

“TOTAL R”

THERMAL PERFORMANCE CALCULATIONS

TO AS/NZS 4859.1:2002/Amdt 1 (Dec 2006)

The following calculations by James M Fricker Pty Ltd are based upon:

- a) AS/NZS 4859.1:2002/Amdt 1 (Dec 2006) “Materials for the thermal insulation of buildings. Part 1: General criteria and technical provisions”,
- b) the Australian Institute of Refrigeration Air-conditioning & Heating (AIRAH) Handbook (2007 Edition), and (if necessary) the ASHRAE Fundamentals Handbook.

R-values for parallel-faced air cavities were calculated using the Reflect-3 computer software that is based on Robinson and Powell data and research by Oakridge National Laboratory, USA. These calculations are iterative and only the converged results are shown. (Note that Reflect-3 calculations are limited to a maximum 100mm air gap. Where parallel-faced air gaps exceed 100mm, calculation is done per ISO 6946:2007 Building components and building elements — Thermal resistance and thermal transmittance — Calculation method.)

Total R-values are based on product in-service conditions in accordance with AS/NZS 4859.1:2002/Amdt 1 (Dec 2006) including the alteration of insulation material R for temperature, and derations of reflective foil emittances due to dust as noted. Where a cavity is sealed, it is assumed there is no dust and hence emittance is not derated.

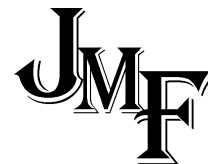
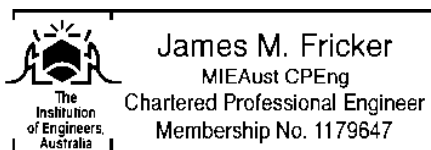
Results are reported as R_{Ti} for the **insulation path** only per the original AS/NZS 4859.1:2002 Clause 1.5.3.3 – “Total thermal resistance - A total resistance associated with a material or a system or construction of materials, specified as a Total R, including surface film resistances” to be in alignment with the BCA2009 Specification J1.3 examples.

Summary results are reported for the **Overall (Surface Average) Total R** after consideration of thermal bridging through frames, per AS/NZS 4859.1:2002/Amdt 1 2006 Clause 1.5.3.3 – “A total resistance associated with a material or a system or construction of materials, computed or measured over an area sufficient to be fully representative of the element of construction, and specified as a Total R, including surface film resistances.”

The calculations have not yet been independently verified per requirements of AS/NZS 4859.1:2002/Amdt 1.

Each calculation result is subject to any specific notes and assumptions listed on the calculation.

If a construction differs from the described system, the thermal resistance may be different.



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THERMAL INSULATION EVALUATION BY CALCULATION

R for THERMADOOR™ insulation path. (98.9%)													
section: Metal wall skin, 10mm unventilated reflective air gap, reflective foil on EPS (e=0.03), 35mm M Class Expanded Polystyrene, vinyl indoor skin													
R winter							R summer					cavity properties	
Wall section components	m².K/W	°C out	°C in	°C avg	Δt		m².K/W	°C out	°C in	°C avg	Δt	e1	e2 mm
Outdoor air film	0.040	12.00	12.16	12.08	0.16		0.040	36.00	35.66	35.83	0.34		
Metal wall skin	0.000	12.16	12.16	12.16	0.00		0.000	35.66	35.66	35.66	0.00		0
10mm unventilated reflective air gap	0.376	12.16	13.70	12.93	1.54		0.353	35.66	32.63	34.15	3.02	0.03	0.87 10
reflective foil on EPS (e=0.03)	0.000	13.70	13.70	13.70	0.00		0.000	32.63	32.63	32.63	0.00		0
35mm M Class Expanded Polystyrene	0.933	13.70	17.51	15.60	3.81		0.886	32.63	25.04	28.84	7.60		35
vinyl indoor skin	0.001	17.51	17.51	17.51	0.00		0.001	25.04	25.03	25.03	0.01		0
Indoor air film (unreflective surface)	<u>0.120</u>	17.51	18.00	17.76	0.49		<u>0.120</u>	25.03	24.00	24.51	1.03		
Total Thermal Resistance, R_{Ti} =	1.47	winter				6.00	1.40	summer				12.00	45

R for THERMADOOR™ edge path. (1.1%)													
section: Metal wall skin, 48mm unventilated unreflective air gap, vinyl indoor skin													
R winter							R summer					cavity properties	
Wall section components	m².K/W	°C out	°C in	°C avg	Δt		m².K/W	°C out	°C in	°C avg	Δt	e1	e2 mm
Outdoor air film	0.040	12.00	12.69	12.34	0.69		0.040	36.00	34.48	35.24	1.52		
Metal wall skin	0.000	12.69	12.69	12.69	0.00		0.000	34.48	34.48	34.48	0.00		0
48mm unventilated unreflective air gap	0.187	12.69	15.91	14.30	3.22		0.156	34.48	28.56	31.52	5.92	0.87	0.87 48
vinyl indoor skin	0.001	15.91	15.93	15.92	0.02		0.000	28.56	28.56	28.56	0.00		0
Indoor air film (unreflective surface)	<u>0.120</u>	15.93	18.00	16.97	2.07		<u>0.120</u>	28.56	24.00	26.28	4.56		
Total Thermal Resistance, R_{Te} =	0.35	winter				6.00	0.32	summer				12.00	48

THERMADOOR™ OVERALL R RESULT													
424w01	Overall Total Thermal Resistance, R_T =												
	1.42	winter					1.35	summer					

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

The results are believed representative at the date of calculation, however the author reserves the right to revise calculations.

35mm M Class Expanded Polystyrene assumed to have conductivity 0.0386W/m·K at 23°C

Insulation R adjusted for temperature at 0.39%/K per AS/NZS 4859.1:2002/Amdt 1, Clause K3.1

Cavity air space insulation values (shown in italics) were estimated with Reflect3 software using infrared emittances e1 & e2 and stated gap.

The calculations use the assumptions of AS/NZS 4859.1:2002/Amdt 1 including emittance degradation from dust. (Vertical surface remains dust free.)

Total R values include indoor and outdoor air films. Total Conductance (U) calculated by U=1/R

Overall Total R result for the whole door surface calculated by the parallel path method using the percentage proportions assumed and stated.

This computation is not compliant for labelling of insulation products to AS/NZS 4859.1:2002 without an endorsement from a recognised laboratory per Section 4.3 of the standard.

This report may not be reproduced except in full. Results may not be quoted without reference to the assumptions.

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Signed:

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THERMAL INSULATION EVALUATION BY CALCULATION

R for THERMADOOR™ insulation path. (98.9%)														
section: Metal wall skin, 10mm unventilated reflective air gap, reflective foil on EPS (e=0.03), 30mm M Class Exanded Polystyrene, vinyl indoor skin														
R winter						R summer					cavity properties			
Wall section components	m².K/W	°C out	°C in	°C avg	Δt	m².K/W	°C out	°C in	°C avg	Δt	e1	e2	mm	
Outdoor air film	0.040	12.00	12.18	12.09	0.18	0.040	36.00	35.62	35.81	0.38				
Metal wall skin	0.000	12.18	12.18	12.18	0.00	0.000	35.62	35.62	35.62	0.00			0	
10mm unventilated reflective air gap	0.376	12.18	13.87	13.02	1.69	0.353	35.62	32.30	33.96	3.32	0.03	0.87	10	
reflective foil on EPS (e=0.03)	0.000	13.87	13.87	13.87	0.00	0.000	32.30	32.30	32.30	0.00			0	
30mm M Class Exanded Polystyrene	0.799	13.87	17.46	15.66	3.59	0.760	32.30	25.14	28.72	7.16			30	
vinyl indoor skin	0.001	17.46	17.46	17.46	0.00	0.001	25.14	25.13	25.14	0.01			0	
Indoor air film (unreflective surface)	0.120	17.46	18.00	17.73	0.54	0.120	25.13	24.00	24.57	1.13				
Total Thermal Resistance, R _{Ti} =	1.34	winter	6.00			1.27	summer	12.00			40			

R for THERMADOOR™ edge path. (1.1%)														
section: Metal wall skin, 43mm unventilated unreflective air gap, vinyl indoor skin														
R winter						R summer					cavity properties			
Wall section components		m².K/W	°C out	°C in	°C avg	Δt	m².K/W	°C out	°C in	°C avg	Δt	e1	e2	mm
Outdoor air film		0.040	12.00	12.69	12.34	0.69	0.040	36.00	34.48	35.24	1.52			
Metal wall skin		0.000	12.69	12.69	12.69	0.00	0.000	34.48	34.48	34.48	0.00			0
43mm unventilated unreflective air gap		0.188	12.69	15.92	14.30	3.23	0.157	34.48	28.55	31.52	5.93	0.87	0.87	43
vinyl indoor skin		0.001	15.92	15.94	15.93	0.02	0.000	28.55	28.55	28.55	0.00			0
Indoor air film (unreflective surface)		0.120	15.94	18.00	16.97	2.06	0.120	28.55	24.00	26.27	4.55			
Total Thermal Resistance, R _{Te} =		0.35	winter			6.00	0.32	summer			12.00			43

THERMADOOR™ OVERALL R RESULT														
424w011 Overall Total Thermal Resistance, R_T =	1.30	winter				1.23	summer							

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

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30mm M Class Expanded Polystyrene assumed to have conductivity 0.0386W/m·K at 23°C

Insulation R adjusted for temperature at 0.39%/K per AS/NZS 4859.1:2002/Amdt 1, Clause K3.1

Cavity air space insulation values (shown in italics) were estimated with Reflect3 software using infrared emittances e1 & e2 and stated gap.

The calculations use the assumptions of AS/NZS 4859.1:2002/Amdt 1 including emittance degradation from dust. (Vertical surface remains dust free.)

Total R values include indoor and outdoor air films. Total Conductance (U) calculated by U=1/R

Overall Total R result for the whole door surface calculated by the parallel path method using the percentage proportions assumed and stated.

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