

Shedeye Investigator

Investigation Report 100590

By Shedeye

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Insulation in Class 10a Buildings



Summary

Insulation has almost become a non-subject as a result of the Governments Insulation Scheme where many people still are in the dark regarding the various forms of insulation and their performance in buildings.

This report is to simply explain all the forms of insulation, the interpretation of the relevant Building Codes and the implications on Class 10a Buildings.

The BCA on stand-alone Class 10a building infers they not require roof or wall insulation installed if a non-habitable building and not attached to any other class of building that is subject to insulation requirements. The other factor is if the Class 10a has a cooling or heating system that requires outside energy source. Simply this is air-conditioners, ducted A/C etc. If the building has any of these, then insulation will be required.

The big question is why Class 10a buildings are exempt from insulation regardless of how basic the shed is. Most Class 10a buildings are utilised for car accommodation, storage or basic workshop area. The major factor in an uninsulated shed is the temperature rise when all openings are closed off (or simply locked up). The temperature inside an uninsulated shed with only steel roof cladding can climb to very high temperatures, and possibly adequate to cause a fire danger to some of the flammable contents. Also a consideration is the comfort level for normal human activity is severely reduced. What is insulation, how does it reduce heat build-up inside sheds, why all the complicated terminology, are different brands better or worse and what types are available.

This report basically covers only two areas regarding insulation in Class 10a buildings:

- 1. Why is insulation not required in most Class 10a buildings?**
- 2. A description and interpretation of how different types of insulation work.**

Insulation is a cost effective method of increasing comfort and safety levels within the interior of a Class 10a building.

Acknowledgements

Reviews of current Australians Insulation Supplier and Manufacturer Websites, ICANZ website, Shed Supply Companies and Shed Owners have all contributed to compiling this report.

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Introduction

The insulation industry is very competitive and all seek a market share of sales, and the result is that many of the terminologies used are often more perplexing to the average shed customer than trying to standardise and provide factual information and comparisons. To cover the items mentioned in the Summary – below are the two main areas of discussion:

1. Insulation Types, Terminology and Definitions.
2. Insulation requirements in Class 10a Buildings

Insulation Types, Terminology and Definitions

The following is just a brief list and sketches of the insulation types available for your shed. The three main types are blanket, foil and air-bubble that all have different applications and depending on the type, thickness and manufacture all have different efficiencies in their value of heat reduction in summer and preventing heat loss in winter.

1. Single sided poly weave foil in Figure 1.

Reinforcing Polymer Mesh
Hot Melt Flame Retardant Adhesive
Kraft Paper
Aluminium Foil

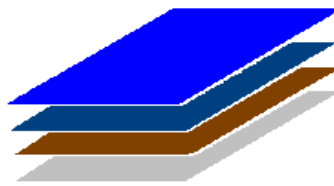


Figure 1

2. Double sided Antiglare Foils in Figure 2

Aluminium AntiGlare Foil Coat
Flame Retardant Adhesive
Reinforcing Glass Fibre
Kraft Paper
Laminating Adhesive
Aluminium Foil

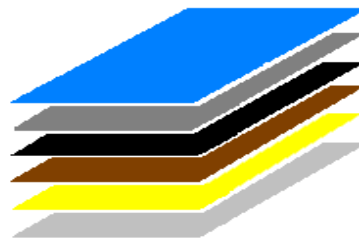


Figure 2

3. Bubble Foil in Figure 3

Aluminium Antiglare Foil Coating
Internal Air Bubbles
Aluminium Foil

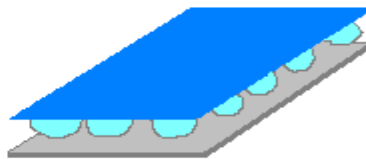


Figure 3

4. Foil Faced Blanket in Figure 4

Aluminium Antiglare Foil Coating
Bulk Mineral Insulation Blanket



Figure 4

The various types above all have different properties and the supplier have the list of Material R-value ratings for each one. All of the above normally have an emissivity of the

bright side foil at 0.003, the antiglare face as 0.01, poly weave as 0.87 used in calculating total R-value of the finished structure whether in walls, roofs or ceilings.

They all perform the single use as insulation that combines with the other materials in the structure such as roof sheets, air space etc to finally give the total R-value for that wall or roof depending on what is selected.

This is a very long list of terms frequently used in the insulation industry:

Definitions

Added R-value is the thermal resistance added to a construction element by insulating.

Bulk Insulation is Insulation depending for its performance upon thickness and thermal conductivity to achieve material R-value.

Climate Zone An area outlined in the BCA Climate Zone Map of Australia.

Class 10a Building is the code by BCA of the class of building if it is a non-habitable building or structure normally a private garage, carport or shed.

Conditioned Space means a space within the building that is heated or cooled by an external service (power, ducting etc) unless the kilowatt capacity is less than 1.2kW total. This also applies if a hot water system is installed in the building.

Conduction is the heat flow transfer by exiting molecules of a solid material.

Convection is the heat flow transferred by movement of a fluid (e.g. air movement)

Domestic Services mean that heating, air-conditioning, mechanical ventilation systems and hot water systems are fitted to the building (excludes cooking facilities and portable appliances)

Emittance is the ratio of radiant energy emitted by a surface compared to that of a blackbody (a blackbody emits radiation energy at the maximum rate possible)

Envelope is all the building cladding or parts that separate the exterior of the building or other spaces not artificially heated or cooled from the interior of the conditioned space.

Fabric is simply the structural building elements of the buildings walls, roof, ceiling and floor.

Glass Wool is insulation composed of bio-soluble glass fibres

Heat Transfer is the heat flow from a hot body to a cold body.

Indoor Air Film is the layer of air immediately adjacent to the internal surface of the building element (cladding)

Material R-value is a measurement of the thermal resistance determined by dividing the thickness by thermal conductivity, excluding the surface air film resistance. This measured in m^2K/W and applies to bulk insulation and expressed as material R-value. For reflective insulation the thermal resistance is measured in Total R-value.

Mineral Wool is insulation composed of fibres manufactured from glass or rock.

Non-Ventilated is the air space enclosed by non permeable building materials.

Radiation is the heat flow transfer by electromagnetic radiation (infra red waves).

Rock Wool is insulation composed of bio-soluble rock fibres.

Outdoor Air Space is the layer of air adjacent to the external surface of the building element (cladding).

Summer is the BCA design heat flow direction INTO the structure.

System R-value is thermal resistance of the system combining all the construction elements.

Ventilated is the air space ventilation provided by an opening designed to allow air movement or even forced mechanical air ventilation.

Winter is the BCA design heat flow direction OUT of the structure.

Insulation Requirements of Class 10a Buildings

A quick review of the regulations of the BCA mention Clause 3.12.1.1-3.12.1.5 must apply if the Class 10a Building has a conditioned space (A/C or heated) or not thermally separated from an attached Class 1 building and Clause 3.12.1.6 must apply for all Class 10a buildings attached to a Class 1 building. This simply means that the BCA regulations on insulation apply if your shed is air-conditioned, heated, got a hot water system or attached to a house. Beware that many other implications regarding the building construction will also change dramatically if this occurs. This summary is only covers the insulation implications of your shed and the BCA clauses impact in this area.

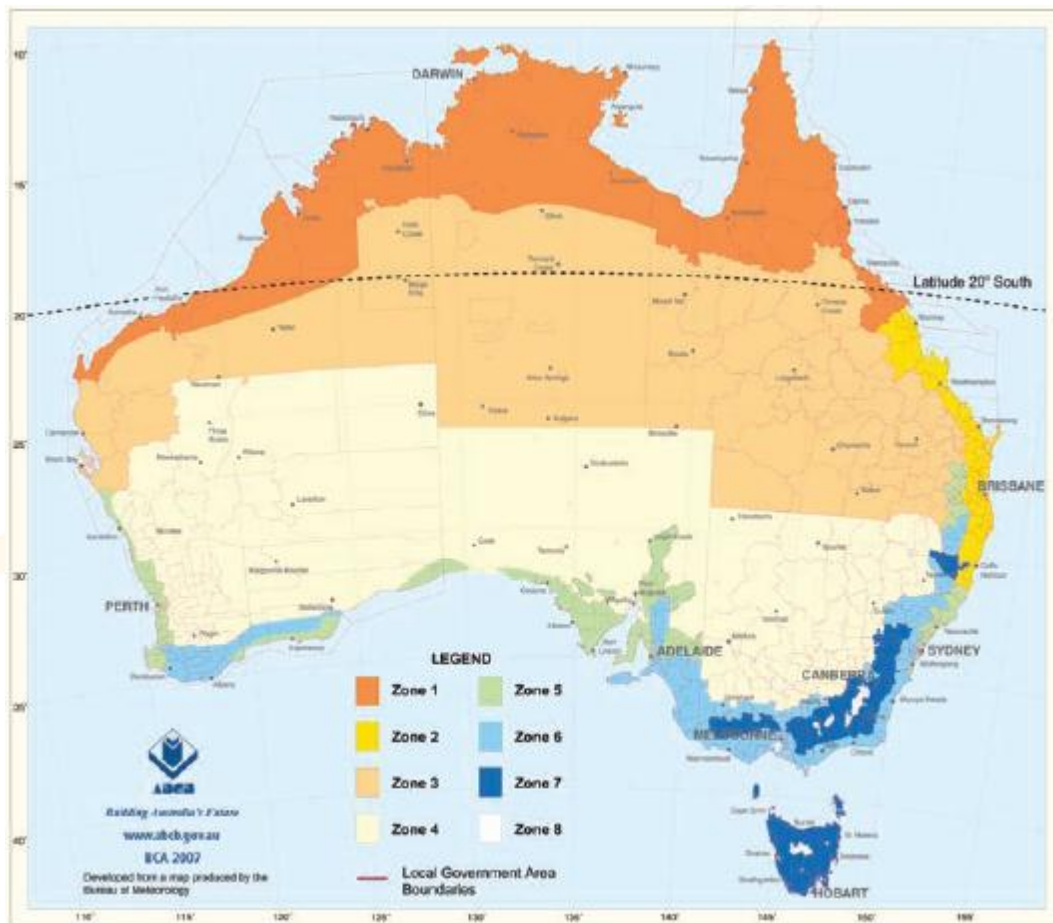


Figure 5

The above Figure 5 is the BCA Climate Zone Map which covers Australia and zones different areas to aid customers to determine which level of insulation is appropriate for their Class 10a building. It also yields different values for roofs and walls as opposed to floors.

The BCA Climate Zone Map is used in conjunction with the Table of areas to determine the R-value required for the project. It is shown below as Figure 6.

Climate Zone		1	2	3	4	5	6	7	8
			Below 300m	Above 300m					
ROOF/WALLS	Class 1-10,2,3,4,9c	Summer		Winter					
	Class 5,6,7,8,9a,9b	Summer						Winter	
FLOORS	Class 1-10	Summer		Winter					
	Class 2,3,4,5,6,7,8,9a,9b,9c	Summer			Winter				

Figure 6

From the BCA Climate Zone map – select your area of building and refer to the table for the summer heat flow in and the winter heat flow out according to the building class. An example is Alice Springs which in Climate Zone 3 and for the Class 10a building for Roofs/Walls the Winter Blue Zone is the correct selection. This will then enable you to work out the Total R-Value of the different elements which another table is utilised as shown in Figures 7 and 8.

Climate Zone									
Climate Zone	1	2	3	4	5	6	7	8	
		Below 300mm altitude	At or above 300mm altitude						
Minimum Total R-Value	2.7	2.7	3.0	2.7	3.5	3.2	3.7	4.3	4.8
Direction of heat flow	Downwards		Down and Upwards		Upwards				
Note: Altitude means the height above the Australian Height Datum at the location where the building is to be constructed									

For a Class 10a building with a conditioned space in climate zones 1, 2, 3, the Total R-Value specified in Table J1.3 can be reduced by R0.5, where:

Figure 7

So for the Alice Springs example your shed roof has to attain a R-value with a minimum of R2.7 in the roof structure using Figure 7 above and a wall minimum Total R-value of R1.9 as selected in Figure 8.

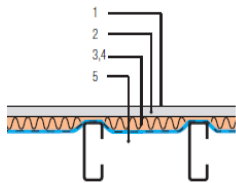
Climate Zone									
Climate Zone	1	2	3	4	5	6	7	8	
Minimum Total R-Value	R1.9	R1.9	R1.9	R2.2	R1.9	R2.2	R2.4	R3.3	

Figure 8

That is the minimums sorted for the walls and roof structure of your Class 10a shed and now another table to estimate what Total R-value you can obtain with the different insulation types listed above.

The following is from the ICANZ Insulation Handbook in relation to estimating Total R-values of R0900 – which are flat metal roof sheets with no ceilings. Even though it applies to warehouses – most shed or Class 10a structures are exactly the same system as below in Figure 9.

ROOFS **R0900 - FLAT METAL ROOF WITH NO CEILING (Warehouse)**



ICANZ System Reference R0900

Structure

Metal roof at 0 to 5° pitch, purlins may be at various centres. Reflective foil laid over safety mesh with airspace between foil and metal roof ranging from 0mm to 40mm.

Insulation Installation

Foil faced blanket insulation laid over safety mesh. Laps in foil should be 150mm, any tears or holes in the reflective foil should be repaired with foil tape. Where foil faced blanket is used, it should be allowed to recover to its nominal thickness by dishing the safety mesh. Foil side of blanket should face into the airspace below.

Tight safety mesh denotes no airspace between reflective insulation and flat metal roof. Hence no contribution from an airspace.

NOTE: Total R-Values can be increased by substituting bulk insulation products of higher Material R-Value.

R-VALUES FOR SYSTEM R0900	FOIL FACED R2.5 BLANKET ON DISHED SAFETY MESH		ANTIGLARE BUBBLE FOIL ON TIGHT SAFETY MESH (NO AIRSPACE ABOVE FOIL)		DOUBLE-SIDED ANTIGLARE FOIL ON TIGHT SAFETY MESH (NO AIRSPACE ABOVE FOIL)		ANTIGLARE BUBBLE FOIL ON 40mm DISHED SAFETY MESH		DOUBLE-SIDED ANTIGLARE FOIL ON 40mm DISHED SAFETY MESH	
	VENTILATED		VENTILATED		VENTILATED		VENTILATED		VENTILATED	
	R0966W	R0966S	R0930W	R0930S	R0920W	R0920S	R0934W	R0934S	R0924W	R0924S
No: Element Description:	WINTER	SUMMER	WINTER	SUMMER	WINTER	SUMMER	WINTER	SUMMER	WINTER	SUMMER
1 Outdoor Air Film	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040
2 Flat Metal Roof	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3 Unventilated 40mm Air Space							0.383	0.593	0.373	0.583
4 Reflective Insulation Material R-value	2.633	2.363	0.140	0.140	0.000	0.000	0.140	0.140	0.000	0.000
5 Indoor Air-Film (Reflective Surface)	0.230	0.800	0.230	0.800	0.230	0.800	0.230	0.800	0.230	0.800
Total R-Value	2.9	3.2	0.41	0.98	0.27	0.84	0.79	1.6	0.64	1.4
Total R-Value of roof and ceiling materials	0.15	0.20	0.15	0.20	0.15	0.20	0.15	0.20	0.15	0.20
Added R-Value of insulation	2.8	3.0	0.26	0.80	0.12	0.60	0.64	1.4	0.49	1.2

Figure 9

Now this table is for the roof area only and there is another table for wall systems which will be covered later. Alice Springs shed requires a minimum of R2.7 and with 5 different examples above only the first utilising Foil Faced Blanket R2.5 on safety mesh (dished) will achieve this rating. In both Winter and Summer BCA guidelines it is R2.9 and R3.2 respectively.

Regardless of the information given to customers by insulation or shed companies – these complex set of regulations will determine the exact Total R-value you will achieve on your shed. There are also many variations of each product and the values given by the manufacturer have to be substituted into Figure 9 above to recalculate the Total R-value. There are many Antiglare Bubble Foils on the market produced by nearly all the manufacturers – but unless they can guarantee that these will achieve a total R-value

required in your locality they do not perform to the level of some of the Foil Faced Blankets. With the garage or shed – often appearance of the insulation is selected over the performance and certainly the Antiglare Bubble Foils outdo the blankets in this regard.

The next area is the walls and a similar table is used in exactly the same way as the roof table in Figure 9. Below is the W1300 – Metal Cladding (no cavities) form the ICANZ Insulation Handbook shown in Figure 10.

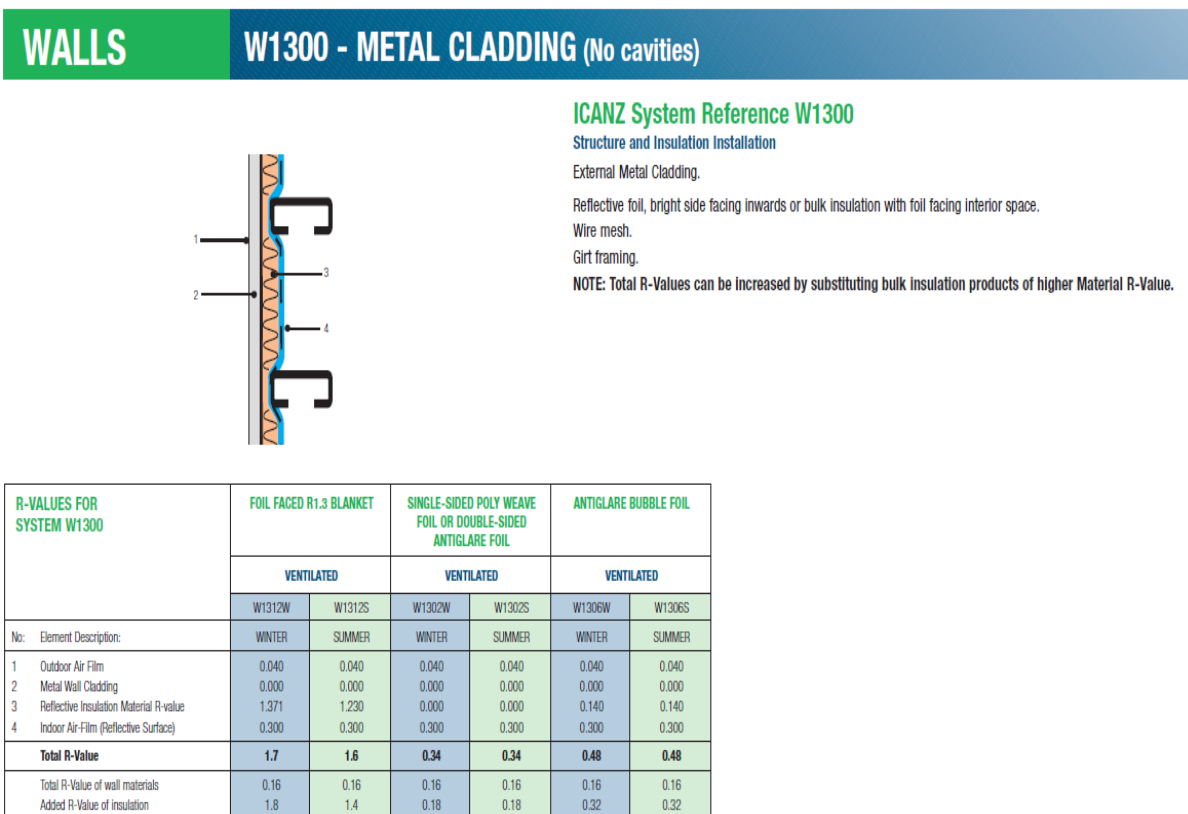


Figure 10

For Alice Springs again the wall Total R-value has to be a minimum of R1.9 so none of the above systems are suitable. What is required is an increase in the Foil Faced blanket from R1.3 to approximately R2.0 which increases the Total R-value by 0.7 in both Summer and Winter requirements.

Even with this example, it is difficult to evaluate your shed insulation – but overall it shows a method that can be utilised (if correctly) to give quite large reductions of heat build up in summer and heat loss in winter.

Overall the aim is to reduce temperature variations within the Class 10a buildings and insulation is the most cost effective method of achieving this. Insulation can reduce on average (if the correct R-Values are achieved) the heating and cooling costs by around 30% and if your Shed or garage has got Air-conditioning – then the pay-back period of insulation resulting from these reduced power costs is approximately 3-5 years. The insulation will also

last normally for the life of the building (typical 50 – 70 years) so the cost is once only. The extra bonus is the increase in property value that results from an insulated shed or garage.

Insulation Suppliers, Manufacturers and Industry Bodies

The above calculations for Total R-values are example only and the data for each brand and type of insulation should be obtained from the supplier. The industry body ICANZ have as its members – the majority of the major manufacturers and all are aware of the latest regulations. Shed design engineers will also be able to calculate Total R-values for sheds with insulation fitted.

Be prepared to question the layout of your shed with the supplier and make note of the different insulation products on offer and the setup of this insulation in the roof and walls. Below Figure 11 is a basic layout of a shed roof with some of the terms marked to aid in your selection.

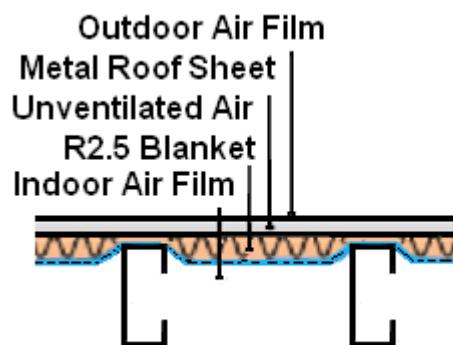


Figure 11

Conclusion

Although the BCA does not require insulation, many shed suppliers are offering this as an extra and will result in added comfort to the Class 10a building. It is recommended that stand alone Class 10a buildings have some form of R-Value requirements for reduction of urban heat build up and also for user comfort minimums.