



INSULATING SINGLE SKIN MASONRY WALLS

Some of the most significant changes to the Building Code Clause H1 are for solid masonry construction and the level of insulation required when using the schedule method. We look at how you can meet the new requirements.

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The recently released revision to the New Zealand Building Code Clause H1 *Energy efficiency* distinguishes between solid masonry construction that makes thermal mass available to the interior of the building as a heat source, and that which does not – the masonry is isolated from the interior by a layer of insulating material. Typical examples of the second situation are where:

- the masonry wall has been strapped, insulation is fitted into the depth of the strapping and a plasterboard or similar lining fixed to the strapping
- polystyrene or similar rigid foamed plastic insulation is fixed as a continuous layer to the masonry and a plasterboard lining material attached to it.

Where the thermal mass is isolated from the interior, it must be treated for H1 purposes as if the construction is a framed wall, i.e. a non-solid wall. The H1 revision allows a lower R-value where the thermal mass is made available – that is, the insulation is on the outside of the wall.

Table 1 gives the minimum schedule method R-values for solid masonry and non-solid construction.

Insulation on the inside

The H1 changes have meant that walls with insulation on the inside often do not provide sufficient performance to meet the schedule

requirements for non-solid construction, i.e. a minimum construction R-value of 1.9 for climates zones 1 and 2 and R2.0 for zone 3.

Examples of *insufficient* insulation performance under the schedule method include:

- 20 mm strapping with insulation fitted between
- 45 mm strapping with insulation fitted between (45 mm strapping at 600 mm centres with R1.4 insulation will have a wall R-value of R1.3)
- any 20 mm foam insulation adhered to the masonry with plasterboard fixed to the insulation
- any 40 mm polystyrene insulation adhered to the masonry with plasterboard fixed to the insulation
- 50 mm H grade polystyrene adhered to the masonry with plasterboard fixed to the insulation.

Options for climate zone 3

Where the insulation is installed on the inside face of the masonry walls, several options that meet the climate zone 3, H1 schedule method minimum wall R-value of R2.0 are shown below.

Options for a 20 series (190 mm) all cells filled concrete block wall are:

- a 90 mm framed false wall with studs at 600 mm centres and dwangs at 1200 mm centres with insulation of R2.0 or better

- a 70 mm framed false wall with studs at 600 mm centres and dwangs at 1200 mm centres with insulation of R2.4 or better

- polystyrene or other rigid insulation material (with a R-value greater than 1.68) fixed to the wall and plasterboard lining adhered to the polystyrene. To achieve this will require a minimum of 64 mm of H grade polystyrene or 47 mm of extruded polystyrene.

Options for a 15 series (140 mm) all cells filled concrete block wall are:

- a 90 mm framed false wall with studs at 600 mm centres and dwangs at 1200 mm centres – insulation of R2.1 or better is required for compliance
- polystyrene or other rigid insulation material (with a R-value greater than 1.72) fixed to the wall and plasterboard lining adhered to the polystyrene. To achieve this will require a minimum of 65 mm of H grade polystyrene or 48 mm of extruded polystyrene.

Where a material of the specified minimum required R-value is not available, higher grade material that is thicker must *not* be compressed into the space available.

Any foamed plastic insulation material (for example, polystyrene), is required under Building Code Clause C *Fire safety* to be isolated from the interior of the building by a flame barrier – typically plasterboard.

Table 1: Minimum R-values required to meet NZS 4218: 2004 and Building Code Clause H1 (Third edition)¹ schedule method.

Construction type	Building component	Climate zone 1 ²		Climate zone 2 ²		Climate zone 3 ²	
Framed or strapped wall construction (on the interior face of masonry) ³	Roof	R2.9		R2.9		R3.3	
	Wall	R1.9		R1.9		R2.0	
	Floor ^{5,6}	R1.3		R1.3		R1.3	
	Glazing ⁷	R0.26		R0.26		R0.26	
	Skylights ⁸	R0.26		R0.26		R0.31	
		Option 1a	Option 1b	Option 2a	Option 2b	Option 3a	Option 3b
Solid wall construction (offering thermal mass) ⁴	Roof	R3.5	R3.5	R3.5	R3.5	R3.5	R3.5
	Wall	R0.8	R0.8	R1.0	R0.9	R1.2	R1.0
	Floor ^{5,6}	R1.5	R1.3	R1.5	R1.3	R1.5	R1.3
	Glazing ⁷	R0.26	R0.31	R0.26	R0.31	R0.26	R0.31
	Skylights ⁸	R0.26	R0.31	R0.26	R0.31	R0.31	R0.31

Notes:

- Higher levels of insulation are required in a heated roof, wall or floor.
- Climate zone boundaries are shown in Figure B1 of NZS 4218: 2004. Generally:
 - zone 1 is the Northland, Auckland and Thames-Coromandel districts and the Kermadecs
 - zone 2 is all that is not zone 3 or zone 1
 - zone 3 is the South Island, Stewart Island, the central North Island volcanic plateau and the Chatham Islands.
- Non-solid construction is wall construction methods other than solid construction, see NZS 4218 definitions.
- Requirements that apply for masonry, concrete and earth solid wall constructions.
- Carpets or floor coverings can not be included in the calculation of the floor R-value.
- Suspended floors insulated with draped foil that do not have a continuous enclosed perimeter need sheet linings to the underside of the floor joists to meet the required R-value.
- Glazing of more than 30% of the wall area may lead to solar overheating and excessive heat loss. Use the NZS 4218 calculation or modelling methods, or the BPI calculation using ALF.
- Maximum skylight area of 1.2 m².

Options for climate zones 1 and 2

In climate zones 1 and 2, the required minimum wall R-value is R1.9. Insulation options are shown below.

Options for a 20 series (190 mm) all cells filled concrete block wall to meet the schedule method are:

- a 90 mm framed false wall with studs at 600 mm centres and dwangs at 1200 mm centres with insulation of R2.0 or better
- a 70 mm framed false wall with studs at 600 mm centres and dwangs at 1200 mm centres with insulation of R2.2 or better

- polystyrene or other rigid insulation material (with a R-value greater than 1.58) fixed to the wall and plasterboard lining adhered to the polystyrene. To achieve this will require a minimum of 60 mm of H grade polystyrene or 44 mm of extruded polystyrene.

Options for a 15 series (140 mm) all cells filled concrete block wall to meet the schedule method are:

- a 90 mm framed false wall with studs at 600 mm centres and dwangs at 1200 mm centres – insulation of R2.1 or better is required for compliance

- polystyrene or other rigid insulation material (with a R-value greater than 1.62) fixed to the wall and plasterboard lining adhered to the polystyrene. To achieve this will require a minimum of 62 mm of H grade polystyrene or 45 mm of extruded polystyrene.

Basis of calculations

The calculations above are based on values of:

- R0.09 for the inside resistance
- R0.045 for the 10 mm plasterboard
- thermal conductivity (k) of 0.038 for →

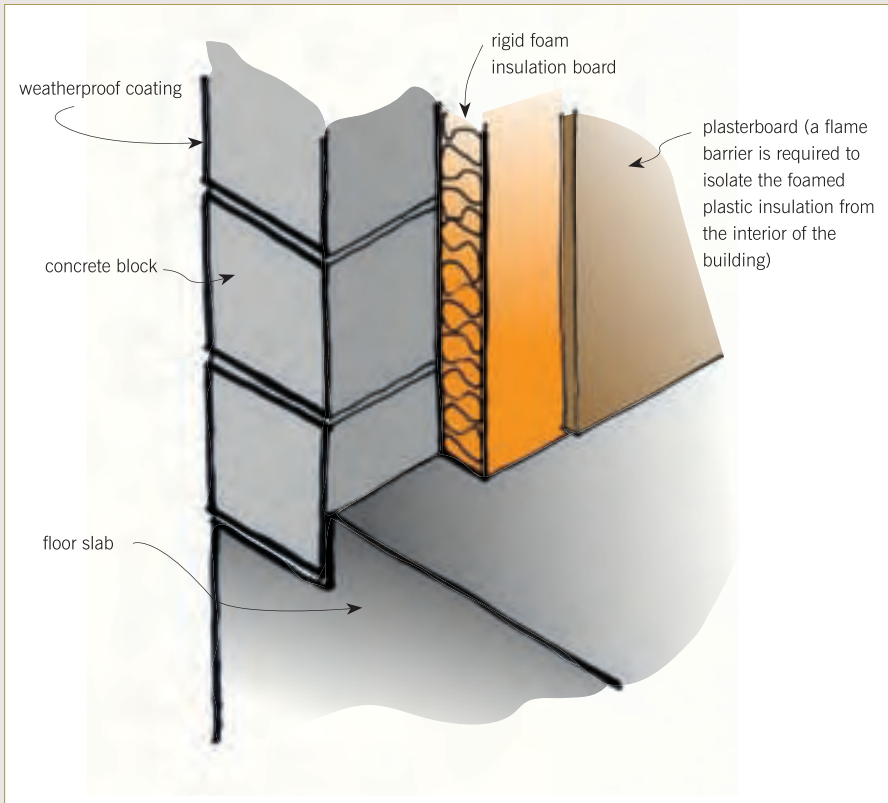


Figure 1: Indicative sketch of rigid continuous insulation installed to inside face of wall.

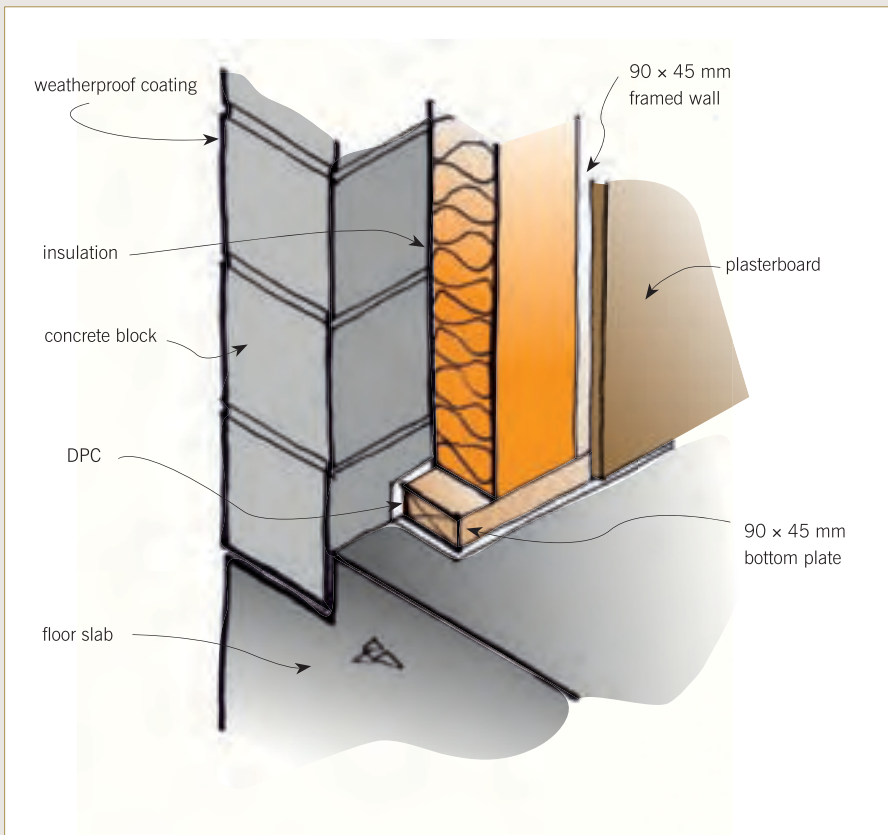


Figure 2: Indicative sketch of rigid framed wall with insulation installed to inside face of wall.

- H grade polystyrene, and 0.028 for extruded polystyrene
- R0.15 (from BRANZ *House insulation guide*) for 20 series block all cells filled and R0.12 for 15 series block all cells filled
- R0.03 for inside surface resistance.

Insulation on the outside

The bottom half of Table 1 gives the required schedule method R-value options where the insulation is applied to the outside surface of the wall to gain the benefit of the thermal mass. Construction R-values for specified insulation R-values are given in the BRANZ *House insulation guide* Third edition where an EIFS systems is fixed to the outside face of the wall. For example, installing an insulation material with an R-value of 1.0 or more will ensure that the minimum requirements of the schedule method will be met for all block sizes and all of the options and climate zones given in Table 1.

As with all insulation installing, more than the minimum is recommended, and installing R1.8 insulation will give wall R-values of 2.0 or more, depending on the block used.

Proprietary systems

Where a proprietary insulated block system is being specified, specific thermal performance data must be obtained from the manufacturer.

Other compliance paths

If the construction R-values are not able to meet the requirements of the schedule method, the designer has the options of (possibly) showing compliance with the requirements of Building Code Clause H1 by using the calculation, modelling or Building Performance Index (BPI) methods. ◀