

# RAVATHERM<sup>TM</sup> XPS X

Insulating floors and basements  
with Ravatherm XPS X





**Ravatherm XPS X offers excellent insulation for groundbearing and suspended floors in both new-build and renovation projects. Ravatherm XPS X range of extruded polystyrene boards can deliver thermal performance and strength for the lifetime of a structure.**

# About Ravatherm XPS X

Ravatherm XPS X delivers improved thermal performance for flooring applications. It is made using extrusion technology which gives it a uniform structure of closed cells and a smooth skin. This makes it suitable for applications where the insulation material is directly exposed to a moist environment over a long period. The closed cell structure also gives the foam great rigidity and makes it highly resistant to compression.

Ravatherm XPS X insulation is available in a range of compressive strengths to match the loading requirements of individual projects. Ravatherm XPS X insulation can be installed under or over the slab in ground bearing concrete floors and is suitable for use with suspended beam and block and timber floors.

With low water absorption, Ravatherm XPS X has natural resistance to rain, snow, frost and water vapour which makes it an exceptionally stable material. It retains its initial insulation performance and physical integrity in exposed conditions over the very long term.

Ravatherm XPS X has attained a BREEAM Green Guide Rating A. Ravatherm XPS X is made using carbon dioxide as the main blowing agent, Ravatherm XPS X has an Ozone Depletion Potential (ODP) of zero and a Global Warming Potential (GWP) of less than five.

Ravatherm XPS X has high strength and rigidity, and good dimensional stability. It can be cut easily and accurately using hand tools, offering simple and quick installation with minimal waste.

Ravatherm XPS X boards have low susceptibility to rot, minimising mould or fungal growth. They are clean, odourless and free from irritating dust.

## **FIRE**

Information on aspects of fire performance of extruded polystyrene in building applications is given in BS 6203: 2003, 'Guide to fire characteristics and fire performance of expanded polystyrene materials (EPS and XPS) used in building applications'.

Ravatherm XPS X achieves Euroclass E for reaction to fire BS EN 13501 – 1.

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

Ravatherm XPS X contains a flame retardant additive to inhibit accidental ignition from a small fire source. However, Ravatherm XPS X is combustible and if exposed to an intensive fire may burn rapidly. During shipment, storage, and installation Ravatherm XPS X products should not be exposed to flames or other ignition sources.

Ravatherm XPS X, once installed, should be adequately protected from direct exposure to fire.

## **TEMPERATURE**

Polystyrene products will melt when brought into direct contact with high temperature heat sources: for Ravatherm XPS X boards the recommended maximum continuous working temperature is 75°C.

## **WATER/MOISTURE**

Ravatherm XPS X is:

- highly resistant to water absorption
- very resistant to the passage of water vapour
- highly resistant to repeated freeze/thaw cycles.

## **BIOLOGICAL**

Ravatherm XPS X has a low susceptibility to rot, and mould or fungal growth is therefore minimised.

## **CHEMICAL**

Ravatherm XPS X boards are compatible with most commonly occurring construction materials such as lime, cement, plaster, anhydrous gypsum, solvent-free bituminous compounds, water-based wood preservatives, as well as alcohols, acids and alkalis.

Certain organic materials such as solvent-based wood preservatives, coal tar and derivatives (creosote), paint thinners and common solvents (e.g. acetone, ethyl acetate, petrol, toluene and white spirit) will attack Ravatherm XPS X resulting in softening, shrinkage and possible dissolution, with a consequent loss of performance.

The use of solvent-free adhesives is advised. Compatibility with Ravatherm XPS X should be checked with the adhesive suppliers.

## **SUNLIGHT**

Protect Ravatherm XPS X from prolonged exposure to sunlight to prevent degradation of the surface of the board.

## **DURABILITY**

Properly installed, Ravatherm XPS X boards have a service life comparable with that of the building or structure.

## **ENVIRONMENTAL**

Ravatherm XPS X is non bio-degradable and does not present an environmental hazard.

## **DISPOSAL**

Where circumstances allow Ravatherm XPS X can be:

- recycled
- disposed of as landfill
- incinerated to recover the energy content.

# Insulating floors - basic principles

## Floor types

**Ground floors** are in contact directly, or indirectly, with the ground.

**Exposed floors** form the lowest part of a structure over unenclosed airspace (e.g. a balcony).

**Semi-exposed floors** form the lowest part of a structure over an enclosed but unheated space (e.g. a floor over a garage).

**Intermediate floors** have heated space above and below.

Ground floors may have insulation:

*below* a ground bearing slab

(Figure 1 - Strip foundation together with a ground bearing concrete floor)

(Figure 2 - Raft foundation)

*above* a ground bearing slab

(Figure 3 - Strip foundation with a ground bearing concrete floor, and screed finish)

*above* a suspended slab

(Figure 4 - Pile foundation with suspended concrete floor and screed finish)

(Figure 5 - Strip foundation with a beam and block suspended floor and screed finish).

The ground absorbs heat from floors that are in contact with or are close to the ground. Most heat is usually absorbed around the external floor perimeter where the ground is generally colder. A high soil moisture content increases heat absorption.

These effects, when combined with the natural temperature gradient in buildings, can lead to an uncomfortable internal environment, condensation at external wall/floor junctions and higher than predicted energy usage.

These factors must be taken into account when calculating the insulation requirements for a ground floor.

All other floor types are, by definition, suspended and heat is lost/gained uniformly across the entire surface. Exposed and semi-exposed floors suffer heat loss to air in the same way as other building elements.

Heat loss can be reduced, and at the junctions of floors and walls, thermal bridging can be avoided if a layer of thermal insulation is included in the floor construction, continuous with that in the rest of the building envelope.

Thermal insulation must never compromise any of the following functional requirements.

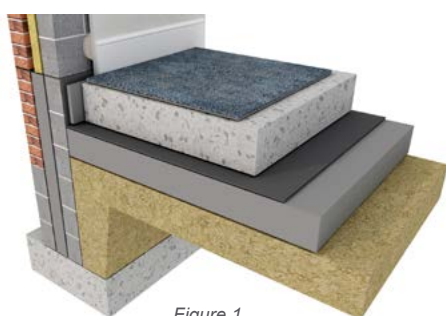


Figure 1



Figure 2

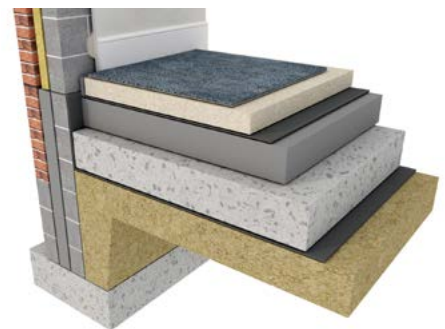


Figure 3

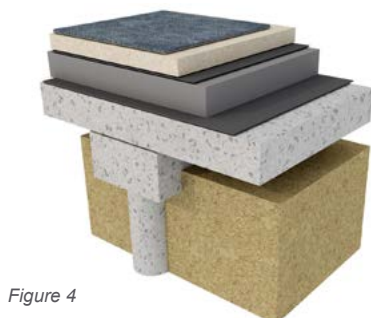


Figure 4



Figure 5

## 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 thermal response' fabric (low thermal mass) with the thermal insulation on the inside of the structure. Heating systems which utilise the structure as a heat store (high thermal mass) 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 loadbearing 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) at [www.defra.gov.uk](http://www.defra.gov.uk).

Floors must also be resistant to ground hazards as outlined in building regulations.

## Loadings

Floors should be designed to sustain safely the combined dead and imposed loads, without excessive deflection.

In self-contained dwellings Ravatherm XPS X 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 Ravatherm XPS X insulation boards. Internal masonry walls must have their own foundations. For buildings other than dwellings the correct grade of Ravatherm XPS X insulation should be selected on the basis of an assessment of the loading by a structural engineer.

The maximum acceptable load on Ravatherm XPS X insulation products is the design load together with a suitable design factor.

The Design Compressive Strengths (DCS is the load that if applied as a UDL for 50 years then max compression 2%) of Ravatherm XPS X products:

- Ravatherm XPS X 300 SB and Ravatherm XPS X 300 SL: 130 kN/m<sup>2</sup>
- Ravatherm XPS X 500 SL: 180 kN/m<sup>2</sup>
- Ravatherm XPS X 700 SL: 250 kN/m<sup>2</sup>

## Thermal performance

Table 1 gives the thicknesses of Ravatherm XPS X 300 SB or Ravatherm XPS X 300 SL required to achieve a range of U-values for ground floors.

The insulation boards are available in single thicknesses of 50mm, 75mm, 100mm, 125mm, 150mm and 200mm.

Multiples can be used in order to achieve the desired total thickness.

Refer to BS EN ISO 6946, BS EN 13370, CIBSE Guide A and BRE BR 443 'Conventions for U-value calculations' for the method. 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 is recommended by BRE to avoid thermal bridging and condensation at the floor perimeter.

Ravatherm XPS X boards may be installed as vertical or horizontal edge insulation depending on the application.

When used as vertical edge insulation, Ravatherm XPS X may be placed on the outside of walls.

Where horizontal perimeter insulation is used beneath the slab, to maintain the minimum slab thickness Ravatherm XPS X boards may be set into the sand blinding or the overall depth of the slab increased. Refer also to BRE document BR 262 'Thermal insulation: avoiding risks' and DEFRA/DTLR 'Robust Details'.

Thickness of Ravatherm XPS X 300 SB (mm)

Solid ground bearing floor											
U-values	P/A	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
0.12		75	150	200	200	200	225	225	225	225	225
0.15		50	100	150	150	150	175	175	175	175	175
0.18		50	75	100	125	125	125	150	150	150	150
0.2		50	75	100	100	100	125	125	125	125	125
0.22		0	50	75	100	100	100	100	125	125	125
0.25		0	50	50	75	75	100	100	100	100	100
No insulation		0.21	0.36	0.48	0.58	0.67	0.75	0.82	0.89	0.95	1

65mm screed

Suspended beam & block floor											
U-values	P/A	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
0.12		125	175	200	200	225	225	225	225	225	225
0.15		75	125	150	150	175	175	175	175	175	175
0.18		50	100	125	125	125	125	150	150	150	150
0.2		50	75	100	100	125	125	125	125	125	125
0.22		50	75	100	100	100	100	100	100	125	125
0.25		0	50	75	75	75	100	100	100	100	100
No insulation		0.25	0.39	0.50	0.58	0.65	0.71	0.76	0.80	0.84	0.87

65mm screed; block 75 x 440mm. (0.51 W/mK); beam 60mm. (1.13 W/mK)  
Deck thermal resistance 2m<sup>2</sup>K/W

# Disclaimer

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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 Ravago with the use of Ravatherm XPS X and PERIMATE™ DI-AP products.

Any drawings are meant only to illustrate various possible applications and should not be taken as a basis for design.

Since Ravago Building Solutions is a materials supplier and exercises no control over the installation Ravatherm XPS X products, no responsibility is accepted for such drawings and recommendations.

In particular, no responsibility is accepted by Ravago for the systems in which Ravatherm XPS X products are used or the method of application by which they are installed. The legal obligations of Ravago in respect of any sale of Ravatherm XPS X products shall be determined solely by the terms of the respective sales contract.

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