with joints lapped and edges turned up.
4. Fit flooring boards, leaving a 10mm gap at perimeters.

Key points

- avoid point loading (eg wheelbarrows and foot traffic) of FLOORMATE thermal insulation during installation; provide scaffold boards or similar.
- protect FLOORMATE boards and DPM while concreting or screeding.
- lay insulation over whole floor leaving no gaps.
- stagger board joints when laying insulation in two or more layers.
- use temporary timber battens over perimeter walls to protect edge insulation (if present).
- tape joints in DPM and lap with wall DPC. Ensure DPM is correctly positioned and continuous with DPC.
- ensure all damp proof membranes and slip sheets are installed and turned up correctly.
- ensure reinforcement and installation procedures for screeds are carried out in accordance with the specification.
- allow screeds to cure before any floor finishes are applied.
- at penetrations of the floor slab by service and soil pipes, take care to avoid ground moisture bypassing the DPM. Cut FLOORMATE boards to fit the penetration closely. Fill small gaps with an expanding polyurethane foam to form an airtight seal.
- where services are run within a concrete slab, they should be tested before the slab is laid.
- keep service runs beneath the flooring to a minimum, ensure they are accessible for maintenance. Allow a gap of at least 10mm between timber based flooring panels and the wall.

Insulating suspended floors: design

General considerations

Suspended floors are supported on the walls and can be formed from:

- timber joists and boarding.
- cast in-situ concrete.
- concrete beams and block infills.
- precast concrete units.

Intermediate floors are by definition suspended and are only required to incorporate thermal insulation if the floor divides a heated space from an unheated space or outside air, or when a floor slab extends to form a balcony over the outside air.

FLOORMATE insulation is designed to give the maximum benefit in suspended ground and intermediate floors:

- a range of compressive strengths to match loading conditions.
- resistant to ground moisture.
- thicknesses from 25mm to 100mm allow thermal performance to be matched to project requirements.

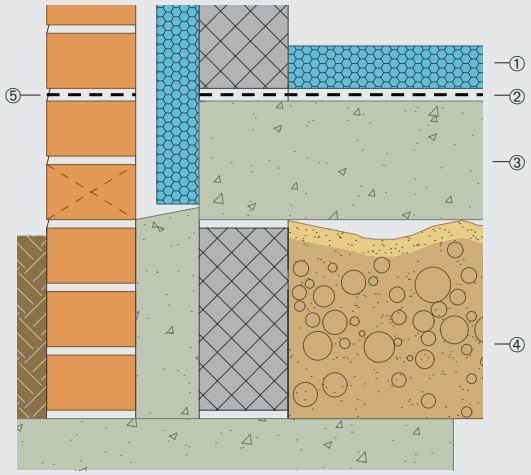
Consult the technical data on Page 09 for the full physical and performance properties of FLOORMATE.

Suspended ground floors of cast in-situ concrete

Ground floor slabs may be formed in-situ onto fill which is expected to settle and is therefore regarded merely as temporary shuttering. In such cases the slab must be designed and reinforced as a suspended slab even though it is, initially, ground-bearing (figure 43). In this type of floor, the DPM should be laid directly on the slab and then covered by the FLOORMATE, followed by the other layers of the floor construction.

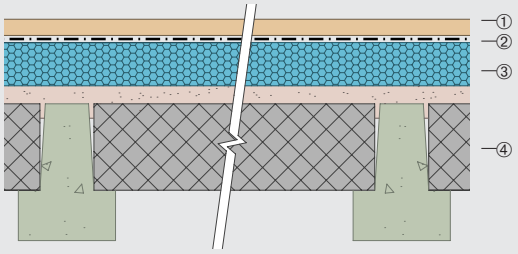
Beam and block and precast ground floors

Beam and block floors (figure 44) and precast floors (figure 45) should be levelled ie. no more than 5mm deviation under a 3m straight edge with a screed or grouted prior to laying FLOORMATE boards. FLOORMATE insulation is best applied over the beams and beneath a screed or boarded finish.



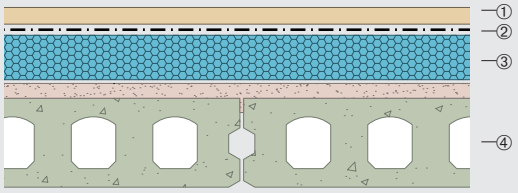
① FLOORMATE
② DPM
③ concrete slab
④ hardcore with sand blinding
⑤ DPC

Figure 43 >> FLOORMATE boards over cast in-situ concrete



① board or screed finish
② VCL/SS
③ FLOORMATE
④ beam and block floor with levelling topping

Figure 44 >> FLOORMATE boards over beam and block floor



① board or screed finish
② VCL/SS
③ FLOORMATE
④ precast floor with levelling topping

Figure 45 >> FLOORMATE boards over precast concrete floor

Suspended ground floors of timber

Timber joisted floors involve no wet trades, are simple to install and avoid the need for large amounts of compacted backfill. They can be insulated using FLOORMATE extruded polystyrene in several ways:

- between joists (figure 46).
- attached to bottom of joists.
- on decking (for example suitable grade of chipboard) laid over joists.

FLOORMATE boards should not be positioned directly onto the joists.

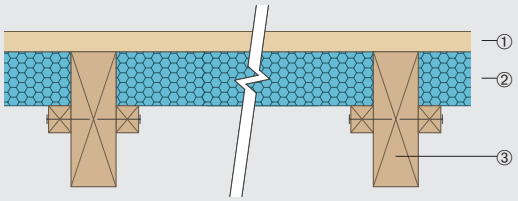


Figure 46 >> FLOORMATE boards between joists

Thermal bridging

In suspended ground floors, as with groundbearing floors, it is important to detail wall/floor junctions to avoid thermal bridges.

In exposed floors, there is a risk of thermal bridging at the wall/floor junction where the wall is built off a projecting floor. Ensure continuity of wall and floor insulation (figure 47) or use insulating blockwork and overlapping layers of insulation (figure 48) or insulate internally (figure 49).

Where the floor structure is timber joists, ensure the space between the joist and the wall is packed with thermal insulation or fix FLOORMATE boards to the underside of the floor externally and apply a vandal proof soffit. Refer also to BRE BR 262 'Thermal insulation: avoiding risks' and DEFRA/DTLR 'Robust Details'.

The detailing of balconies requires careful attention to avoid problems with thermal bridging; for guidance refer to BRE BR 262.

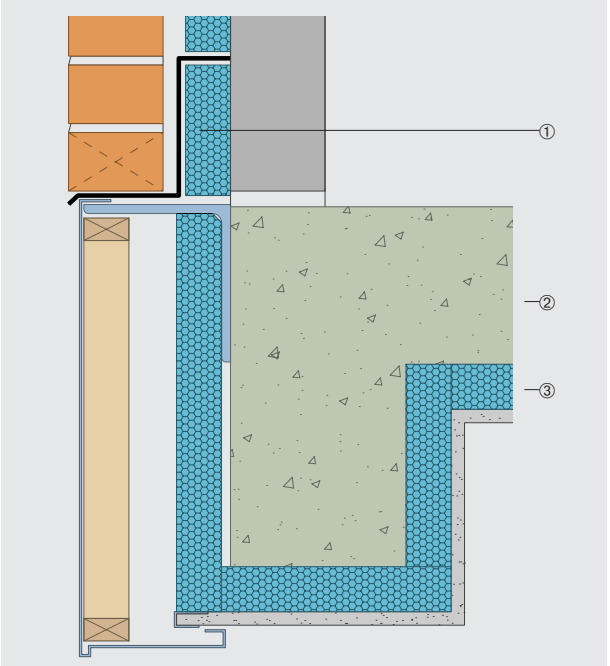
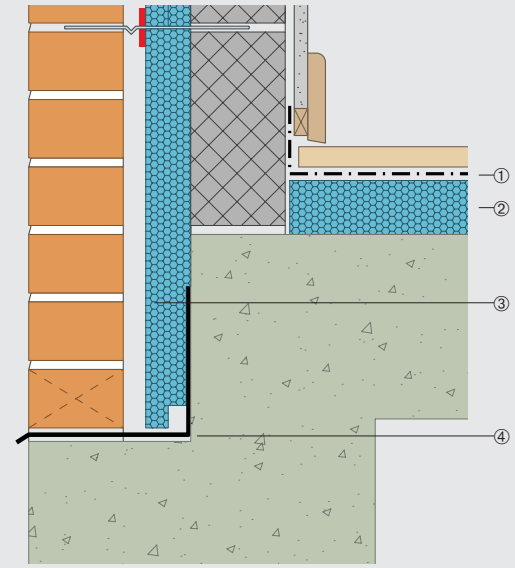
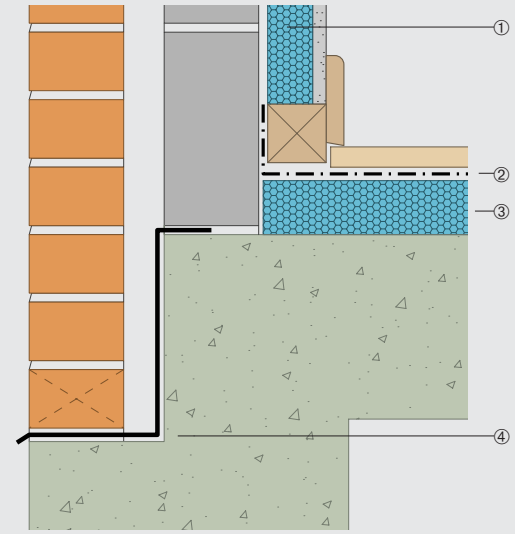


Figure 47 >> Exposed wall/floor junction, outer leaf supported independently



① VCL/SS
② FLOORMATE
③ WALLMATE CW-X
④ DPC/tray

Figure 48 >> Exposed wall/floor junction, insulation applied internally



① STYROFOAM LB - X /plasterboard laminate
② VCL/SS
③ FLOORMATE
④ DPC/tray

Figure 49 >> Exposed wall/floor junction, lightweight blockwork inner leaf

Services

Central heating pipes are often run in the void below suspended timber floors or within the joist depth. When FLOORMATE boards are incorporated in the construction, it is best to locate the pipework above the insulation to minimise heat loss into the cold void (figure 50). The pipes should be insulated to concentrate heat output at the radiators.

Run gas pipes below the FLOORMATE boards.

Cables run close to FLOORMATE insulation may need to be de-rated in line with IEE Regulations. PVC-covered cables likely to come into contact with FLOORMATE insulation should be protected by metal or uPVC conduit or trunking to avoid the risk of plasticiser migration from the PVC.

Specification

The following NBS clauses are relevant to the specification of FLOORMATE insulation:

P10 Sundry insulation

255 Rigid board insulation supported between floor joists

››› **Insulation:** extruded polystyrene boards

››› **Thickness:**
25/30/35/40/50/60/70/80/90/100/120/140† mm
†delete as appropriate

››› **Manufacturer and reference:**
Dow Chemical Co. Ltd,
Building Solutions,
2 Heathrow Boulevard,
284 Bath Road, West Drayton, Middlesex, UB7 0DQ.
Tel: 020 8917 5050 - Fax: 020 8917 5413

FLOORMATE 200-X
Board size: 2500mm x 600mm
Edge profile: butt edge
Compressive strength: 200kN/m²
Design loading: 60kN/m²
Fire classification:
Reaction to fire: BS EN 13164 - Euroclass E

››› Supports: saddle clips†† / nails†† / preservative treated battens††

››› Fit tightly with closely butted joints, leaving no gaps

† select appropriate values using STYROFOAM Solutions Product Data
†† delete as appropriate

Insulation laid on boarding may also be specified with: K11 - 115/125/135/145/215/235/245, K20 - 150/160, K21 - 120/130

Insulating suspended floors: installation

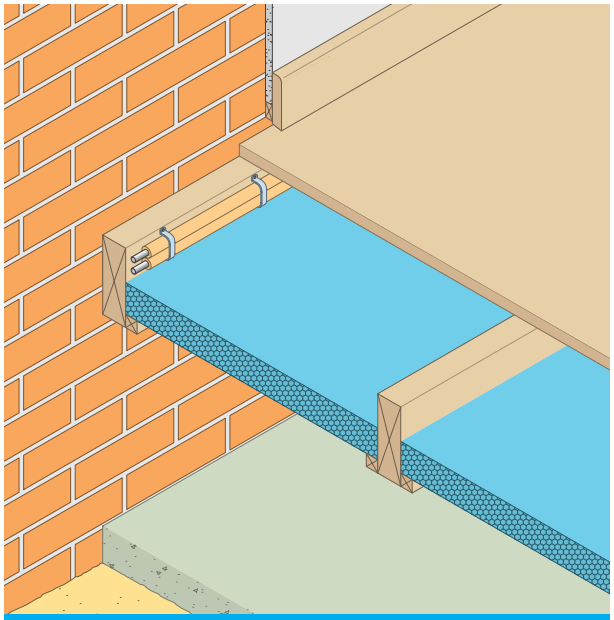


Figure 50 >> Services above FLOORMATE boards

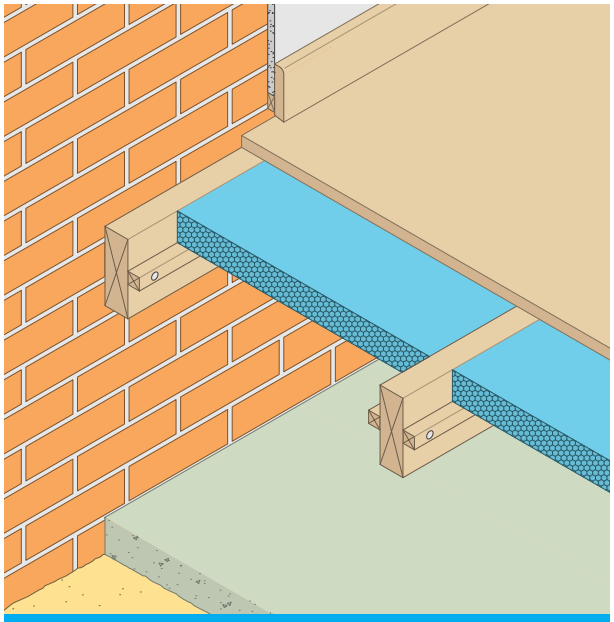


Figure 51 >> FLOORMATE boards between joists

Installation sequence

Beam and block and precast floors

(figures 45 and 45)

1. Lay topping to provide necessary level surface.
2. Lay FLOORMATE boards with edges tightly butted.
3. Overlay with slip sheet with edges lapped.
4. Lay board or screed finish (allow to cure for at least 7 days).

Timber floors (figure 51)

1. Fix preservative treated battens to the sides of floor joists so the height of the joist above the batten is the same as the thickness of the FLOORMATE boards.
2. Cut FLOORMATE boards so they will fit tightly between the joist and lay on the battens.
3. Lay and fix floor boards.

Key points

Beam and block and precast floors

- refer to Key Points under Insulating groundbearing floors: installation.

Timber floors

- fit FLOORMATE boards tight to the underside of the floor to avoid air movement between the FLOORMATE boards and the floor.
- pack FLOORMATE insulation into any spaces at the perimeter.
- at penetrations cut boards around the pipe or duct and seal the gap with polyurethane foam.
- ensure underfloor ventilation is clear and not restricted at sleeper walls.

Insulating floors: renovating floors

General considerations

Improving the thermal performance of existing floors during renovation can be desirable and economic. Existing timber ground floors may be overlaid with insulation and a new flooring surface.

Timber ground floors in pre-war properties often suffer from rot and insect infestation while the underfloor void can be a habitat for rodents. Such floors may be replaced by a groundbearing concrete floor incorporating thermal insulation (see figure 52).

Overlaying existing timber floors

When upgrading an existing timber floor the skirting should be removed and the appropriate grade of FLOORMATE laid. The flooring and finish is then laid on it. The skirting will then be reinstalled or replaced and doors shortened to open over the new level.

Renovating with a concrete groundbearing floor

When replacing an existing timber floor with a concrete groundbearing floor follow the guidance on pages 35 - 44 of this brochure, taking account of the following:

- fill deep sub-floor voids with hard core or a suitable non-settling fill to a maximum depth of 600mm.
- if the DPM cannot be tied into the DPC, it should be dressed up behind a skirting.
- block off ventilation openings.

FLOORMATE extruded polystyrene can also be used to provide floor insulation in conversions, for example when converting an agricultural building to domestic use. Old concrete, stone or earth floors should be removed down to a level suitable to accept the new insulated floor. Site assessment and preparation in refurbishment projects should follow the same procedures as for new-build.

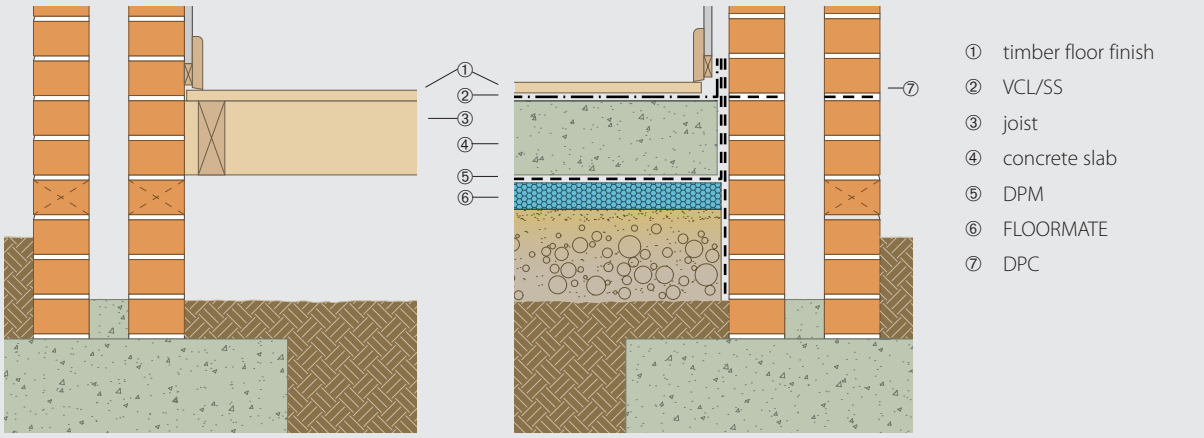


Figure 52 >> Replacement of decaying timber floor with a new insulated concrete floor

References

Agrément certificates

- 87/1836 Pitched roofs - warm roof concept
- 88/2105 Cavity walls
- 92/2782 Floors
- 97/3431 Inverted roofs

Building Regulations

- Approved Documents to the Building Regulations
  - A Structure
  - B Fire safety
  - C Site preparation and resistance to moisture
  - E Resistance to the passage of sound
  - L1A Conservation of fuel and power in new dwellings
  - L1B Conservation of fuel and power in existing dwellings
  - L2A Conservation of fuel and power in new buildings other than dwellings
  - L2B Conservation of fuel and power in existing buildings other than dwellings
- Technical Handbooks to Building Standards Scotland Regulations

BRE publications

- Thermal insulation: avoiding risks BR 262:2002.
- Conventions for U-value calculations
  - B. Anderson BR443: 2006
- Building Elements: 'Floors and Flooring' – PW Pye and HW Harris BR 332: 1997
- Foundations, basements and external walls BR 440: 2002.
- BRE Digest 311. Wind scour of gravel ballast on roofs.
- BRE IP 17/01. Assessing the effects of thermal bridging at junctions and around openings in the external elements of buildings.

British Standards

- BS 743: 1970: Specification for materials for damp proof courses.
- BS 476: Fire tests on building materials and structures.
  Part 2: 1987. Methods for determination of the fire resistance of loadbearing elements of construction.
  Part 3: 1958: External fire exposure roof test
- BS 743:1970: Specification for Materials for Damp proof courses.
- BS 1202: Specification for nails.
  Part 1: 2002: Steel nails.
- BS 5250: 2002: Code of practice for control of condensation in buildings.
- BS 5427: Code of practice for the use of profiled sheet for roof and wall cladding on buildings.
  Part 1: 1996: Design.
- BS 5950: Structural use of steelwork in building.
  Part 4: 1994 Code of practice for design of composite slabs with profiled steel sheeting.
- BS 5268: Structural use of timber.
  Part 4: Fire resistance of timber structures.
  – Section 4.2: 1990: Recommendations for calculating fire resistance of timber stud walls and joisted floor constructions.
  Part 7: Recommendations for the calculation basis for span tables.
  – Section 7.1: 1989: Domestic floor joists.
- BS 5502: Buildings and structures for agriculture.
  Part 23: 1990: Code of practice for fire precautions.
  Part 42: 1990: Code of practice for design and construction of pig buildings.
  Part 71: 1992: Code of practice for design and construction of ventilated stores for potatoes and onions.
- BS 5534: 2003: Code of practice for slating and tiling.
- BS 5628: Code of practice for use of masonry.
  Part 3: 1985: Materials and components, design and workmanship.
- BS 6203: 1991 (1996) Guide to fire characteristics and fire performance of expanded polystyrene materials used in building applications.
- BS 6229: 2003: Code of practice for flat roofs with continuously supported coverings.
- BS 6398: 1983: Specification for bitumen damp proof courses for masonry.
- BS 6399: Loading for Buildings
  Part 1: 1996: Code of practice for dead and imposed loads.
  Part 2: 1997: Code of practice for wind loads.
  Part 3: 1988: Code of practice for imposed roof loads.

References

- BS 6515: 1984 (1996) Specification for polyethylene damp-proof courses for masonry.
- BS 8000: Workmanship on building sites.
  Part 4: 1989: Code of practice for waterproofing.
- BS 8102: 1990: Code of practice for protection of structures against water from the ground.
- BS 8103 Structural Design of low-rise buildings.
  Part 1: 1995: Code of practice for stability, site investigation, foundations and ground floor slabs for housing.
- BS 8110: Structural use of concrete.
  Part 1: 1997: Code of practice for design and construction.
- BS 8203: 2001 Code of practice for resilient floor coverings.
- BS 8204: Screeds, bases and in-situ floorings.
  Part 1: 1999 Code of practice for concrete bases and cement sand levelling screeds to receive floorings.
  Part 2: 1999: Code of practice for concrete wearing surfaces.
- BS 8215: 1991: Code of practice for design and installation of damp proof courses in masonry construction.
- BS 8218: 1998: Code of practice for mastic asphalt roofing.
- CP 1018: 1971 (1993) Electric floorwarming systems for use with off-peak and similar supplies of electricity.

European standards

- BS EN 1264: Floor heating. Systems and components.
  Part 4: 2001 Installation
- BS EN 12056: Gravity drainage systems inside buildings.
  Part 3: 2000: Roof drainage, layout and calculation.
- BS EN 13164: 2001 Thermal insulation products for buildings - Factory made products of extruded polystyrene (XPS) specification.
- BS EN 13501: Fire classification of construction products and building elements.
  Part 1: Classification using test data from reaction to fire tests
- BS EN 13370: 1998 Thermal performance of buildings – Heat transfer via the ground – Calculation methods
- BS EN 13789: 1999: Thermal performance of buildings - Transmission heat loss coefficient - Calculation method.

International standards

- BS EN ISO 6946: 1997 Building components and building elements – Thermal resistance and thermal transmittance – Caculation method.

Other publications

- CIBSE Guide A (1999)
- DEFRA/DTLR Robust Details – Limiting thermal bridging and air leakage: Robust Construction details for dwellings and similar buildings. 2002
- NBS Domestic Heating Compliance Guide: 2006

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Recommendations

The STYROFOAM range of blue extruded foamed polystyrene insulation products includes FLOORMATE, ROOFMATE, WALLMATE and PERIMATE.

STYROFOAM products contain a flame retardant additive to inhibit accidental ignition from a small fire source. STYROFOAM is, however, combustible and if exposed to an intensive fire may burn rapidly.

During shipment, storage, installation and use STYROFOAM products should not be exposed to flames or other ignition sources.

Fire classification is based on small-scale tests, which may not reflect the reaction of the products in its end use state under actual fire conditions.

STYROFOAM products should, when installed, be adequately protected from direct exposure to fire.

Recommendations about the methods, use of materials and construction details are given as a service to designers and contractors. These are based on the experience of Dow with the use of STYROFOAM products. Any drawings are meant only to illustrate various possible applications and should not be taken as a basis for design. Since Dow is a materials supplier and exercises no control over the installation of STYROFOAM products, no responsibility is accepted for such drawings and recommendations.

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Notes

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