Energy efficiency for timber floors

Australian timber flooring association

Information Sheet #24 September 2010

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Introduction

Timber floors can easily meet home energy efficiency regulations across Australia with a minimum of fuss and expense. Energy efficiency regulations vary between the different states and territories. In the case of timber floors, energy efficiency regulations only apply to suspended ground floors either built on a frame (e.g. timber, steel etc) or other material (e.g. reinforced or aerated concrete etc). Floors on mezzanine, first and higher floors do not have any requirements to be met. Timber floors laid on a concrete slab on ground also do not have requirements to be met (although there may be some requirements for the slab itself).

For Class 1 and 10 buildings (includes houses and non habitable buildings), energy efficiency regulations are contained in Part 3.12 of Volume 2 of the Building Code of Australia (BCA). For other building classes the regulations are in Part J of Volume 1. Different states and territories set different levels of compliance or allow exemptions with the requirements in the BCA. In NSW the BASIX system is the primary regulatory tool in this area.

Meeting the regulations

There are two ways to meet the regulations, either with a prescriptive approach or with a modelling approach.

Prescriptive approach

This approach, also called acceptable construction in Volume 2 of the BCA, deemed-to-satisfy in Volume 1 and 'Rapid' and 'DIY' in the NSW BASIX system, requires the ground floor to meet specific minimum insulation levels (R-values) for the ground floor.

For most states and territories all the required minimum R-values for the ground floor element are in the latest edition of the BCA. However some states may have exemptions from or additional requirements to the BCA. Some states may also have requirements which refer to previous editions of the BCA.

Modelling approach

The modelling approach requires a home to meet minimum energy efficiency levels for the energy needed to heat and cool the whole house. These minimum levels are set by the state and territory governments and are minimum 5 star, 6 star or in the NSW BASIX system, minimum heating and cooling loads which vary depending on the homes location. The minimum energy efficiency of the whole house as designed is required to be modelled using computer software such as FirstRate, AccuRate or BERS Professional by a trained energy assessor. This modelling approach allows considerable flexibility in how a home achieves the minimum energy efficiency rating. It may mean, for example, that no additional insulation is required on the ground floor because of increased wall and ceiling insulation or changes to glazing type, coverage or frames.

For both approaches the insulation properties of the timber flooring itself or the insulation properties of timber flooring when used as part of a particular floor system will need to be known. Guidance of both is provided below.

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R values for suspended timber floors systems

Insulation value is commonly called an “R-value” and is a measure of thermal resistance.

There are two ways in which R-values are listed:

- Product or material R-value is the R-value of the product or material on its own.
- System R-value includes the combined insulation value of flooring material, air spaces, any additional insulation and other variables working in conjunction.

Timber products all have a material R-value. The thermal conductivity of kiln dried hard wood (across the grain) is 0.16 W/mK. The R-value of a material is determined by dividing the thermal conductivity of the material (in metres) by the thickness so the R-value of 19 mm thick kiln dried hardwood flooring is R 0.12. R-value for other timber flooring products should be obtained from the supplier.

e.g. R = Thickness (m) / Conductivity (W/mK) =0.019 / 0.16 = 0.12 ($m^2 \cdot K/W$)

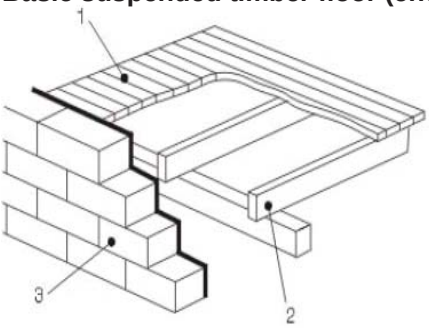
The R-values for suspended timber ground flooring systems vary and R-values for a common selection of systems where the sub-floor is enclosed are included below.[1]

R-Values – Downward or Upward

The direction that insulation needs to inhibit heat transfer depends upon the climate zone and whether the dwelling predominantly requires heating, cooling or heating and cooling. R-values can be measured depending on the direction of heat flow (upward or downward) that one wants to reduce. In cooler climates higher down R-values and lower up R-values are appropriate. In hot, humid climates where houses are naturally ventilated lower down R-values and higher up R-values are appropriate for floors. The BCA and BASIX in NSW most often require a minimum downwards R-value

Note: Reference needs to be sought from the tables in the Building Code of Australia as each climatic area has different characteristics.

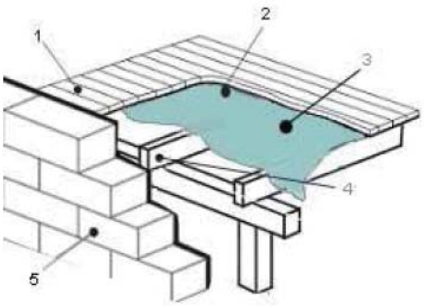
Basic suspended timber floor (enclosed perimeter)



1. 19mm timber floor
2. Timber floor joist
3. Sub-floor wall

Sub-floor height	R-Value (DOWN)
0.5 m	1.06
2.5 m	0.72

Reflective foil laminate (RFL) over floor joists (minimum airspace to ave.13mm)



1. 19mm timber floor
2. Air space (reflective)
3. RFL
4. Timber floor joist
5. Sub-floor wall

Sub-floor height	R-Value (DOWN)
0.5 m	2.36
2.5 m	2.03

[1]R-values calculated in accordance with the relevant provisions of Australian Standard AS/NZ4859.1 – Materials for the thermal insulation of buildings. General criteria and technical provisions and the International Standards Organisation standard ISO13370 – Thermal performance of buildings – Heat transfer via the ground – Calculation methods is used as the methodology for determining the R-value of suspended timber floors. The following assumptions are made: typical suburban location in humidity zone 3, standard brick veneer with a wall cavity barrier, sub-floor enclosed with single skin masonry (110mm), standard floor joist depth, over a clay soil.

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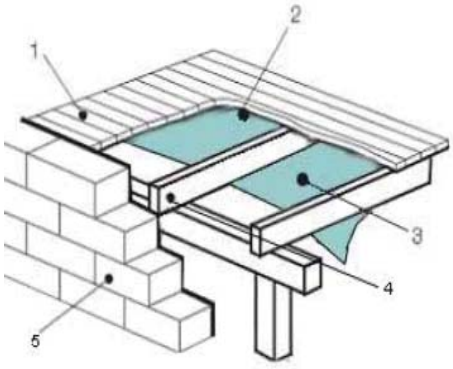
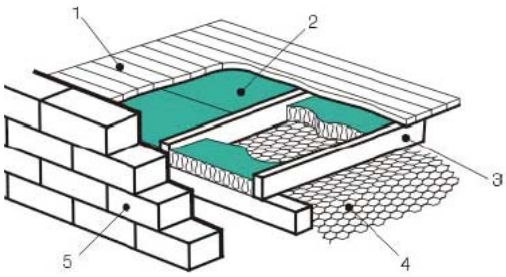
Reflective foil laminate (RFL) under floor joists



1. 19mm timber floor
2. Air space (reflective)
3. RFL
4. Timber floor joist
5. Sub-floor wall

Sub-floor height	R-Value (DOWN)
0.5 m	2.95
2.5 m	2.63

Bulk insulation under the floor between floor joists



1. 19mm timber floor
2. Bulk insulation
3. Timber floor joist
4. Mesh
5. Sub-floor wall

Joists @450 or 600 crs

R-value of bulk insulation	R-Value (DOWN)
R1.5	2.42
R2.0	2.82
R2.5	3.19
R3.0	3.55

Hazards to avoid

- Precautions need to be taken so underfloor insulation does not get wet during construction which may cause mould or fungal growth to develop under the timber flooring.
- If underfloor insulation does get wet, ensure adequate sub-floor air ventilation and circulation is present to dry it out.
- Ensure if using RFL it continuously envelopes the complete building.
- If using draped RFL over the floor joists ensure a trough is formed and that the RFL is perforated where the trough is formed with a 3 mm diameter holes at spacings of 450mm to allow water to pass through. The aim of this is not to cause ventilation but to drain any water trapped in this area with minimum effect, excessive ventilation will negate the insulation effect of the RFL.
- As timber floors which are properly laid are in an enclosed environment only very little water can possibly enter into the foil space.
- Placing additional insulation underneath floors where the sub-floor perimeter is not enclosed may require additional support to keep insulation in place. Various commercial support systems are available. Lining underneath the floor joists with particleboard or plywood may be needed to deliver additional R-value required and secure the insulation.
- When using bulk insulation and recalculating total floor system R-value, care must be taken as it is not a straight forward matter of adding the material R-value. The bulk insulation displaces air which itself has some insulation effect. For example installing fibre batts with an R-value of 1.5 between the floor joists will increase the R-value by R0.74 (upwards) to R1.21 (upwards) not R1.5.

Further information

A number of other options for insulating under floors (and upward R-values) are contained in the report "*Insulation Solutions to Enhance the Thermal Resistance of Suspended Timber Floor Systems in Australia*". This report can be found at www.timber.org.au in the Design and Construction section under Thermal Performance.

Due to the magnitude of solutions and products available only a few systems are noted above. Advice on the most suitable product for your climate and conditions including information on correct installation of additional insulation under the floor should be sought from the insulation supplier/manufacturer.

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