sustainable energy INFO

INFO fact sheet

# INSULATION TYPES

**The following pages provide general information on the range of insulation materials available.**

## Types of insulation products

Australian Standards cover most insulation products. Provided the product complies with the Australian Standard, good levels of performance and reliability can be expected. If no Australian Standard exists, it is vital to ensure the product has been independently tested to ensure performance is optimised. This should be done in a National Association Testing Authorities-accredited laboratory.

### Bulk insulation

Bulk insulation contains millions of tiny pockets of still air trapped within the material. This air provides the material's insulating effect so it is important not to compress bulk insulation. Bulk insulation is available as batts, blankets and boards, or as loose fill which is pumped, blown or placed by hand into an area.

***Batts and blankets***

*Glasswool (fibreglass)*

- Made from melted glass spun into a flexible mat of fine fibres
- Available as batts or blankets
- Easy to cut and install
- Commonly sold in DIY packs with R values clearly labelled
- Should not be compressed or moistened
- All ends and edges should be butted together firmly during installation
- Blankets are manufactured in rolls for specific types of installations, e.g. under roofing in a cathedral or raked ceiling or under a flat roof
- Blankets are thinner and denser than batts, and are available with reflective foil attached to one side

*Rockwool*

- Made from volcanic rock melted at high temperatures and spun into a mat of fine fibres
- Available as batts or blankets
- Denser than glasswool, so R value per unit thickness is higher
- Better sound absorption qualities than glasswool
- Generally more expensive than glasswool

Other characteristics are similar to glasswool

Glasswool and rockwool are together referred to as 'mineral wool' products. Due to their potential to irritate the skin and the upper respiratory tract, full protective clothing, including gloves and a face mask, should be worn during installation.

*Natural wool*

- Made from sheep's wool formed into batts or blankets
- Should only be manufactured from new, scoured wool treated with a vermin and rot-proofing agent during the scouring process
- Moth-proofing of wool is vital—check with the manufacturer for test results to guarantee this (test results should not be more than four months old)
- Most batts and blankets are made of a wool-polyester blend to reduce settling and compression
- Naturally flame-resistant, however, the addition of synthetic fibres increases flammability—check with supplier for fire resistance testing results
- As different types of wool can provide different R values for the same thickness, check with the supplier for R value tests and certifications

*Polyester*

- Made from polyester fibres (including recycled PET bottles) spun into a flexible mat
- Available as batts or blankets
- Similar physical properties to mineral wool, but is non-irritable, with no known physical or health hazards
- Does not burn, but will melt if exposed to a direct flame at high temperature

***Loose-fill insulation***

This type of insulation consists of shredded or granulated material supplied in a loose form, and is usually installed by the supplier/manufacturer. It must be correctly installed at even depth to provide adequate insulation cover. Barriers should be installed to prevent insulation falling down through exhaust fans, wall cavities, ceiling vents and light fittings.

Loose-fill material may settle over time, reducing its effectiveness—your contractor should quote you a guaranteed 'settled R value', which is the final R value achieved after any settling has occurred.

This type of insulation is more suited to flat or shallowly-sloping ceilings of less than 25° pitch. With the exception of some rockwool products, loose-fill is only suitable for insulating ceilings.

*Cellulose fibre*

- Made from waste paper pulverised into a fine fluff
- Must be treated with fire retardant chemicals to reduce flammability
- Cheaper to purchase and install than other types of bulk insulation
- Quality and installation can vary greatly, so ensure the product complies with Australian Standard *AS2462 (1981): Cellulosic fibre thermal insulation*

*Natural wool*

- Natural sheep's wool off-cuts
- Should consist of pure, new, scoured wool only—should not contain any synthetic fibres, or dyed or recycled materials
- Cheaper grades of wool are commonly used and can include small leather fragments—this should not affect performance
- Should be treated with a vermin and rot-proofing agent during the scouring process
- Other characteristics are similar to natural wool batts and blankets

*Granulated rockwool*

- A loose-fill form of rockwool
- If treated with a water-repellent agent, can sometimes be used to fill cavity brick and brick veneer walls—check with the supplier to see if it is suitable

***Boards***

These are used mainly in walls and cathedral ceilings.

*Extruded polystyrene*

- Rigid, waterproof boards of closed cell polystyrene
- High compressive strength
- Contain flame-retardants, however, installation is only recommended between non-combustible surfaces (e.g. plasterboard, reflective foil or brickwork)
- Very high R value per unit thickness
- Generally more expensive than other types of bulk insulation
- Some products available with reflective foil backing

*Foil-faced expanded polystyrene*

- Rigid boards of polystyrene beads with reflective foil attached to both sides
- Should be installed with foil facing still air spaces of at least 25 mm width to maximise R value
- Expanded polystyrene has lower R value per unit thickness than extruded polystyrene
- Also available as boards without foil facing—these have similar properties to extruded polystyrene, but have lower compressive strength and are not water resistant

## Reflective insulation

Reflective insulation is made of thin sheets of highly reflective aluminium foil laminate, which reflects heat from its polished surfaces while

absorbing and emitting only a small amount. It must work in conjunction with a still air layer for maximum effectiveness (see figure 7.6).

An R value supplied by reflective foil insulation is equivalent to the same R value provided by bulk insulation. Reflective foil R values are influenced by the characteristics of adjacent air spaces, such as their orientation, thickness and temperature differences.

Adequate performance can be achieved by combining reflective insulation with bulk insulation and/or using specialist foil products, provided they are carefully installed. Any gaps or tears will significantly reduce performance, as will dust build-up on surfaces. Four types of reflective insulation products are currently available.

***Reflective foil laminate***

> Foil laminated to paper with glass fibre reinforcement
> Supplied in rolls
> Typically used as roof sarking and wall insulation
> Double-sided foil is more effective than single-sided, provided that both sides face a still air space; it is also more water resistant
> Double-sided foil is typically produced with an anti-glare coating—this reduces the insulation's effectiveness by around 10%

*Multi-cell reflective foil products*

> Two, three or four layers of laminated foil separated by partitioning to provide a one, two or three-layered cell structure
> Can be installed over ceiling joists and between or across wall studs, depending on the product
> Should be butted firmly together to prevent air movement through gaps
> R value depends on the number of cells and the presence of still air layers between the batts and other materials

*Expandable concertina-style foil*

> Double-sided reflective foil formed into an expandable concertina
> Used mainly under timber floors and between wall studs
> Adjustable width to suit varying gaps
> Should be installed with an adjacent sealed air space and be well sealed against the building frame

*Foil bonded to bulk insulation*

> Reflective foil bonded to batts, blankets or polystyrene boards
> Increases insulation benefits if installed with the foil facing a still air space
> Blankets are a common method of insulating cathedral ceilings and under flat roofs

## Soundproofing

Some insulating materials can be used for soundproofing. Bulk insulation, particularly denser materials such as rockwool, has good sound absorbing qualities. The soundproofing performance of a particular product is measured by a sound reduction index referred to as Sound Transmission Class (STC). The higher the STC rating, the greater the soundproofing performance. If soundproofing is desired between rooms (e.g. between a bedroom and a bathroom), high density insulation can be installed in internal walls or between floors in a two-storey building. Blanket type insulation installed directly under metal roofing also helps reduce external noise caused by wind, rain and hail. Specialised acoustic insulation products are also available which provide even better soundproofing performance.

## Overall R value

The overall R value is the total resistance of a building element. It takes into account resistance provided by construction materials used in a wall

or ceiling, internal air spaces, thermal bridging, insulation materials and air films adjacent to solid materials. Each of these components has its own inherent R value, the sum of which provides the overall R value.

### Added R value

The added R value or added thermal resistance is the value of the insulating material alone. This is the term most used when buying insulation.

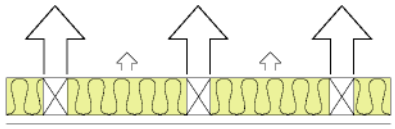
The manufacturer should provide the R value of bulk insulation. Some products will trap air or gas more effectively, and so will have a higher R value for a specified thickness. For example, 45 mm thick extruded polystyrene and 80 mm thick glasswool both have an R value of approximately 1.5.

Reflective insulation must work in conjunction with enclosed air spaces between surfaces, and cannot be said to have an R value by itself. To compare the performance of bulk and reflective insulation, the resistance of any existing air space(s) must be calculated. Reputable manufacturers can supply this information. Note that the effectiveness of reflective insulation installed on horizontal or sloping surfaces will eventually be reduced due to dust build-up, which reduces reflectivity.

### Thermal bridging

Thermal bridging is the transfer of heat across building elements, which have less thermal resistance than the added insulation. This decreases the overall R value (see figure 7.8).

Wall frames and ceiling joists are examples of thermal bridges, having a lower R value than the insulating material placed between them. Because of this, the overall R value of a typical ceiling is reduced. For example, adding R2.5 bulk insulation between timber joists will result in an overall R value for the whole ceiling of R2.2. Metal framing, which has lower thermal resistance, reduces the overall R value even further. Consequently, higher levels of added insulation must be installed to compensate for this.



insulation R2.5
ceiling joists R0.9
overall R value of ceiling R22

Figure 7.8: Thermal bridging through ceiling joists

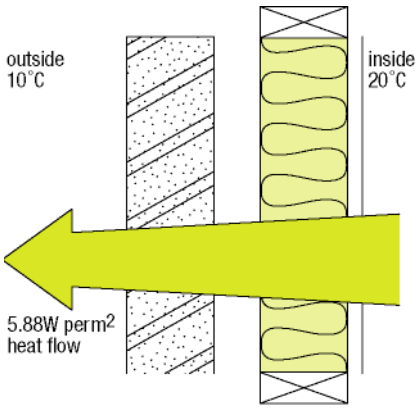



Figure 7.9: Heat transfer through R1.7 insulated brick veneer wall

## Insulation levels

### Minimum insulation levels for Victoria

Whilst minimum thermal performance requirements are standard practice in many countries, Victoria is the only state in Australia to currently set minimum insulation levels. A national framework has been developed for House Energy Ratings which will address insulation as one of several components.

In March 1991, government regulations were introduced specifying minimum insulation levels for all new homes and extensions built in Victoria. Small alterations or renovations to existing buildings requiring a building permit may also have to comply with the regulations, depending on the local council.

The regulations ensure that a reasonable level of thermal insulation is incorporated into residential buildings. New buildings of classes I, II and III

(includes all residential dwellings such as homes, flats and units, and the residential sections of hotels, motels, schools, special accommodation and health-care buildings) must reach these prescribed insulation requirements.

The regulatory requirements may be met by:

- complying with either of the following two basic options shown in table 7.2; or
- achieving a House Energy Rating of at least 3 stars and at least equivalent to that which would be achieved using option A or B (see table 7.2), as assessed by a registered building practitioner accredited in the use of the Sustainable Energy Authority's *FirstRate* house energy rating software.

Common building materials, such as brick, timber or tiles have little inherent insulation value.

The R values of some typical forms of wall construction are shown in Table 7.3. The regulations require a minimum R value of 1.3 for walls. Only 200 mm aerated concrete meets the Victorian minimum insulation requirements by itself. Brick veneer and weatherboard walls have R values of 0.51 and 0.53 respectively, thus needing the addition of insulation to comply with the regulations.

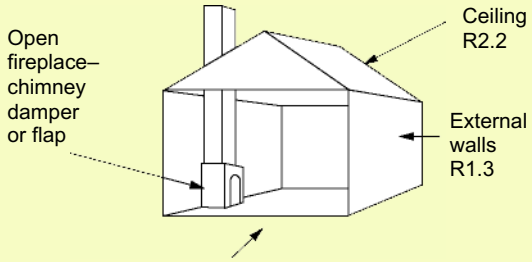
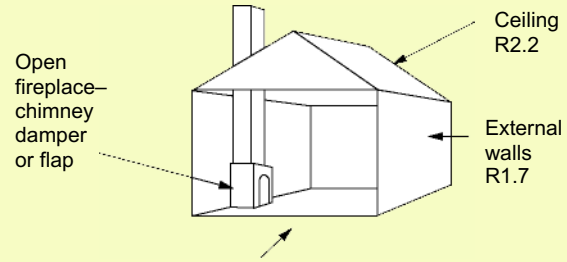
| OPTION A: MINIMUM OVERALL R RATINGS | | OPTION B: MINIMUM OVERALL R RATINGS | |
|---|---|---|---|
| **Ceiling R2.2** | Equivalent to adding R2.5 batts between the joists | **Ceiling R2.2** | Equivalent to adding R2.5 batts between the joists |
| **Walls R1.3** | Equivalent to reflective foil in a framed wall | **Walls R1.7** | Equivalent to adding R1.5 batts between the studs of a framed wall or R1.0 foam board over the face of the studs |
| **Floor R1.0** | Equivalent to an uninsulated concrete slab-on-ground, or a timber floor with an enclosed floor space | **Floor R0.7** | Equivalent to a timber floor with an open sub-floor space |
| **Open fireplace** | Chimney damper or flap | **Open fireplace** | Chimney damper or flap |
|  Floor R1.0 – Concrete slab-on-ground or suspended floor with an enclosed sub-floor space | |  Floor R0.7 – Suspended floor with an open sub-floor space | |

Table 7.2: Minimum thermal insulation regulations

| WALL CONSTRUCTION | OVERALL R VALUE |
|---|---|
| Weatherboard | 0.55 |
| Brick veneer | 0.51 |
| Cavity brick | 0.53 |
| Solid brick (230 mm thick) | 0.44 |
| Solid concrete (100 mm thick | 0.23 |
| Solid concrete (200 mm thick) | 0.30 |
| Aerated concrete (100 mm block) | 0.78 |
| Aerated concrete (200 mm block) | 1.54 |
| Mud brick (300 mm block) | 0.40 |

Table 7.3: Estimated R values* of common wall construction types

* As R value increases, the insulation benefit improves.

### *Exemptions*

Certain wall types have been exempted from the regulations. Cavity brick, mud brick, earth wall or other masonry walls thicker than 180 mm (excluding any cavity) are exempt from requiring wall insulation, provided the floor is of concrete or masonry in direct contact with the ground. To ensure adequate levels of energy efficiency and comfort, however, it is recommended that such walls be insulated to meet the minimum regulatory requirements.

Garages, where separated from the residential section of a house, are not subject to the regulations. Connecting walls between a garage and a house must still be insulated.

### *Higher insulation levels recommended*

The insulation levels prescribed by the Victorian regulations are minimum requirements only. Higher levels of insulation will increase energy savings and comfort levels. In Melbourne for instance, adding R3.0 to ceilings and R1.5 to walls can save an additional 12% on energy bills each year. At a certain point, depending on the climate, the cost of adding extra insulation is not reflected in substantial savings on energy bills.

*AS2627.1 (1993)* contains recommended levels of insulation for locations throughout Australia. Table 7.4 is an extract of recommended levels of ceiling and wall insulation for Victoria. Note that many locations would benefit from installing more than the mandatory levels for greater energy efficiency and comfort, especially in areas which experience extreme temperatures.

| LOCALITY | ADDED R VALUE | |
|---|---|---|
| | Ceilings | External walls |
| Alexandra | 3.0 | 2.0 |
| Ararat | 3.0 | 2.0 |
| Avoca | 3.0 | 2.0 |
| Bairnsdale | 2.5 | 1.5 |
| Ballarat | 3.5 | 2.0 |
| Beechworth | 3.5 | 2.0 |
| Benalla | 2.5 | 1.5 |
| Bendigo | 2.5 | 1.5 |
| Bogong | 3.5 | 2.0 |
| Bright | 3.0 | 2.0 |
| Camperdown | 2.5 | 1.5 |
| Castlemaine | 3.0 | 2.0 |
| Colac | 3.0 | 2.0 |
| Corryong | 3.0 | 2.0 |
| Creswick | 3.5 | 2.0 |
| Donald | 2.5 | 1.5 |
| Dookie | 2.5 | 1.5 |
| Echuca | 2.5 | 1.5 |
| Erica | 3.0 | 2.0 |
| Euroa | 2.5 | 1.5 |
| French Island | 2.5 | 1.5 |
| Forrest | 3.0 | 2.0 |
| Geelong | 2.5 | 1.5 |
| Hamilton | 2.5 | 1.5 |
| Heathcote | 3.0 | 2.0 |
| Horsham | 2.5 | 1.5 |
| Jeparit | 2.5 | 1.5 |

Table 7.4: Recommended levels of ceiling and wall insulation (Victoria). Continues following page.

| LOCALITY | ADDED R VALUE | |
|---|---|---|
| | Ceilings | External walls |
| Kerang | 2.5 | 1.5 |
| Kyabram | 2.5 | 1.5 |
| Kyneton | 3.5 | 2.0 |
| Lake Eildon | 3.5 | 2.0 |
| Lakes Entrance | 2.5 | 1.5 |
| Lismore | 2.5 | 1.5 |
| Lorne | 2.5 | 1.0 |
| Macedon | 3.5 | 2.0 |
| Maffra | 2.5 | 1.5 |
| Maldon | 3.0 | 2.0 |
| Mangalore | 2.5 | 1.5 |
| Maryborough | 2.5 | 2.0 |
| Melbourne | 2.5 | 1.5 |
| Mildura | 2.5 | 1.0 |
| Mitta Mitta | 3.0 | 2.0 |
| Mt Beauty | 3.0 | 2.0 |
| Mt Buffalo | 4.0 | 2.0 |
| Mt Dandenong | 3.5 | 2.0 |
| Mt St Leonard | 3.5 | 2.0 |
| Nhill | 2.5 | 1.5 |
| Noojee | 3.0 | 2.0 |
| Numurkah | 2.5 | 1.5 |
| Omeo | 3.5 | 2.0 |
| Orbost | 2.5 | 1.5 |
| Ouyen | 2.5 | 1.5 |
| Point Lonsdale | 2.5 | 1.5 |
| Portsea | 2.5 | 1.5 |
| Queenscliff | 2.5 | 1.5 |
| Rennick | 3.0 | 2.0 |
| Robinvale | 2.5 | 1.0 |
| Rochester | 2.5 | 1.5 |
| Rubicon | 4.0 | 2.0 |
| Rutherglen | 3.0 | 2.0 |
| Sale | 2.5 | 1.5 |
| Seymour | 3.0 | 2.0 |
| Shepparton | 2.5 | 1.5 |
| St Arnaud | 2.5 | 1.5 |
| Stawell | 2.5 | 1.5 |
| Swan Hill | 2.5 | 1.5 |
| Tatura | 2.5 | 1.5 |
| Terang | 3.0 | 2.0 |
| Tooradin | 2.5 | 1.5 |
| Warrnambool | 2.5 | 1.5 |
| Wangaratta | 2.5 | 1.5 |
| Warragul | 2.5 | 1.5 |
| Wilsons Prom | 2.5 | 1.5 |
| Wodonga | 2.5 | 1.5 |
| Wonthaggi | 2.5 | 1.5 |
| Yallourn | 2.5 | 1.5 |
| Yarrawonga | 2.5 | 1.5 |

Table 7.4: Recommended levels of ceiling and wall insulation (Victoria)

### *Ceilings and walls*

Added R3.5–R4.0 in ceilings and added R2.0 insulation in walls should be installed if:

- the home is in colder areas such as Ballarat, Macedon, Eildon or alpine areas.
- higher levels of comfort and energy savings are desired.

Added R1.0 polystyrene boards should be installed to all solid masonry and cavity brick walls. Insulation should be placed on the outside of the inner wall leaf where there is a cavity.

### *Floors*

The minimum insulation regulations do not require floor insulation for concrete slab-on-ground construction. However energy savings will accrue from R1.0 polystyrene board slab-edge insulation, particularly if:

- building in cold climate areas; or
- slab heating is used.

Timber floors will benefit from additional insulation where:

- there is no carpet over timber floors;
- the underfloor space is open or well ventilated;
- they overhang garages, balconies, etc.; or
- you are building in cooler areas.

## Insulation selection

When selecting insulation, ensure that the material is:

- the recommended R value for the relevant area;
- appropriate for the intended installation;
- a material covered by Australian Standards or approved by other recognised testing authorities; and
- sufficient to meet local building authority requirements.

A list of recommended levels of ceiling and wall insulation is provided in table 7.4.

## Fire safety

All insulation products should be independently tested for flammability prior to being sold. *AS1530.1 (1989)* provides a standard testing procedure to measure:

- ignitability;
- the spread of flame;
- if the material is heat evolved; and
- if the material is smoke evolved.

Ignitability is rated on a scale of zero to 20, while other factors are rated on a scale of zero to ten. The lower the number, the smaller the risk.

Cellulose fibre must be treated with a fire retardant such as a mix of borax and boracic acid during manufacture. The treatment ensures that, if the material does ignite, the flame will not spread. Expanded and extruded polystyrene are combustible, and should only be installed between fire-resistant surfaces (this includes plasterboard). Natural wool is flame resistant, provided only pure, new scoured wool is used. Wool which is oily, or has synthetic fibres mixed with it is potentially flammable.

As there is no Australian Standard, the quality of individual products may vary considerably. Ensure that the manufacturer supplies details of independent fire resistance tests. All other insulation products are essentially non-combustible.

## Suggested applications for insulation products

Table 7.5 on the following pages, provides general information about the various insulation products currently available, together with the most common applications for each product. It is possible to adapt most products for different uses if required.

| INSULATING MATERIAL | | MATERIAL DESCRIPTION | TYPICAL APPLICATIONS | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | FLAT CEILINGS PITCHED ROOFS | CATHEDRAL CEILINGS OR RAKED CEILINGS | TIMBER FLOORS | SUSPENDED CONCRETE SLABS | CONCRETE SLAB EDGES | FULL MASONRY WALLS | FRAMED WALLS |
| BATTS AND BLANKETS | Glasswool | Manufactured from melted glass spun into a mat of fine fibre. Made to an Australian Standard and commonly sold in DIY with R values clearly labelled. Easy to cut and install. Remains inert. Should not be compressed or moistened. Butt all ends and edges together firmly. | ✔ | ✔ | ✔ | | | | ✔ |
| | Rockwool | Volcanic rock melted at high temperatures and spun into a mat of fine fibres. Denser than glasswool so R value per unit thickness is higher. Good sound absorption properties. See glasswool for other characteristics. | ✔ | ✔ | ✔ | | | | ✔ |
| | Glasswool/ rockwool—foil attached | Characteristics same as above with foil providing increased insulating value (in summer) and moisture resistance. R value depends on method of installation. | ✔ | ✔ | | | | | |
| | Natural wool | Should only be made from new, scoured wool. Must be treated with a vermin/rot proofing agent during the scouring process. Dirt or grease can add to flammability. Some include synthetic (usually polyester) fibres to reduce settling and compression. The Wool Mark logo signifies batt is made from pure wool only. No Australian Standard as yet. | ✔ | ✔ | ✔ | | | | ✔ |
| | Polyester | Manufactured from polyester strands spun into a mat. Similar physical properties to glasswool and rockwool. Non-toxic, with no known physical or health hazards. Does not burn, but will melt if exposed to a direct flame. Butt all edges firmly. No Australian Standard as yet. | ✔ | ✔ | ✔ | | | | ✔ |

Table 7.5: Insulation products and possible applications.

Continues on following page

| INSULATING MATERIAL | | MATERIAL DESCRIPTION | TYPICAL APPLICATIONS | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | FLAT CEILINGS PITCHED ROOFS | CATHEDRAL CEILINGS OR RAKED CEILINGS | TIMBER FLOORS | SUSPENDED CONCRETE SLABS | CONCRETE SLAB EDGES | FULL MASONRY WALLS | FRAMED WALLS |
| BOARDS | Extruded polystyrene (styrofoam) | Rigid boards of close cell polystyrene which retain air but exclude water. High R value per unit thickness. Suitable where space is limited. Easy to cut and install. Should only be used between non-combustible materials such as brick, aluminium and plasterboard. Can be rendered. Most commonly used material for slab-edge and cavity brick wall insulation. Greater structural strength and moisture resistance than expanded polystyrene. | | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |
| | Expanded polystyrene (EPS) | Semi-rigid boards of white polystyrene beads. High water absorbency. Combustible and should only be used between fire resistant materials. Easy to cut and install. Available as preclad panels. | | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |
| | Expanded polystyrene —foil attached | Expanded polystyrene boards sandwiched between reflective foil. Characteristics same as above, however, higher R values achieved due to the addition of two reflective surfaces and higher water resistance. | | ✔ | | | | | ✔ |
| LOOSE FILL | Cellulose fibre | Manufactured from waste paper pulverised into a fine fluff. Fire retardant added. Generally pumped into roof by contractor. Difficult for the purchaser to ensure uniform thickness and density installing by hand. Product should be manufactured to AS2462 and installed in a consistent, even layer. Must be kept dry. Must not be compressed. Settling of up to 20 mm per 100 mm thickness may occur, decreasing performance. | ✔ | ✔ | | | | | |
| | Granulated rockwool | Properties as per rockwool batts. However, material is loose, not a prefabricated mass. Treated with a water repellent. Should be installed in an even, consistent manner. | ✔ | ✔ | | | | ✔ | ✔ |
| | Natural wool | Made from off-cuts of natural sheep's wool. Quality and density can vary considerably, affecting the R value. Other characteristics same as for natural wool batts. | ✔ | ✔ | | | | | |

Table 7.5 continued. Continues on following page.

| INSULATING MATERIAL | | MATERIAL DESCRIPTION | TYPICAL APPLICATIONS | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | FLAT CEILINGS PITCHED ROOFS | CATHEDRAL CEILINGS OR RAKED CEILINGS | TIMBER FLOORS | SUSPENDED CONCRETE SLABS | CONCRETE SLAB EDGES | FULL MASONRY WALLS | FRAMED WALLS |
| REFLECTIVE | Reflective foil | Aluminium foil laminated with glass fibre reinforcement. Supplied in rolls, one side often painted with an anti-glare paint. Does not have a significant R value itself, and requires a sealed air space of at least 25 mm between foil and solid surface to achieve full insulation qualities. Gaps in foil reduce performance. Valuable in combination with bulk insulation for enhancing performance. Useful barrier against transfer of moisture. Reflective surface needs to remain clean and dust-free. Dust build-up reduces R value. | ✔ | ✔ | ✔ | | | | ✔ |
| | Concertina foil batts | Expandable concertina folded foil-paper laminate. Can be adjusted to suit varying gaps. Other characteristics identical to laminate bought as rolls. | | | ✔ | | | | ✔ |
| | Multi-cell foil batts | Prefabricated batts made from layers of laminated foil with partition reflective strips to produce a cell construction with enclosed air cavities. Gaps will significantly reduce performance. Double or triple-cell batts (two and three layers of cells, respectively) may be necessary to achieve adequate winter insulation levels. Dust build-up reduces R value. | | ✔ | ✔ | | | | ✔ |

Table 7.5 continued. Continues on following page.

| INSULATING MATERIAL | | MATERIAL DESCRIPTION | TYPICAL APPLICATIONS | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | FLAT CEILINGS PITCHED ROOFS | CATHEDRAL CEILINGS OR RAKED CEILINGS | TIMBER FLOORS | SUSPENDED CONCRETE SLABS | CONCRETE SLAB EDGES | FULL MASONRY WALLS | FRAMED WALLS |
| BUILDING MATERIALS | Aerated concrete | Lightweight blocks or panels aerated to trap insulating pockets of air. Blocks provide solid masonry wall and insulation in the one product. Good thermal and acoustic properties. Non-combustible. Easy to handle. | | | | | | ✔ | ✔ |
| | Expanded polystyrene | Hollow forms filled with concrete. Hollow EPS blocks and panels create a solid formwork which is then filled with concrete, or sprayed with an external concrete render. | | | | | | ✔ | ✔ |
| | Weather-proof housewrap | Sheeting made of polyethylene fibres bonded together by heat and pressure. Added to buildings during construction to weatherproof and draught proof walls. Can add up to R0.8 to walls by trapping a layer of still air. | ✔ | ✔ | ✔ | | | | ✔ |

Table 7.5 continued.