Dow Building Solutions

Insulating floors with STYROFOAM™ Solutions: basic principles

Introduction

STYROFOAM™-A

Dow Building Solutions' STYROFOAM™-A products include FLOORMATE™-A materials for flooring applications. STYROFOAM™-A products use carbon dioxide as the main blowing agent - the Ozone Depletion Potential (ODP) is zero and the Global Warming Potential (GWP) is less than five.

FLOORMATE™-A

The STYROFOAM™-A Solution for insulating groundbearing and suspended floors in new build and renovation projects is FLOORMATE™-A.
The product range includes FLOORMATE™ 300-A, FLOORMATE™ 500-A and FLOORMATE™ 700-A.

Insulating floors

Basic principles

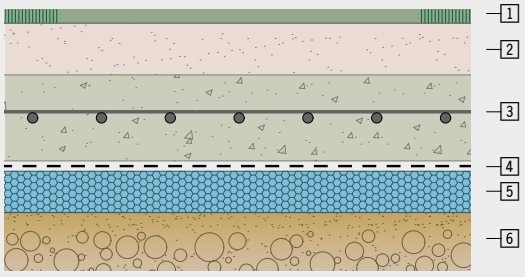
Floors are classified as:
- ground floors, in contact directly, or indirectly with the ground
- exposed floors, forming the lowest part of a structure over unenclosed airspace (e.g. a balcony)
- semi-exposed floors, forming the lowest part of a structure over an enclosed but unheated space (e.g. a floor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

Ground floors may be groundbearing (**Figure 1**) or suspended (**Figure 2**): all other floors are, by definition, suspended.

The ground absorbs heat from floors close to or in contact with it, which is increased by high soil moisture content. These effects, when combined with the natural temperature gradient in buildings, can lead to an uncomfortable internal environment, condensation at wall/floor junctions and higher than predicted energy usage.

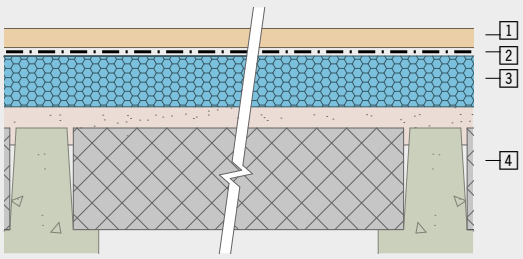
Exposed and semi-exposed floors suffer heat loss to air, in the same way as other building elements.

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.



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

Figure 1: Insulation below the slab



1 board or screed finish
2 vapour control layer (VCL)/SS 500 gauge polyethylene
3 FLOORMATE™-A
4 beam and block floor with levelling topping

Figure 2: Suspended beam and block floor

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 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) at 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 (Building Regulations 1991: Schedule-1 Requirement A1: Standard 1.1 in Scotland).

In self-contained dwellings FLOORMATE™-A 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™-A insulation boards. Internal masonry walls must have their own foundations.

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

The maximum acceptable load on FLOORMATE™-A 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).

Design loads of FLOORMATE™-A products:
FLOORMATE™ 300-A: 130 kN/m^2
FLOORMATE™ 500-A: 180 kN/m^2
FLOORMATE™ 700-A: 250 kN/m^2

Thermal performance

Table 1 gives the thicknesses of FLOORMATE™ 300-A required to achieve a range of U-values for ground floors. FLOORMATE™ 300-A is 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 of U-value calculation.

Table 1: Thickness of FLOORMATE 300-A (mm) to meet U-values (W/m².K)

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		100	175	225	250	250	250	275	250	275	275
0.15		50	125	150	175	175	200	200	200	200	200
0.18		50	100	125	150	150	150	150	150	175	175
0.2		50	75	100	125	125	150	150	150	150	150
0.22		0	50	75	100	100	125	125	125	125	125
0.25		0	50	75	75	100	100	100	100	100	125
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		150	225	225	250	250	250	250	250	250	275
0.15		100	150	175	200	200	200	200	200	200	200
0.18		75	125	150	150	150	150	150	175	175	175
0.2		50	100	125	125	125	150	150	150	150	150
0.22		50	75	100	100	125	125	125	125	125	125
0.25		50	50	100	100	100	100	100	100	100	100
No insulation		0.26	0.41	0,52	0.61	0.68	0.74	0.79	0.83	0.88	0.91

65mm screed; block 100 × 440mm. (0.51 W/mK); beam 60mm. (1.13 W/mK)
Deck thermal resistance 2m²K/W

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™-A boards may be installed as vertical or horizontal edge insulation depending on the application. When used as vertical edge insulation, FLOORMATE™-A may be placed on the outside of walls.

Where horizontal edge insulation is used beneath the slab maintain the minimum slab thickness by setting the FLOORMATE™-A 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’.

Recommendations

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

During shipment, storage, installation and use XENERGY™ 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. XENERGY™ 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 XENERGY™ products. Any drawings offered by Dow 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 XENERGY™ products, no responsibility is accepted for such drawings and recommendations.

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

Visit **www.dowxenergy.co.uk** for further information on XENERGY™ SL insulation products as well as adhesives and sealants from Dow Building Solutions. For technical enquiries email FKLTECH@dow.com.

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