DESIGN RIGHT

Retrofitting insulation

BY ANN GALLOWAY,
FNZIA, ANN GALLOWAY ARCHITECT LTD, NAPIER

MAKING ADDITIONS OR ALTERATIONS TO AN OLDER HOME CAN PROVIDE AN OPPORTUNITY TO IMPROVE ITS THERMAL PERFORMANCE. HOWEVER, INSTALLING INSULATION TO MAXIMISE THE BENEFITS IS NOT ALWAYS AS STRAIGHTFORWARD AS IT MIGHT SEEM.

ADDING INSULATION will help to keep the house warmer in winter and cooler in summer and can reduce the risk of condensation, meaning less mould and mildew and a healthier environment for the occupants.

R-value

The R-value measures the resistance to the flow of heat through a given thickness of insulating material. The higher the R-value, the better the insulation, but to achieve its full R-value, the insulation must be properly installed with no gaps or compression points, and it must be kept dry.

The schedule method of NZS 4218:2009 *Thermal insulation – Housing and small buildings*, called up in Acceptable Solutions and Verification Methods to Building Code clause H1 *Energy efficiency*, specifies minimum R-values for floor, wall and ceilings (see Table 1).

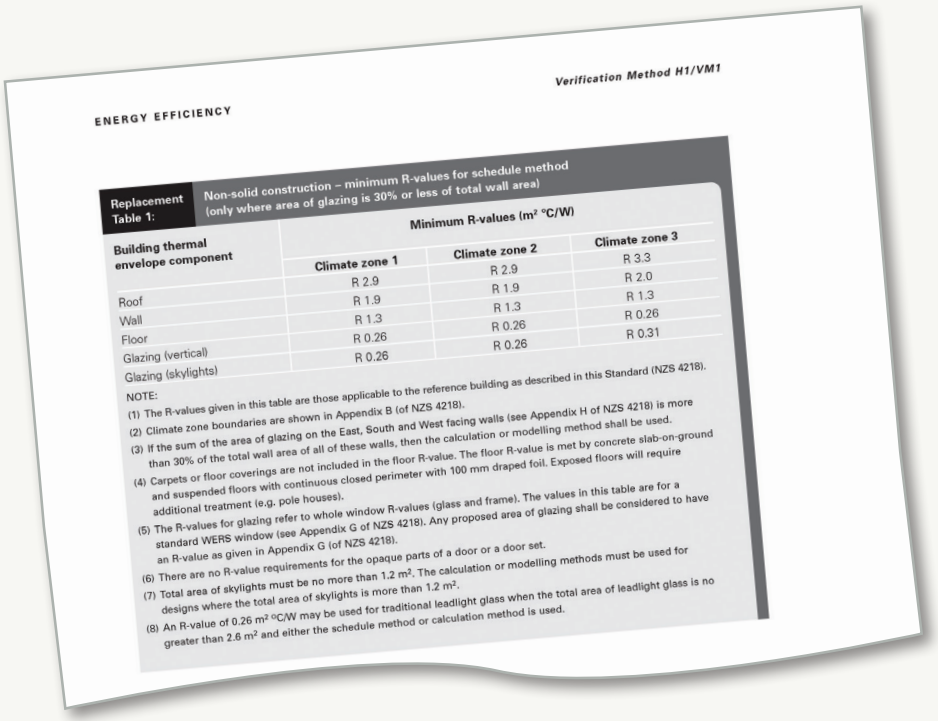
The alternative is to use the calculation or modelling methods identified. Houses built before the late 1970s are unlikely to have any wall insulation, although ceiling and floor insulation may have been retrofitted.

Insulation installed in houses built between 1979 and 2007 is likely to have lower R-values than currently required.

While there is no mandatory requirement to upgrade the insulation of existing houses, all new work must meet and preferably exceed current standards. During renovations is generally the most cost-effective time to upgrade.

Table 1

H1/VM1 REPLACEMENT TABLE 1



ENERGY EFFICIENCY

Verification Method H1/VM1

Replacement Table 1: Non-solid construction – minimum R-values for schedule method (only where area of glazing is 30% or less of total wall area)

Building thermal envelope component	Minimum R-values (m² °C/W)		
	Climate zone 1	Climate zone 2	Climate zone 3
Roof	R 2.9	R 2.9	R 3.3
Wall	R 1.9	R 1.9	R 2.0
Floor	R 1.3	R 1.3	R 1.3
Glazing (vertical)	R 0.26	R 0.26	R 0.26
Glazing (skylights)	R 0.26	R 0.26	R 0.31

NOTE:
(1) The R-values given in this table are those applicable to the reference building as described in this Standard (NZS 4218).
(2) Climate zone boundaries are shown in Appendix B (of NZS 4218).
(3) If the sum of the area of glazing on the East, South and West facing walls (see Appendix H of NZS 4218) is more than 30% of the total wall area of all of these walls, then the calculation or modelling method shall be used.
(4) Carpets or floor coverings are not included in the floor R-value. The floor R-value is met by concrete slab-on-ground and suspended floors with continuous closed perimeter with 100 mm draped foil. Exposed floors will require additional treatment (e.g. pole houses).
(5) The R-values for glazing refer to whole window R-values (glass and frame). The values in this table are for a standard WERS window (see Appendix G of NZS 4218). Any proposed area of glazing shall be considered to have an R-value as given in Appendix G (of NZS 4218).
(6) There are no R-value requirements for the opaque parts of a door or a door set.
(7) Total area of skylights must be no more than 1.2 m². The calculation or modelling methods must be used for designs where the total area of skylights is more than 1.2 m².
(8) An R-value of 0.26 m² °C/W may be used for traditional leadlight glass when the total area of leadlight glass is no greater than 2.6 m² and either the schedule method or calculation method is used.

Several types of insulation

Bulk insulation

Bulk insulation uses small air pockets within the material to reduce or prevent heat flow.

Materials include fibreglass, mineral wool, polyester, wool, expanded foams such as polystyrene and polyisocyanurate (PIR) foam, and paper-based products. It is available in a variety of formats – blankets, segments, biscuits, rigid sheets or loose fill (see Table 2).

Polystyrene should be separated from PVC electrical cables with waxed paper strips. However, electrical cables can safely be in contact with PIR foam.

Reflective insulation

Reflective insulation works by letting through only a small percentage of the radiant heat it receives and reflecting the rest. A gap next to the reflective surface forms a layer of still air, which is important for reducing heat flow.

Table 2

COMPARISON OF DIFFERENT TYPES OF INSULATION MATERIALS

	FIBREGLASS	MINERAL WOOL	WOOL	POLYESTER	POLYSTYRENE	PIR FOAM	PAPER-BASED
BATT	√	√	√	√			
BLANKET	√	√	√	√			
LOOSE	√	√	√	√			√
PANEL					√	√	
RETROFIT FLOORS	√	√	√	√	√	√	
RETROFIT WALLS	√	√	√	√	√	√	√
RETROFIT CEILINGS	√	√	√	√	√	√	√
ON EXTERIOR (PART OF CLADDING SYSTEM)					√	√	
APPROX. R-VALUE FOR 100 MM THICK*	2.6	2.6	1.8–2.3	1.8–2.0	2.5–3.0	4.79	2.5
APPROX. RECYCLED CONTENT*	<80%	<15%	varies	varies	varies		<100%
SUSCEPTIBLE TO MOISTURE	√	√	√	√			√
MAY SLUMP OR SETTLE OVER TIME	√	√	√				√

*Check actual values with the manufacturer's literature.

Reflective insulation is permitted for floors, but its use is not recommended by BRANZ. It can be easily damaged and loses its insulation properties once tarnished or dirty.

Start with roofs and ceilings

About 35% of heat loss from an average uninsulated home occurs through the ceiling and roof. In older, draughtier homes, this can be as much as 60%, so installing ceiling insulation is the most cost-effective place to start.

Easier when roof space

Where there is a roof space, the most effective way to insulate the ceiling is to install bulk insulation between the joists. A layer of blanket insulation over the top will eliminate thermal bridging – heat escaping through the timber joists.

Access for installation may be difficult, especially at eaves and in low-pitched roofs.

Options with restricted roof space

Where roof space is restricted (low pitch) or non-existent (skillion roof), insulation installation is less straightforward, but there are still options:

- Install from above by replacing the roofing. This also provides an opportunity to fit roofing underlay. The thickness of insulation is restricted by the rafter depth, as there must be a 25 mm gap between the insulation and the underside of flexible roof underlay. The overall depth can be increased by installing deeper purlins.
- Install from below by removing the ceiling lining – this is only suitable if metal roofing is installed over a roof underlay. A 25 mm air gap must be maintained between insulation and underlay (see Figure 1).
- Install from below by going over the top of the existing ceiling lining with insulation and then overlaying this with a new ceiling lining.

The R-value achieved depends on the type and thickness of material used. There may be difficulties accommodating sufficient thickness into existing detailing or maintaining headroom. Higher-performance insulants, such as some foams, may be used to increase thermal performance. However, their use must meet Building Code durability and protection from fire requirements.

For skillion roofs with exposed rafters, installing insulation between rafters is an option.

Points to remember

- Fit roofing underlay to older houses without any. The roofing underlay allows any condensation that forms on the underside of the roofing to drain to the outside rather than remaining within the roof space to evaporate.
- Maintain 25 mm clearance between insulation and roofing underlay.
- Existing blown-in macerated paper may have settled and need to be topped up or replaced.
- In skillion roofs with an air-leaky ceiling (for example, timber boarded), an air barrier must be installed over the ceiling to prevent air movement into the roof framing.
- Access is generally good but may be difficult in small roof spaces.
- Check clearances required around downlights and other fire hazards. ➤

Floors

Up to 14% of heat loss occurs through the floor of an uninsulated house. Fit segments or panels of insulation between the joists.

Points to remember

- Panel or segment insulation is most effective.
- Fit snugly between the joists and as close to the underside of the flooring as possible.
- Access may be difficult.
- Install a vapour barrier, especially if ground clearance is limited.
- Existing foil insulation should be replaced with a bulk insulation.
- Take care to avoid electrical wiring and plumbing.

Walls

Up to 25% of the heat loss from an average uninsulated home is through the walls.

If linings or claddings are being replaced, it is relatively easy to install blanket or panel insulation into older houses, which were typically constructed with studs only and no dwangs. However, these houses also had no building paper or underlay, relying on air movement in the wall cavity to allow evaporation of the moisture that inevitably made its way past the weatherboards.

If the insulation is susceptible to moisture, wall underlay will have to be retrofitted. One way to do this is to fix continuous strips of underlay between the studs, creating a pocket and separating the insulation from the cladding (see Figure 2). Installing wall underlay in houses with dwangs is done in the same way but is more time consuming.

An alternative is to install rigid sheet insulation, fitted tight between the studs but not the full depth of the framing.

For match-lined walls, remove every second or third board and insert insulation as above.

Points to remember

- Consider wall insulation after insulating floors and ceilings or if you are replacing linings or claddings.
- Install bulk insulation with wall underlay folded into the framing cavity if none is present.
- Fit sheet insulation clear of the back of the cladding.
- For brick (double-skin or veneer), ensure the cavity is not compromised by insulation.
- A building consent is required to install insulation in exterior walls, see www.dbh.govt.nz/retrofitting-insulation-guidance.

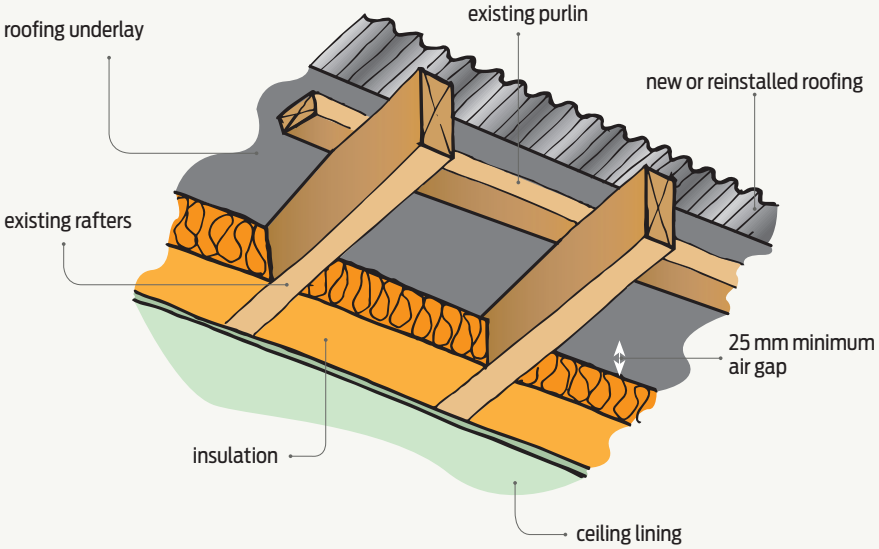


Figure 1 **Retrofitting insulation into a skillion roof.**

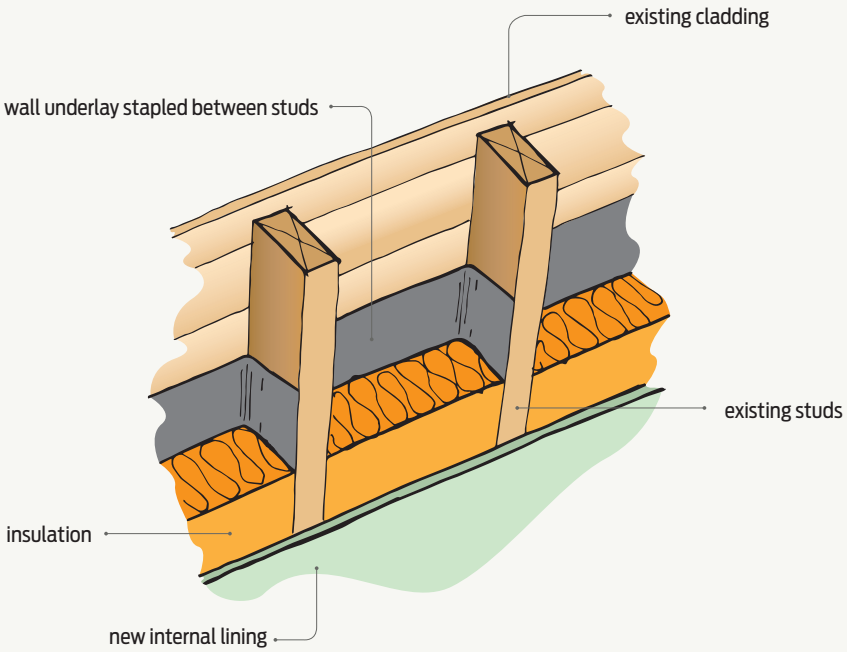


Figure 2 **Retrofitting wall insulation.**

- For a discussion on injected insulation, see www.buildmagazine.org.nz/articles/show/foam-insulation-concerns/.

More expensive may be more economic

When comparing prices, consider the R-value you're aiming to achieve, the thickness of insulation needed and the labour cost to install it.

In some situations, a more expensive product may be more economic overall.

Note **The Warm Up New Zealand: Heat Smart programme provides subsidies for installing insulation in houses built before 2000, see www.energywise.govt.nz/funding-and-programmes/insulation-programme.**