CONCRETE BLOCK ASSOCIATION

External Insulation of Solid Walls

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Introduction

Solid masonry walls constructed with aggregate blocks externally insulated provide the following attractive opportunities for:

- Achieving a wide range of U-values on a standard masonry core.
- Simplicity of construction.
- Improving building airtightness.
- Reducing building costs.
- Minimizing wall width.
- Taking advantage of thermal mass.

Additional benefits:

- Improved speed of construction.
- Wide range of construction options.
- Numerous insulation options and wall finishes.
- Building Regulations simple rules requirements for dwellings met.
- Good design option for buildings in areas of high driving rain.
- Robust background for finishes and fixings.
- Detailing to avoid thermal bridging is simplified.
- Fire resistant structural core.
- Low risk of interstitial condensation.
- No cavity insulation drying-out issues after flooding.

Masonry Construction Options

Unless designed otherwise, solid external walls should be a minimum of 190mm wide. In order to meet the HSE manual handling guidance of blocks for repetitive handling not exceeding 20kg, this width of wall can be achieved with the following options:

Full width blocks - Solid superlightweight (Group 1) 190mm or 215mm wide aggregate blocks.*

Cellular or hollow lightweight (Group 2) 190mm or 215mm wide aggregate blocks.*

Blocks laid flat - (Group 1) Solid 190mm or 215mm high aggregate blocks laid flat.*

Collar jointed walls - Solid, hollow or cellular (Group 1 or 2) min. 90mm wide aggregate blocks collar jointed.*

For dwellings up to 9 metres high, Building Regulations require a solid external wall to be a minimum width of 190mm and no structural design is needed. Blocks forming the ground floor of 3 storey dwellings need to be 7.3N/mm^2, otherwise blocks for dwellings may be 2.9N/mm^2.

**Consult manufacturer to confirm block weights.*

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Insulation Options

Walls can be externally or internally insulated. External insulation is the most technically robust option and is recommended by CBA as it removes the risk of interstitial condensation. It also affords the maximum opportunity for utilising the thermal mass of the masonry as well as providing a better background for fixings.

External insulation is normally adhesive bonded and/or fixed by mechanical means and finished with a protective layer which not only helps keep the wall substrate dry but also provides an aesthetically pleasing finish.

The following insulation materials can be used:

- Extruded polystyrene (XPS)
- Expanded polystyrene (EPS – HD grade recommended)
- Polyurethane (PU)
- Polyisocyanurate (PIR)
- Phenolic foam (PF)
- Cellular glass (CG)
- Mineral wool (MW)

When an insulation material is to be used below dpc level, in an area of high driving rain or in a flood plain the selection should take into account its water resistance and its susceptibility to absorb water.

Table 1: Examples of insulation thickness and U-values

Masonry type	Masonry thickness	Insulation		U-value
		Type	Thickness	
Superlightweight aggregate blocks (Approx. 850 kg/m³ density.)	190 190 190 190	HD/EPS HD/EPS PF PF	100 150 80 125	0.23 0.16 0.20 0.14
Lightweight aggregate blocks (Approx. 1400 kg/m³ density.)	190 190 190 190	HD/EPS HD/EPS PF PF	100 150 80 125	0.24 0.17 0.21 0.15
Dense aggregate blocks (Approx. 2000 kg/m³ density.)	190 190 190 190	HD/EPS HD/EPS PF PF	100 150 80 125	0.25 0.18 0.22 0.15

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External Finishes

Externally applied insulation should be protected by a weather-resistant layer.

Options include:

- Polymer-modified factory produced render.
- Traditional factory-produced sand/cement render.
- Weatherboarding.
- Tile hanging.
- Brick slips with factory-produced adhesive and mortar joints.

Of these options, polymer-modified render, weatherboarding and tile hanging all have the benefit of preventing the ingress of precipitation to the insulation or the masonry and can provide good levels of impact resistance.

Internal Finishes

If insulated drylining is used, the internal finish will automatically be plasterboard. Otherwise the options include:

- Dense plaster.
- L/W plaster.
- Drylining.
- Facing masonry.

To maximise the thermal mass benefits and to control the tendency of highly insulated buildings to overheat in summer plaster finishes or facing masonry should be selected.

Laying Masonry

Blocks should be laid with normal M4/(iii) masonry or thin-layer mortar. Thin layer mortar is particularly suited to laying blocks flat. If thin layer mortar is used, the guidance in BS 5628-3 to restrict the daily lift of masonry to 1.5 metres does not apply as thin layer mortar sets more rapidly than traditional mortars. For collar jointed walls, as directed by BS 5628-1, the collars should not be filled with mortar, and the leaves may be tied together with normal wall ties or with bed joint reinforcement in alternate courses.

Thermal Bridging

Detailing to avoid thermal bridging is easy to achieve with solid wall constructions. It will generally be found to be easier from the detailing point of view to locate doors and windows as follows:

Diagram A

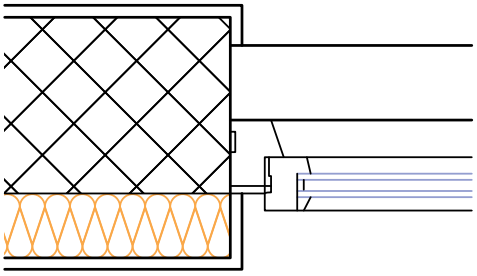

Table 2: Optimum positioning of doors and windows

Insulation position	Door and window position
External Only	Flush with external face of masonry
Internal and external	Flush with internal or external face of masonry

The use of thermally efficient fixings when securing the insulation to the masonry can minimize thermal bridging.

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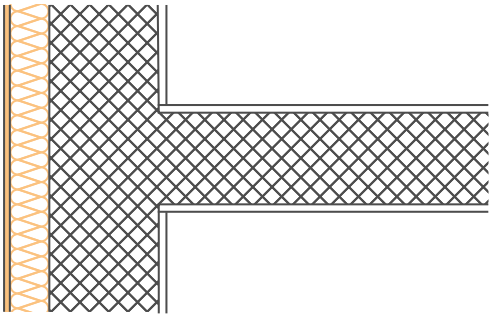
Sound Insulation

Both cavity and solid masonry separating walls may be used in conjunction with solid external walls.

For optimum acoustic performance, solid separating walls should be carried through the external wall to end flush with the outer surface of the masonry.

Diagram B



When using external insulation only, heat transmission to the outside of the walls is controlled by the insulation layer. For systems using both external and internal insulation, it may be necessary to use an insulation layer (ideally mineral wool backed plasterboard) on both faces of the separating wall to prevent thermal bridging. The need for this treatment would depend upon the relative thickness of the external and internal insulation layers.

Airtightness

Internal and external mortar joints should be tooled to ensure that leakage paths are kept to the minimum .

Prior to the fixing of external insulation the wall surface should first be sealed with a coat of bitumen paint or a sand/cement stipple coat or similar to seal the surface. This procedure also gives enhanced resistance to the ingress of floodwater through the masonry. When using both external and internal insulation the surface treatment need only be applied to one face of the wall.

Service penetrations should be designed and made carefully and fully sealed using a system which allows for any differential movement that might occur.

Fire Spread

The choice of external insulation may also be determined by the non-combustible capability of the insulation material. Where a combustible material is selected, fire breaks should be incorporated into the construction.

Movement Joints

When control joints are located in long masonry panels these should be carried through the external finish.

Visit **www.cba-blocks.org.uk** for the latest information, news and views from the CBA. **CBA Technical Helpline: 0116 232 5165**

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