

## **THERMAL INSULATION EVALUATION BY CALCULATION**

### **FLAT METAL ROOF, 40MM SEMIREFLECTIVE AIR GAP, ANTIGLARE RFL, SEALED 50MM AIR GAP, SEMI-REFLECTIVE 55MM SL GRADE POLYSTYRENE, 90MM REFLECTIVE AIR SPACE, PLASTERBOARD CEILING**

**Calculation: 223.26w**

Evaluation for Winter, 12.0°C ambient air temperature, 18.0°C inside air temperature.

Roof Element	m <sup>2</sup> .K/W	°C out	°C in	°C avg	Δt	Assumed Cavity Properties					Note
						e1	e2	mm	Heat Flow		
Outside air film:	0.040	<b>12.00</b>	12.07	12.04	0.07						1
Flat metal roof (0° to 3°):	0.000	12.07	12.07	12.07	0.00						3
Unventilated semireflective 40mm air space:	<b>0.425</b>	12.07	12.86	12.47	0.79	0.87	<b>0.15</b>	40	Up		5,6
Double Sided Antiglare Foil:	0.000	12.86	12.86	12.86	0.00	(bright RFL face down)					3
Sealed reflective 50mm air space:	<b>0.595</b>	12.86	13.97	13.42	1.11	<b>0.03</b>	<b>0.10</b>	50	Up		4
<b>SL Grade EPS, 55mm, with RFL:</b>	<b>1.392</b>	13.97	16.56	15.27	2.59			55			7
Unventilated reflective 90mm air space:	<b>0.605</b>	16.56	17.69	17.12	1.13	<b>0.03</b>	0.87	90	Up		4,5
10mm plasterboard ceiling:	0.059	17.69	17.80	17.74	0.11						3
Indoor air film (unreflective surface):	<u>0.110</u>	17.80	<b>18.00</b>	17.90	<u>0.20</u>						2
<b>R<sub>Ti</sub> = 3.23</b>		m <sup>2</sup> .K/W		6.00							

**Corresponding Total Conductance (k<sub>Ti</sub>): 0.31 W/(m<sup>2</sup>.K)**

**NOTES:**

Calculated 2/7/08 22:30

Ref: 223\_E.xls

**Determinations based upon AS/NZS 4859.1:2002/Amdt 1 2006, Materials for the thermal insulation of buildings**

- 1 AS/NZS 4859.1:2002/Amdt 1 2006, Clause K5(a)
- 2 AS/NZS 4859.1:2002/Amdt 1 2006, Table K1
- 3 AS/NZS 4859.1:2002/Amdt 1 2006, Clause K8.1(a). 'RFL'=Reflective Foil Laminate
- 4 Cavity air space insulation values (shown in italics) were estimated using Reflect3 software. These are iterative calculations per the USA Division of Housing Research Paper 32, applicable for roof pitch 18°-35° to ±0.05 m<sup>2</sup>.K/W. The cavity R calculation assumes an air cavity of the gap shown with uniform parallel surfaces.
- 5 The calculations incorporate the pessimistic dust assumptions of AS/NZS 4859.1:2002/Amdt 1 2006, Clauses K3.2 & K4.2 (e+0.05)
- 6 Double Sided Antiglare Foil assumed e=0.10 and 0.03
- 7 Assumes k=0.0407 W/m.K for 23°C; e=0.10 and 0.03. R adjusted 0.39%/K in line with AS/NZS 4859.1:2002/Amdt 1 2006, Clause K3.1
- 8 Indoor & outdoor air temperatures per AS/NZS 4859.1:2002/Amdt 1 2006, Clause K3.1
- 9 Thermal short-circuiting by frames is not considered here as evaluation is for the insulation path only.
- 10 This report may not be reproduced except in full. Results may not be quoted without reference to the assumptions.
- 11 Calculated by James Fricker, M.AIRAH, M.IEAust, CPEng.

**CONCLUSION:**

For the above roof having SL Grade EPS and Double Sided Antiglare Foil infrared emittances of 0.10 and 0.03, the WINTER Total R-value per AS4859.1:2002/Amdt 1 2006 Clause K3.1 is:

**R3.23 m<sup>2</sup>.K/W** for an air temperature difference of 18°-12° = 6K

Application results for various EPS grades  
(55mm, 15.3°C mean and 6K Δt)

EPS Grade	k at 23°C	EPS R	Total R	Added R value
Class L	0.0427	1.328	3.16	1.97
<b>Class SL</b>	<b>0.0407</b>	<b>1.392</b>	<b>3.23</b>	2.03
Class S	0.0394	1.438	3.27	2.08
Class M	0.0380	1.491	3.33	2.13
Class H	0.0365	1.552	3.39	2.19
Class VH	0.0349	1.622	3.46	2.26
	(W/m.K)	\	m <sup>2</sup> .K/W	/

Signed:

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