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L68151:P7111	F841:X722
CI/SfB (27) Rn7 (M2)	

May 2006

Dow - Building Solutions

Insulating walls with STYROFOAM

Insulating walls: design

Problems with cavity walls

The conventional cavity wall construction was intended originally to prevent problems of damp penetration of thin brick walls. It has since been adapted to meet successive changes in Building Regulations, most notably with the introduction of thermal insulation into the cavity (see figure 55).

With the latest changes in Part L it has become apparent that cavity wall construction may not be a practicable method of achieving the necessary standards of thermal performance:

- the thickness of thermal insulation requires wider cavities which, in turn, require longer and more wall ties to achieve structural stability;
- wider cavities may not comply with the requirements for robust details to Part E;
- thicker walls will either reduce the available space within the building or increase the building footprint, which may, for example, lower the density of dwellings in a development;
- vents to the cavity results in high levels of air infiltration.

To avoid those and other problems designers should consider other forms of wall construction.

Externally insulated solid walls

Solid masonry walls may be insulated on their external surface and the insulation covered by an external finish such as render, boarding or tiling (see figure 56). That construction offers numerous benefits:

- all the thermal mass of the wall lies within the insulation envelope, resulting in a structure with a slow thermal response which is well suited to continuously heated buildings;
- solid walls do not require vented cavities to drain away moisture, which eliminates one route for air infiltration, making it easier to construct buildings with low rates of air permeability;
- detailing of windows and doors is easier as there is only one structural plane to consider within the wall;
- large format blocks and thin joint systems speed construction and reduce the effect of thermal bridging.

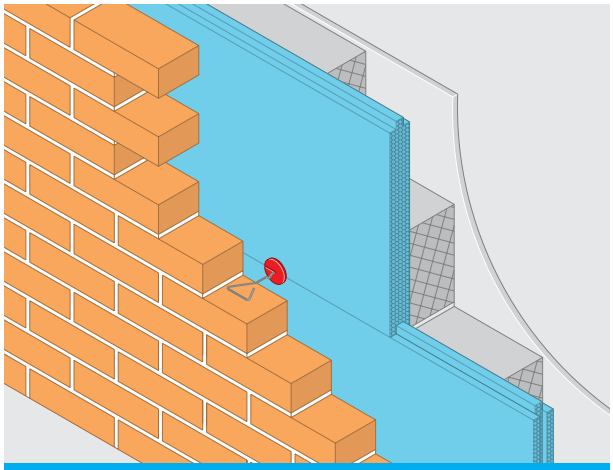

Figure 55 >> Conventional cavity wall construction

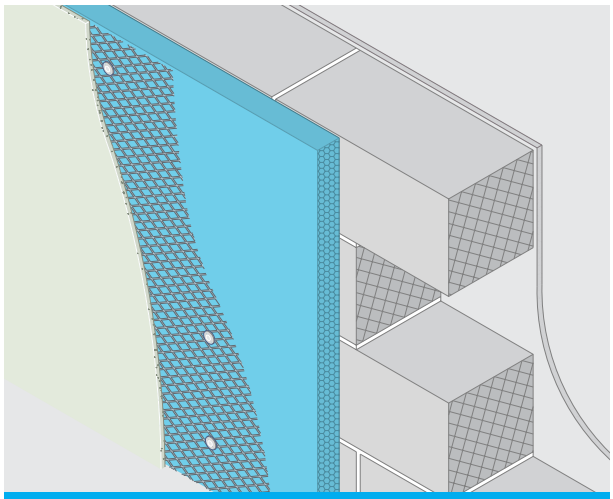

Figure 56 >> Externally insulated solid walls

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Internally insulated walls

Walls may be insulated on their internal face, with the insulation applied between the structure and the internal finish (see figure 57). Installing the insulation in that way will mean the thermal mass of the wall is outside the insulation, resulting in a rapid thermal response, suitable for buildings which are intermittently heated.

Internally insulating walls is a useful solution for upgrading the thermal performance of walls in the course of projects which require consequential improvements. It will not affect the external appearance of the building.

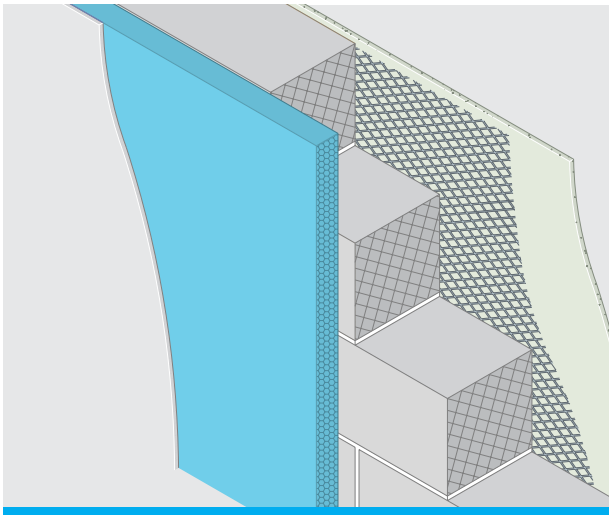

Figure 57 >> Internally insulated walls

Timber or steel framed walls

In framed wall constructions of timber or steel the insulation is fitted between the studs, combining the structure and thermal insulation into the same plane. The internal face of the wall is lined with plasterboard, whilst the external face can be finished with a single leaf of brick, tile hanging, boarding or a render system (see figure 58). Where necessary the thermal performance of the wall can be improved by installing a further layer of insulation across the face of the studs: that will also reduce the effects of thermal bridging.

The use of framed wall construction has become increasingly common, most notably in the Republic of Ireland and Scotland where the required U-values for walls are already as low as 0.27W/m^{2}K and 0.30W/m^{2}K respectively.

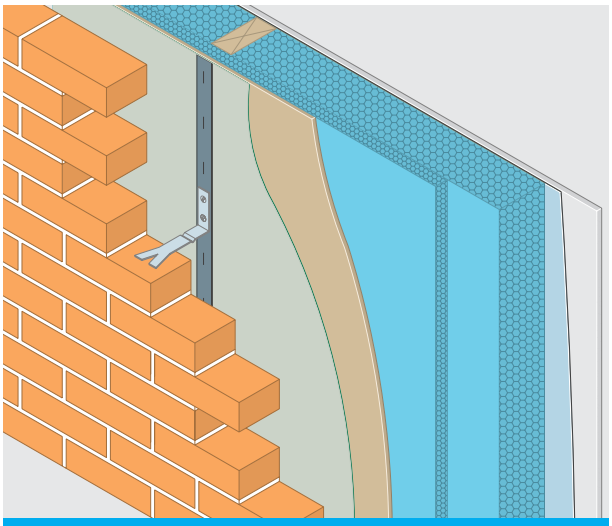

Figure 58 >> Timber or steel framed walls

STYROFOAM Solutions

The STYROFOAM™ solution for partial fill cavity wall constructions is WALLMATE™ CW-X.

WALLMATE CW-X is designed to give the maximum benefit in wall construction:

- tongue and grooved edges ensure a good interlock between boards, avoiding thermal bridging,
- the strong, rigid boards are self-supporting,
- low water absorption means performance is unaffected by moisture.

For the full physical properties and performance characteristics of WALLMATE CW-X see Product Data.

Other STYROFOAM products can be used for internally insulated solid walls and timber or steel frame walls.

Partial fill cavity						
		U value	0.25	0.28	0.30	0.35
	Block λ (W/mK)					
Dense	1.63		100	90	80	70
Medium	0.51		100	90	80	70
Lightweight	0.19		90	80	70	60
Solid - internal insulation						
			110	90	80	70
Timber frame - insulation between and external to studding						
	Stud depth					
	90mm		90+30	90+25	90+25	90
	140mm		140+25	140	140	140

15% timber fraction

Table 16 STYROFOAM thickness (mm) to ahieve U-values (W/m^2.K)

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.
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  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.
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  Part 23: 1990: Code of practice for fire precautions.
  Part 42: 1990: Code of practice for design and construction of pig buildings.
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- 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.
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- 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.

- 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.
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  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.
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  Part 1: 1999 Code of practice for concrete bases and cement sand levelling screeds to receive floorings.
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- BS EN 1264: Floor heating. Systems and components.
  Part 4: 2001 Installation
- BS EN 12056: Gravity drainage systems inside buildings.
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- BS EN 13164: 2001 Thermal insulation products for buildings - Factory made products of extruded polystyrene (XPS) specification.
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  Part 1: Classification using test data from reaction to fire tests
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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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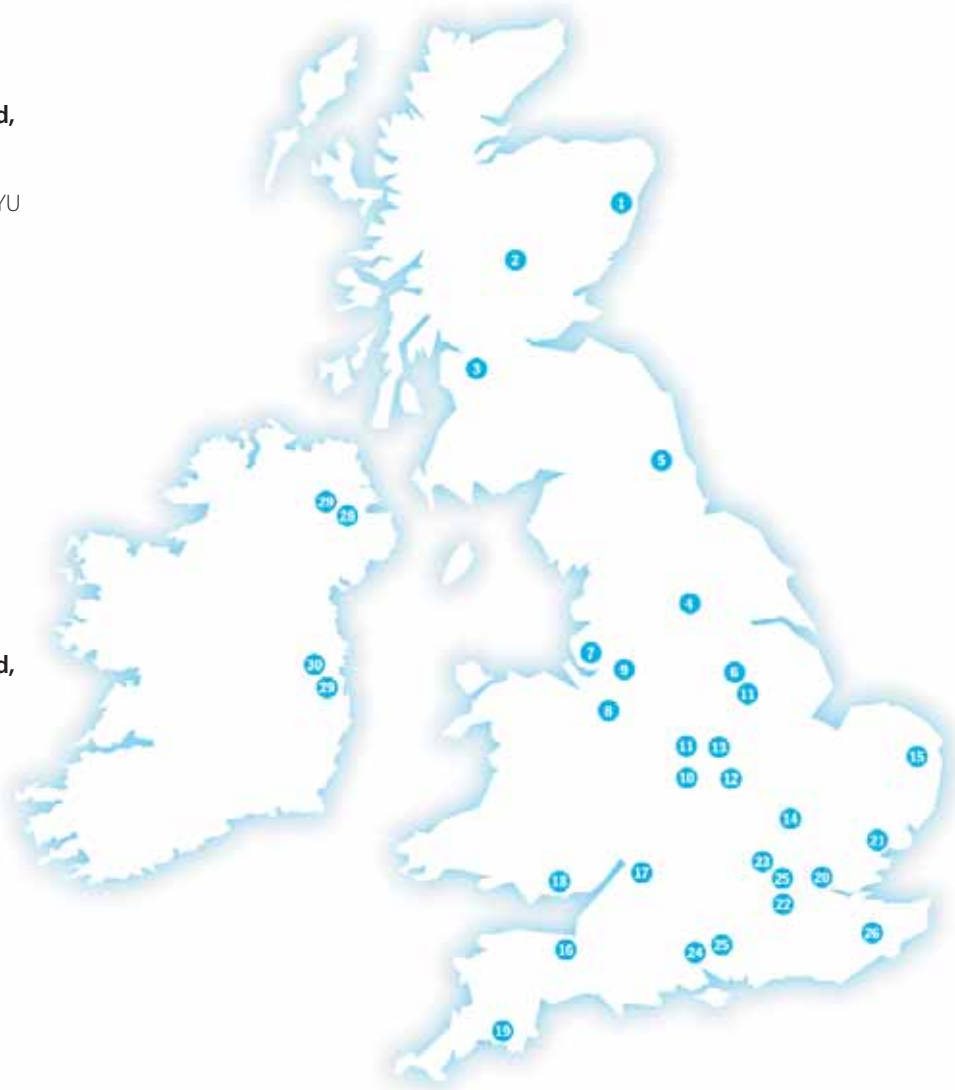

Recommendations

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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