

“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.

Results reported are 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.

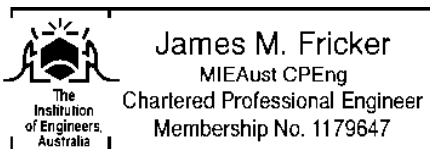
R-values for parallel-faced air cavities were calculated using the Reflect-3 computer software that is based on Robinson and Powell data and research by Oakridge National Laboratory, USA. These calculations are iterative and only the converged results are shown. (Note that Reflect-3 calculations are limited to a maximum 100mm air gap.)

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.

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.



JAMES M FRICKER PTY LTD
54 Felix Crescent
Ringwood North VIC 3134
Mobile: 0414 804 097
Phone: (03) 9879 5744
Fax: (03) 8678 1227
fricker@optusnet.com.au
<http://fricker.net.au>

JMF
Calc.

RITEK XL™ WALLS - SUMMARY

128.02

RITEK XL™ WALL (BARE) COMPRISING 6MM FIBRE CEMENT, CONCRETE, 6MM FIBRE CEMENT				
Panel	Panel total thickness, mm	Concrete thickness, mm	Total R, winter	Total R, summer
115XL	115	103	0.28	0.28
135XL	135	123	0.29	0.29
150XL	150	138	0.30	0.30
165XL	165	153	0.31	0.31
200XL	200	188	0.34	0.34
265XL	265	253	0.38	0.38

128.03

RITEK XL™ WALL WITH 50MM H GRADE EPS, 8MM RENDER, 2MM TEXTURE COAT				
Panel	Panel total thickness, mm	Concrete thickness, mm	Total R, winter	Total R, summer
115XL	175	103	1.70	1.62
135XL	195	123	1.71	1.63
150XL	210	138	1.72	1.64
165XL	225	153	1.73	1.65
200XL	260	188	1.76	1.67
265XL	325	253	1.80	1.72

128.04

RITEK XL™ WALL WITH 50MM 32KG/M³ XPS, 8MM RENDER, 2MM TEXTURE COAT				
Panel	Panel total thickness, mm	Concrete thickness, mm	Total R, winter	Total R, summer
115XL	175	103	2.16	2.05
135XL	195	123	2.18	2.07
150XL	210	138	2.19	2.08
165XL	225	153	2.20	2.09
200XL	260	188	2.22	2.11
265XL	325	253	2.27	2.16

128.05

RITEK XL™ WALL WITH 15MM FOILBOARD™, 28MM REFLECTIVE CAVITY, 10MM PLASTERBOARD				
Panel	Panel total thickness, mm	Concrete thickness, mm	Total R, winter	Total R, summer
115XL	168	103	1.60	1.44
135XL	188	123	1.62	1.45
150XL	203	138	1.63	1.46
165XL	218	153	1.64	1.47
200XL	253	188	1.66	1.50
265XL	318	253	1.71	1.54

NOTES: The above shows Total R determinations based upon AS/NZS 4859.1:2002/Amdt 1 2006, Materials for the thermal insulation of buildings. The insulation total thermal resistance is calculated for the Australian air temperature differences (winter: 18°-12°C = 6K, summer: 36°-24°C = 12K) per AS/NZS 4859.1:2002/Amdt 1 2006.

THERMAL INSULATION EVALUATION BY CALCULATION

**RITEK 115XL™ WALL (BARE) COMPRISING
6MM FIBRE CEMENT, 103MM CONCRETE, 6MM FIBRE CEMENT**

Calculation: 128.02

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

Wall Element	m ² .K/W	°C out	°C in	°C avg	Δt	mm	Note
Outside air film:	0.040	12.00	12.86	12.43	0.86		1
6mm fibre cement:	0.024	12.86	13.37	13.12	0.52	6	3
103mm 25MPa Concrete:	0.072	13.37	14.91	14.14	1.54	103	3
6mm fibre cement:	0.024	14.91	15.42	15.17	0.52	6	3
Indoor air film (unreflective surface):	<u>0.120</u>	15.42	18.00	16.71	<u>2.58</u>		2
Total Thermal Resistance, R_{Ti} =	<u>0.28</u>	m ² .K/W		6.00		115	

Corresponding Total Conductance (U_{Ti}): 3.58 W/(m².K)

NOTES:

Calculated 22/3/11 13:04

Ref: 128_E.xls

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

- AS/NZS 4859.1:2002/Amdt 1 2006, Clause K5(a)
- AS/NZS 4859.1:2002/Amdt 1 2006, Clause K5(b)
- 2007 AIRAH Technical Handbook pages 164-177
- Indoor & outdoor air temperatures per AS/NZS 4859.1:2002/Amdt 1 2006, Clause K3.1
- Thermal short-circuiting by frames is not considered here as evaluation is for the insulation path only.
- This report may not be reproduced except in full. Results may not be quoted without reference to the assumptions.
- This computation is not compliant for labelling of insulation products to AS/NZS 4859.1:2002 without an independent endorsement from a recognised laboratory per Section 4.3 of the standard.
- Calculated by James Fricker, M.AIRAH, M.IEAust, CPEng.

CONCLUSION:

For the above Ritek XL bare wall arrangement, the WINTER Total R-value per AS4859.1:2002/Amdt 1 2006, Clause K3.1 is:

R0.28 m².K/W for an air temperature difference of 18°-12° = 6K

Similarly, the SUMMER Total R-value per AS/NZS 4859.1:2002/Amdt 1 2006, Clause K3.1 is:

R0.28 m².K/W for an air temperature difference of 36°-24° = 12K

Signed:



	James M. Fricker
	MIEAust CPEng Chartered Professional Engineer Membership No. 1179647

Similarly calculated, the results for other wall thicknesses are:

RITEK XL WALL SYSTEM (BARE)				
Ritek panel type	Panel total thickness, mm	Concrete thickness, mm	Total R, winter	Total R, summer
115XL	115	103	0.28	0.28
135XL	135	123	0.29	0.29
150XL	150	138	0.30	0.30
165XL	165	153	0.31	0.31
200XL	200	188	0.34	0.34
265XL	265	253	0.38	0.38

THERMAL INSULATION EVALUATION BY CALCULATION

**RITEK 115XL™ WALL WITH
50MM H GRADE EPS, 8MM RENDER, 2MM TEXTURE COAT**

Calculation: 128.03

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

Wall Element	m ² .K/W	°C out	°C in	°C avg	Δt	mm	Note
Outside air film:	0.040	12.00	12.14	12.07	0.14		1
2mm Texture Coat:	0.005	12.14	12.16	12.15	0.02	2	3
8mm Render:	0.020	12.16	12.23	12.19	0.07	8	3
50mm H Grade EPS:	1.395	12.23	17.15	14.69	4.92	50	4
6mm fibre cement:	0.024	17.15	17.24	17.20	0.08	6	3
103mm 25MPa Concrete:	0.072	17.24	17.49	17.37	0.25	103	3
6mm fibre cement:	0.024	17.49	17.58	17.53	0.08	6	3
Indoor air film (unreflective surface):	<u>0.120</u>	17.58	18.00	17.79	<u>0.42</u>		2
Total Thermal Resistance, R_{Ti} =	<u>1.70</u>	m ² .K/W		6.00		175	

Corresponding Total Conductance (U_{Ti}): 0.59 W/(m².K)

NOTES:

Calculated 22/3/11 13:04

Ref: 128_E.xls

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

- AS/NZS 4859.1:2002/Amdt 1 2006, Clause K5(a)
- AS/NZS 4859.1:2002/Amdt 1 2006, Clause K5(b)
- 2007 AIRAH Technical Handbook pages 164-177
- H Grade expanded polystyrene, k=0.037W/m.K @ 23°C.
R adjusted 0.39%/K in line with AS/NZS 4859.1:2002/Amdt 1 2006, Clause K3.1
- Indoor & outdoor air temperatures per AS/NZS 4859.1:2002/Amdt 1 2006, Clause K3.1
- Thermal short-circuiting by frames is not considered here as evaluation is for the insulation path only.
- This report may not be reproduced except in full. Results may not be quoted without reference to the assumptions.
- This computation is not compliant for labelling of insulation products to AS/NZS 4859.1:2002 without an independent endorsement from a recognised laboratory per Section 4.3 of the standard.
- Calculated by James Fricker, M.AIRAH, M.IEAust, CPEng.

CONCLUSION:

For the above Ritek XL wall with 50mm H Grade EPS and render, the WINTER Total R-value per AS4859.1:2002/Amdt 1 2006, Clause K3.1 is:

R1.70 m².K/W for an air temperature difference of 18°-12° = 6K

Similarly, the SUMMER Total R-value per AS/NZS 4859.1:2002/Amdt 1 2006, Clause K3.1 is:

R1.62 m².K/W for an air temperature difference of 36°-24° = 12K

Signed:

James Fricker



Similarly calculated, the results for other wall thicknesses are:

RITEK XL WALL SYSTEM WITH 50MM H GRADE EPS & RENDER				
Ritek panel type	Panel total thickness, mm	Concrete thickness, mm	Total R, winter	Total R, summer
115XL	175	103	1.70	1.62
135XL	195	123	1.71	1.63
150XL	210	138	1.72	1.64
165XL	225	153	1.73	1.65
200XL	260	188	1.76	1.67
265XL	325	253	1.80	1.72

THERMAL INSULATION EVALUATION BY CALCULATION

**RITEK 115XL™ WALL WITH
50MM 32KG/M³ XPS, 8MM RENDER, 2MM TEXTURE COAT**

Calculation: 128.04

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

Wall Element	m².K/W	°C out	°C in	°C avg	Δt	mm	Note
Outside air film:	0.040	12.00	12.11	12.06	0.11		1
2mm Texture Coat:	0.005	12.11	12.12	12.12	0.01	2	3
8mm Render:	0.020	12.12	12.18	12.15	0.06	8	3
50mm 32kg/m³ extruded polystyrene:	1.857	12.18	17.34	14.76	5.15	50	4
6mm fibre cement:	0.024	17.34	17.40	17.37	0.07	6	3
103mm 25MPa Concrete:	0.072	17.40	17.60	17.50	0.20	103	3
6mm fibre cement:	0.024	17.60	17.67	17.63	0.07	6	3
Indoor air film (unreflective surface):	<u>0.120</u>	17.67	18.00	17.83	<u>0.33</u>		2
Total Thermal Resistance, R_{Ti} =	<u>2.16</u>	m².K/W		6.00		175	

Corresponding Total Conductance (U_{Ti}): 0.46 W/(m².K)

NOTES:

Calculated 22/3/11 13:04

Ref: 128_E.xls

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

- AS/NZS 4859.1:2002/Amdt 1 2006, Clause K5(a)
- AS/NZS 4859.1:2002/Amdt 1 2006, Clause K5(b)
- 2007 AIRAH Technical Handbook pages 164-177
- 32kg/m³ extruded polystyrene (XPS), k=0.028 W/m.K @ 23°C (per 2007 AIRAH Technical Handbook)
R adjusted 0.39%/K in line with AS/NZS 4859.1:2002/Amdt 1 2006, Clause K3.1 (polystyrene)
- Indoor & outdoor air temperatures per AS/NZS 4859.1:2002/Amdt 1 2006, Clause K3.1
- Thermal short-circuiting by frames is not considered here as evaluation is for the insulation path only.
- This report may not be reproduced except in full. Results may not be quoted without reference to the assumptions.
- This computation is not compliant for labelling of insulation products to AS/NZS 4859.1:2002 without an independent endorsement from a recognised laboratory per Section 4.3 of the standard.
- Calculated by James Fricker, M.AIRAH, M.IEAust, CPEng.

CONCLUSION:

For the above Ritek XL wall with 50mm 32kg/m³ extruded polystyrene and render, the WINTER Total R-value per AS4859.1:2002/Amdt 1 2006, Clause K3.1 is:

R2.16 m².K/W for an air temperature difference of 18°-12° = 6K

Similarly, the SUMMER Total R-value per AS/NZS 4859.1:2002/Amdt 1 2006, Clause K3.1 is:

R2.05 m².K/W for an air temperature difference of 36°-24° = 12K

Signed:

James Fricker



Similarly calculated, the results for other wall thicknesses are:

RITEK XL WALL SYSTEM WITH 50MM 32KG/M³ XPS & RENDER				
Ritek panel type	Panel total thickness, mm	Concrete thickness, mm	Total R, winter	Total R, summer
115XL	175	103	2.16	2.05
135XL	195	123	2.18	2.07
150XL	210	138	2.19	2.08
165XL	225	153	2.20	2.09
200XL	260	188	2.22	2.11
265XL	325	253	2.27	2.16

THERMAL INSULATION EVALUATION BY CALCULATION

RITEK 115XL™ WALL WITH 15MM FOILBOARD™, 28MM REFLECTIVE CAVITY, 10MM PLASTERBOARD

Calculation: 128.05

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

Wall Element	m ² .K/W	°C out	°C in	°C avg	Δt	Assumed Cavity Properties			Heat Flow	Note
						e1	e2	mm		
Outside air film:	0.040	12.00	12.15	12.07	0.15					1
6mm fibre cement:	0.024	12.15	12.24	12.19	0.09			6		3
103mm 25MPa Concrete:	0.072	12.24	12.51	12.37	0.27			103		3
6mm fibre cement:	0.024	12.51	12.60	12.55	0.09			6		3
15mm Foilboard™:	0.459	12.60	14.32	13.46	1.72			15		5
Unventilated 28mm reflective airspace:	0.804	14.32	17.33	15.82	3.01	0.03	0.87	28	Wall	4
10mm plasterboard:	0.059	17.33	17.55	17.44	0.22			10		3
Indoor air film (unreflective surface):	0.120	17.55	18.00	17.78	0.45					2
Total Thermal Resistance, R_{Ti} =	1.60	m ² .K/W			6.00			168		

Corresponding Total Conductance (U_{Ti}): 0.62 W/(m².K)

NOTES:

Calculated 22/3/11 13:04

Ref: 128_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, Clause K5(b)
- 3 2007 AIRAH Technical Handbook pages 164-177
- 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. The cavity R calculation assumes an air cavity of the gap shown with uniform parallel surfaces. The calculations incorporate the dust assumptions of AS/NZS 4859.1:2002/Amdt 1 2006, Clauses K3.2 & K4.2
- 5 FOILBOARD 15mm foil based SL Grade polystyrene (R&D Services tested k=0.0339 W/m.K @ 23°C). R adjusted 0.39%/K in line with AS/NZS 4859.1:2002/Amdt 1 2006, Clause K3.1 (polystyrene)
- 5 Indoor & outdoor air temperatures per AS/NZS 4859.1:2002/Amdt 1 2006, Clause K3.1
- 6 Thermal short-circuiting by frames is not considered here as evaluation is for the insulation path only.
- 7 This report may not be reproduced except in full. Results may not be quoted without reference to the assumptions.
- 8 This computation is not compliant for labelling of insulation products to AS/NZS 4859.1:2002 without an independent endorsement from a recognised laboratory per Section 4.3 of the standard.
- 9 Calculated by James Fricker, M.AIRAH, M.IEAust, CPEng.

CONCLUSION:

For the above Ritek XL wall with 15mm Foilboard™, 28mm reflective airspace and plasterboard, the WINTER Total R-value per AS4859.1:2002/Amdt 1 2006, Clause K3.1 is:

R1.60 m².K/W for an air temperature difference of 18°-12° = 6K

Similarly, the SUMMER Total R-value per AS/NZS 4859.1:2002/Amdt 1 2006, Clause K3.1 is:

R1.44 m².K/W for an air temperature difference of 36°-24° = 12K

Signed:



	<p>James M. Fricker MIEAust CPEng Chartered Professional Engineer Membership No. 1179647</p>
--	---

Similarly calculated, the results for other wall thicknesses are:

RITEK XL WALL WITH 15MM FOILBOARD, 28MM AIRSPACE & PLASTERBOARD				
Ritek panel type	Panel total thickness, mm	Concrete thickness, mm	Total R, winter	Total R, summer
115XL	168	103	1.60	1.44
135XL	188	123	1.62	1.45
150XL	203	138	1.63	1.46
165XL	218	153	1.64	1.47
200XL	253	188	1.66	1.50
265XL	318	253	1.71	1.54