AFIA

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HIGH REFLECTION

ALUMINIUM FOIL INSULATION ASSOCIATION INC.

SURVEY REPORT

Installation Survey and Thermal Testing of Continuous Roll Form Foil Backed Fibreglass Building Blanket Insulation

Publication Date: 22 August 2008

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Cheltenhamm VIC 3192

Introduction

This project was an initiation of the Aluminium Foil Insulation Association (AFIA) for the purposes of requesting a formal review of AS/NZS4859.1 *"Materials for the Thermal Insulation of Buildings"* and it's Amendment 1 by BD-058 Committee for Standards Australia. The aim of the review is to seek the full revision of the standard and its amendment to ensure they incorporate appropriate changes and accountabilities for in-situ compression and thermal bridging factors of foil faced glass wool building blanket insulation within declared and promoted Total R-value calculations that state compliance to the above Australian standard amongst other things.

Project Summary

This project also follows on from the AFIA "***Report on Amendment No. 1 to AS/NZS 4859.1-2002 As Developed by Standards Australia Primarily as a Result of Requests by Australian Greenhouse Office & Australian Building Codes Board***" published in March 2007. Extracts of that report are included within this text.

AS/NZS 4859.1 is a joint initiative of Standards Australia and Standards New Zealand and was prepared by Joint Technical Committee BD-058, Thermal Performance and Insulation of Dwellings. The Standard was first published on 15 October 2002.

AS/NZS 4859.1 now contains an amendment which incorporates three new Appendices. The critical appendices are K and L. The Amendment 1 was published on 28 December 2006. The Appendix K contained within Amendment 1 was requested to be developed by the Australian Greenhouse Office and the Australian Building Codes Board as a joint initiative in late 2004.

The content and correctness of Appendix K contained within Amendment 1 remains in a situation of serious and unresolved dispute with AFIA where the Association has continuously pleaded for appropriate accountabilities for all insulation products to be included within the appendices assumptions. Appendix L is a result of post Public Comment development of Appendix-K which has never received any public comment hearing itself while Appendix M is a bibliography only.

In addressing the matters within this report the AFIA states that its membership fully supports the principle of an Australian Standard for insulation whether it is developed under a joint Australian New Zealand initiative or not. We fully support also the principle that such a standard should take into account, with equal emphasis, all environmental factors which affect the ***in-situ and in-service*** performance of all insulation materials over the life-time of the building.

These principal factors, which are currently crafted into Clause 2.3.3.2 of AS/NZS 4859.1:2002, and which are partly within Appendix K, sadly do not reflect or form part of the materials testing regimes prescribed in other sections of the Standard nor are they adequately cross referenced.

The issue being raised is, that regardless of whether an "insulation product" is tested for thermal performance or "calculated" for in-service thermal performance within a computation, it ultimately is sold to the consumer for in-service use and therefore, its declared thermal resistance must reflect and take into account the above fundamentals of Clause 2.3.3.2 and the full intentions of Appendix K.

As` part of the AFIA objections to the current published Appendix-K we felt the appendix and its assumptions never took into account with full fairness the compression and thermal bridging issues encountered when foil backed building blanket insulation is installed in either housing or commercial roofing systems.

We have also long felt that the issues of thermal bridging have long been left un-clarified. Appendix-K, K2 (Calculation Methods) contains only an "e.g." for thermal bridging to be taken into account in Total R-value calculation while the example calculations in Appendix-L take into account thermal bridging.

The BCA however, which calls up AS/NZS4859.1 and Amendment: 1 is diverse in its approach to these issues. In its example calculations and explanatory notes it covers thermal bridging but not compression, e.g., Note: BCA Vol: 2, Part 3.12.1.2, page 508, "Explanatory Information" amongst others. We note in item 4 of the above Note that compressed bulk insulation is considered as providing a thermal break performance of R-0.2 so long as it is not less than 20mm thick, (we assume at the bridging point). The provision does not take into account that when installed the roof sheeting cannot be left floating at 20mm. Nominal thickness would actually be around 2mm to 5mm thick at the screw point.

Our argument is that there is no requirement for that material to be tested to determine its adequacy and performance in either Appendix-K or the BCA while other proprietary products would be required to test for performance. This in itself may be seen as commercial bias and a Trade Practices Act issue given the results from this survey report.

As a result of all the above AFIA in November 2007 sought to have the introduction of Appendix-K into the May 2008 BCA Energy Efficiency Provision (EEP) Amendments deferred for twelve months while it undertook its project to prove to both Standards Australia and the Australian Building Codes Board that it could provide scientific research to support its call for the ABCB to reject Amendment 1 and Appendix-K until Standards Australia could engage in delivering a standard that was scientifically correct.

The deferral request was not granted but a notation within Vol: 1, Page 53, under Table 1, "Schedule of Referenced Documents" within the publication brought relief to members who would otherwise be compelled to considerable expense in having all their calculations remodeled rendering in some circumstances an unfair advantage within the market place for fair trading under the Trade Practices Act. The note states; *"Test and calculation reports for demonstrating compliance with AS/NZS4859.1 carried out prior to the introduction of Amendment 1 remain valid"*.

AFIA confirms it has received written advice stating the note will be withdrawn in the May 2009 BCA publication. Our aim is to have this note either remain in force or have Amendment 1 withdrawn pending the review of AS/NZS4859.1 its amendment and the full integration of Amendment 1 into the Standard.

AFIA has now presented this report to both Standards Australia and the Australian Building Codes Board for consideration and response.

<u>This Study is in Two Parts</u>

1. A study of the typical installed thickness of fiberglass blanket in commercial roofs

2. A study of the actual thermal performance of typical commercial roofs installed with fiberglass blankets at a thickness determined in part 1.

University of South Australia

PROJECT REPORT:

Thermal Testing of Continuous Roll Form foil back fibreglass building blanket insulation

Quality Endorsed Company

ISO 9001
QEC6382

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Report AFIA 12082008 v2.pdf

Important Notice

Report Disclaimer

This report is confidential and was prepared exclusively for the client named above. It is not intended for, nor do we accept any responsibility for its use by any third party.

SUMMARY

The steady-state R-values of Continuous Roll form foil back fibreglass building blanket insulation as installed in commercial roofing systems was measured. The specific commercial roof arrangement tested was flat metal roof with no ceiling, as shown in Figure A.

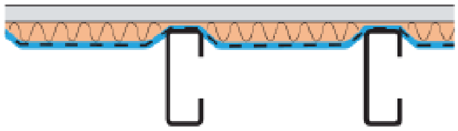


Figure A. Flat metal roof with no ceiling with continuous roll form foil blanket.

The thermal resistance was measured using the 50mm, 75mm & 100mm thick foil blanket product (Vapa-Chek™). The measurement was conducted by applying a known heat source above the roof and measuring the surface temperatures above and below the roof. The table below shows the measured results and compares them to the certified results of the blanket foil. Overall, the measured R values in-situ are considerably lower than the certified R values. An estimation of the R value at the thermal bridge was conducted. It was shown that the R value at this location is 30 – 37% lower than the measured surface to surface total R value.

Table A. Surface to Surface R value of blanket (m^2K/W)

Material	Certified R value of Blanket	Measured R value of Blanket in-situ	% Reduction of R value
100 mm Blanket foil	2.4*	0.95	60%
75 mm Blanket foil	1.8	0.74	59%
50 mm Blanket foil	1.3	0.77	41%

The tables below show the R values of the entire roof arrangement including the thermal resistance of the air film and radiation effect. The values shown are based on the certified and measured R values for the blanket foil. Again, applying the measured R values in-situ, the R value of the entire roof is significantly lower than the calculated R values.

Table 2. R value for flat metal roof with no ceiling for winter condition (m^2K/W)

Material	Calculated R value based on certified R value of blanket	Calculated R value based on measured R value of blanket in-situ.	% Reduction of total R value
100 mm Blanket	2.7*	1.2	56%
75 mm Blanket	2.1	1.0	52%
50 mm Blanket	1.6	1.0	38%

Table 3. R value for flat metal roof with no ceiling for summer condition (m^2K/W)

Material	Calculated R value based on certified R value of blanket	Calculated R value based on measured R value of blanket in-situ.	% Reduction of total R value
100 mm Blanket	3.2*	1.8	44%
75 mm Blanket	2.6	1.6	38%
50 mm Blanket	2.1	1.6	24%

*Blanket R value is unspecified and has been calculated based on the thermal conductivity determined from the specified R values of the 75 and 50 mm blankets as provided by the certificate of compliance from the manufacturer

TABLE OF CONTENTS

AIM

The aim of the project was to measure steady-state R-values of Continuous Roll form foil back fibreglass building blanket insulation as installed in commercial roofing systems. The specific application is for flat metal roof with no ceiling, as shown in Figure 1.

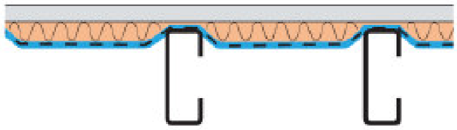


Figure 1. Flat metal roof with no ceiling with continuous roll form foil blanket.

The thermal resistance was measured using the 50mm, 75mm & 100mm thick blanket product at the typical installed conditions, as specified by the client.

EXPERIMENTAL PROCEDURE

A commercial roofing structure was built consisting of 2 C channels (150 x 65 mm) with an overall area of 2.9 m x 2.7 m. The insulation (Vapa-Chek™) was placed on top of a 150 x 200 mm surface wire mesh and the Spandek™ roofing sheet was screwed to the C channels at every flute using standard roofing screws. The structure was installed within the Balanced Ambient Calorimeter Room at the University of SA (Figures 2 and 3.). The roof was installed in the cold room (Room 2), which was conditioned to the cold condition of 16 °C. The section above the roof was conditioned to the hot condition of 40 °C. This arrangement enables heat to flow down through the roof.

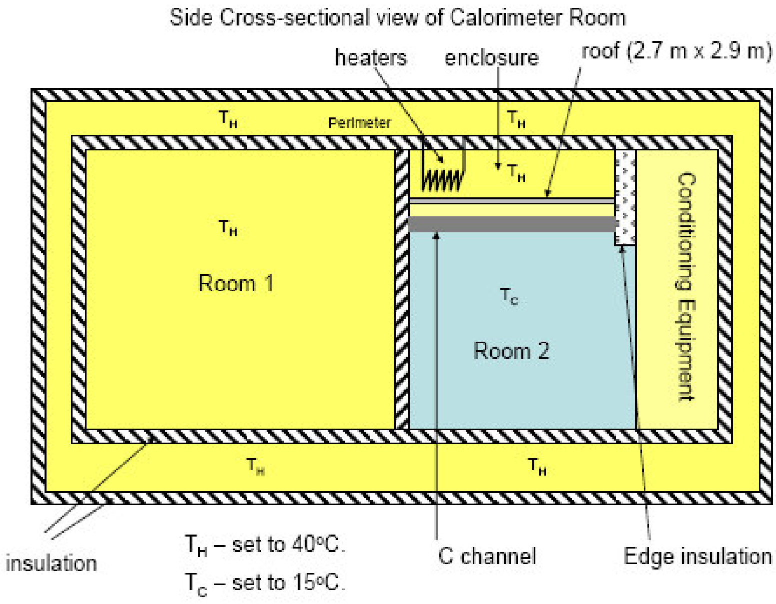
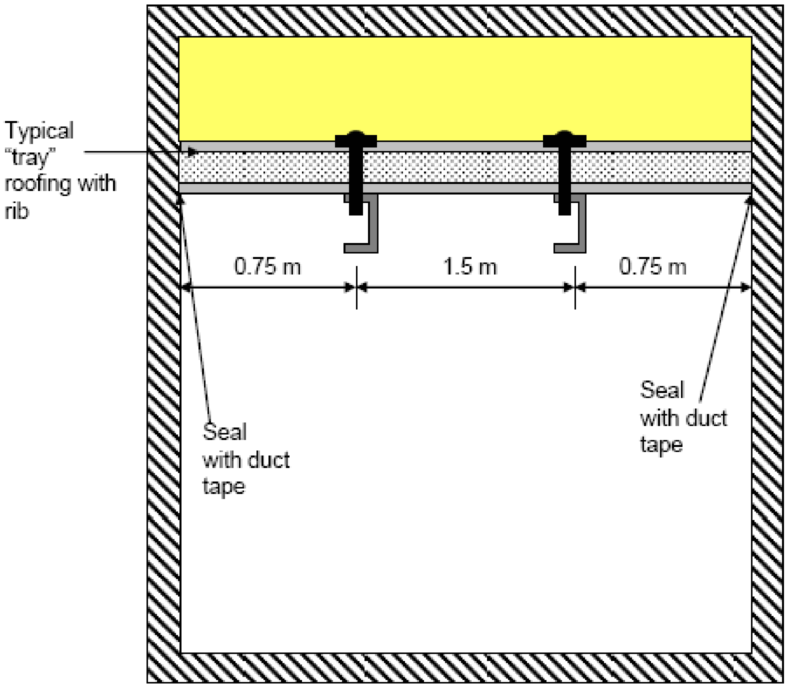


Figure 2. Arrangement of roof within Balanced Calorimeter Room (side view).



Note: Conditioning equipment is at the back in this view

Figure 3. Details of arrangement of roof in Balanced Calorimeter Room (end view).

To prevent edge losses all except one edge of the roof was set against the insulation of the room. The opposite face of this insulation is exposed to Room 1 and the perimeter, both of which were maintained at 40 °C preventing heat flow. One edge of the roof was exposed to the conditions in Room 2. Edge insulation rated at R 7 was used at this side of the roof (Figures 2 and 7). It was calculated that the maximum heat flow across this edge was less than +/-1.5% of the total heat flow, representing a negligible effect on the result.

To support the roofing structure a lifting mechanism was built which would raise or lower the roof from below (Figure 7). To measure the R value of the roof, the top and bottom surface temperature was measured with a number of thermocouples as shown in Figures 4 to 7. The section above the roof was conditioned with electric heaters (Figures 8 and 9). The energy used by these heaters was measured, enabling the surface to surface R value of the roof to be determined. The average surface temperatures were based on the area adjusted average of the surface temperatures.

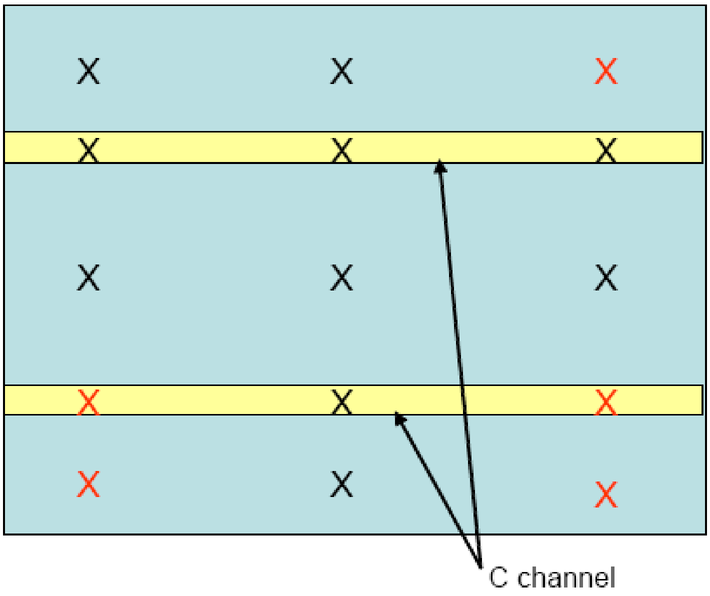


Figure 4. Location of thermocouples on top and bottom surface of roof (plan view). Locations marked in red are calculated measurements.

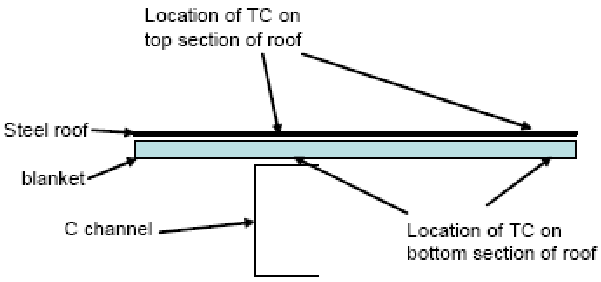


Figure 5. Location of thermocouples (side view).

The temperature of some locations was calculated based on the nearby temperature distribution. This resulted in an error in the measured R value of +/-2% for the 100 mm blanket test and less than +/-0.5% error in the other tests. Overall, the error of the tests was less than +/- 4%.

Figure 6. View from below of roof, as installed for test, showing blanket foil with thermocouples attached.

Figure 7. View from below of roof as installed for test. The lifting mechanism as well as the edge insulation rated to R7 is shown.

Figure 8. View from above roof, just after it has been lowered, showing heaters.

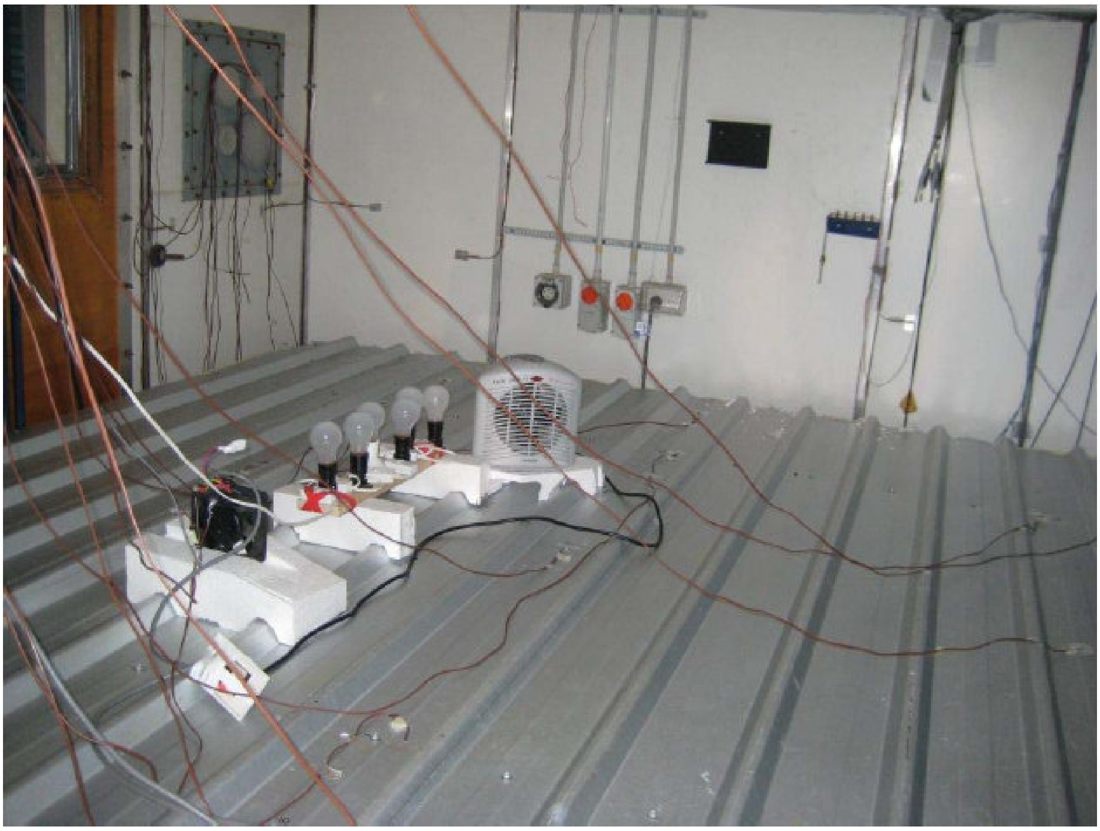


Figure 9. View of roof from above once fully lowered, showing thermocouples.

RESULTS

Measured thickness of blanket at midpoint between C channels was 50 mm for all 3 tests.

100 mm Blanket Test

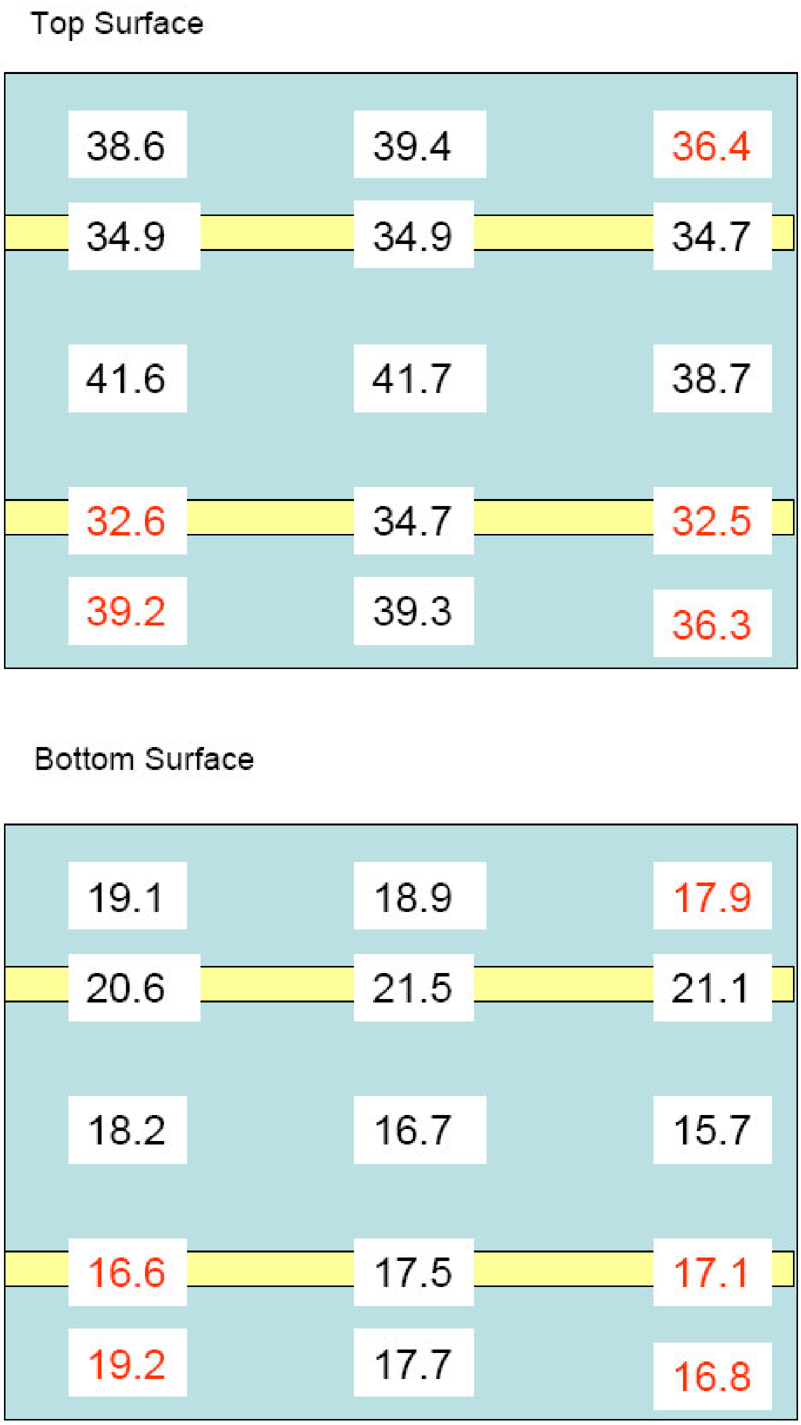


Figure 10. Temperatures of locations on the top and bottom surface of roof. Temperatures in red are calculated.

Measured heat rate was 182 W. Air temperature above and below the roof were 39.8 and 14.3 °C respectively.

Measured R value: 0.95 Km^2/W +/- 4%

75 mm Blanket Test

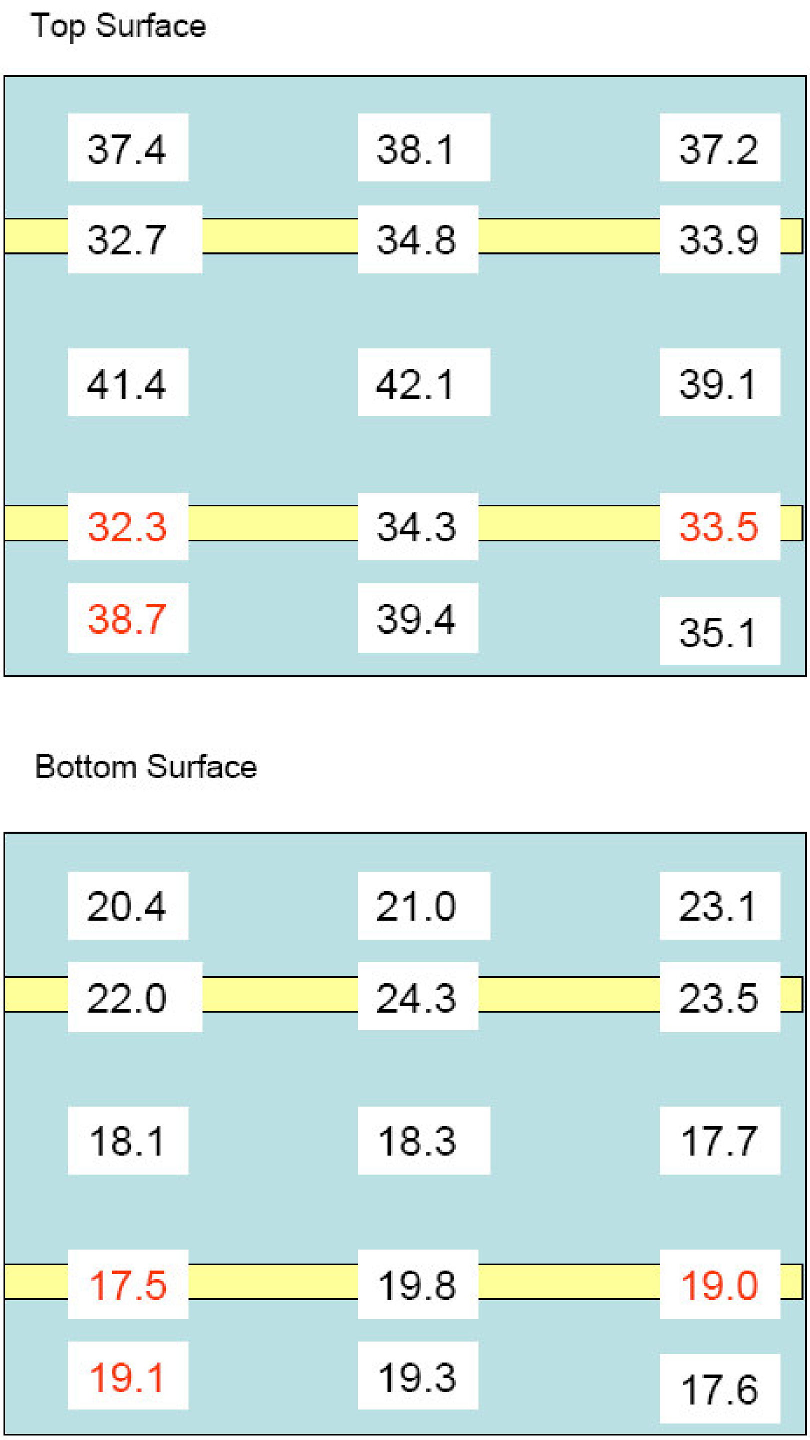


Figure 11. Temperatures of locations on the top and bottom surface of roof. Temperatures in red are calculated.

Measured heat rate was 217 W. Air temperature above and below the roof were 40.0 and 15.2 ^{o}C respectively.

Measured R value: 0.74 Km^2/W +/- 2%

50 mm Blanket Test

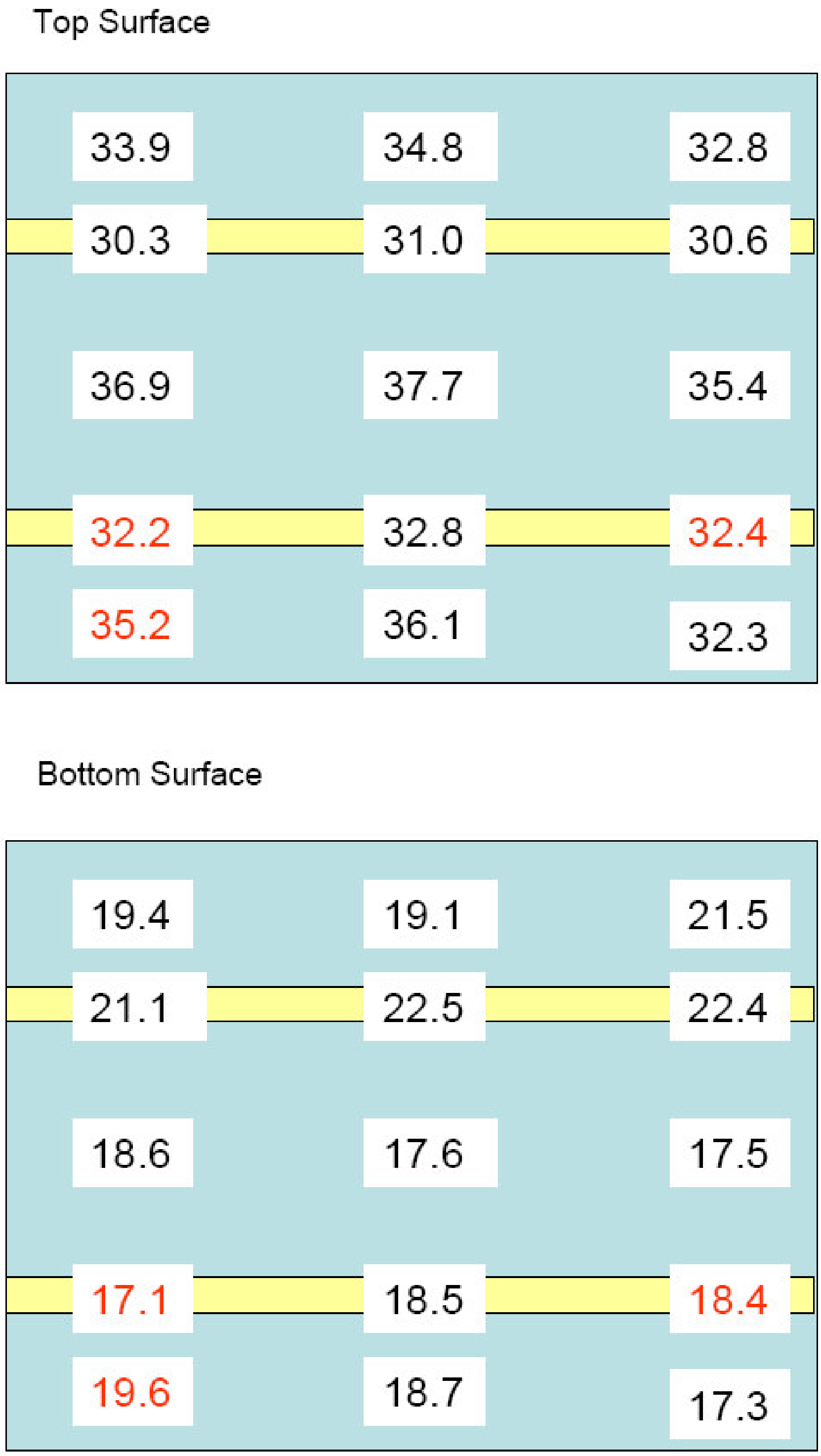


Figure 12. Temperatures of locations on the top and bottom surface of roof. Temperatures in red are calculated.

Measured heat rate was 173 W. Air temperature above and below the roof were 40 and 14.7 °C respectively.

Measured R value: 0.77 Km^2/W +/- 2%

THERMAL RESISTANCE ANALYSIS

Table 1 shows the measured and rated R values of the blankets. The variation is considerable with the rating reducing by 41% to 60%. This results highlights the impact of compression of the blanket as well as the thermal bridging at the C channel. The tests show that the 100 mm blanket provides the highest thermal resistance with the 75 mm and 50 mm blanket producing similar R values.

Table 1. Surface to Surface R value of blanket (m^2K/W)

Material	Certified R value of Blanket	Measured R value of Blanket in-situ	% Reduction of R value
100 mm Blanket foil	2.4*	0.95	60%
75 mm Blanket foil	1.8	0.74	59%
50 mm Blanket foil	1.3	0.77	41%

*Blanket R value is unspecified and has been calculated based on the thermal conductivity determined from the specified R values of the 75 and 50 mm blankets as provided by the certificate of compliance (Appendix).

The stated rating of the entire metal roof arrangement shown in Figure 1, including the impact of the foil is shown in Tables 2 and 3. This information was taken from the Certificate of Compliance for the blanket foil product, developed in accordance with AS4859.1, and is provided in the Appendix. However, these R values are inconsistent with AS 4859.1 with reference to the thermal resistance of an air films with a reflective surface. From Table K1 (refer to Appendix), the resistance of a horizontal air film with a reflective surface is 0.23 and 0.8 m^2K/W for heat flow up and down, respectively. Tables 2 and 3 present the calculated R values of the roof using these values, the certified R value of the blanket, as well as the thermal resistance of an outdoor air film of 0.04 m^2K/W. For example, for the 50 mm blanket foil in winter the total calculated R value = 0.04 + 1.3 + 0.23 = 1.6 m^2K/W.

Given that the surface to surface R value of the blanket in situ is reduced, a new R value for the entire roof arrangement can be specified in accordance with AS 4859.1. For example, the R value for the roof with 50 mm blanket in winter equates to 0.04 + 0.77 + 0.23 = 1.0 m^2K/W. Overall the R value of the roof arrangement is reduced by 24% to 56%.

Table 2. R value for flat metal roof with no ceiling for winter condition (m^2K/W)

Material	R value as provided by manufacture r	Calculated R value based on certified R value of blanket	Calculated R value based on measured R value of blanket in-situ.	% Reduction of total R value, based on certified and measured R value of blanket
100 mm Blanket	2.8*	2.7*	1.2	56%
75 mm Blanket	2.2	2.1	1.0	52%
50 mm Blanket	1.7	1.6	1.0	38%

Table 3. R value for flat metal roof with no ceiling for summer condition (m^2K/W)

Material	R value as provided by manufacture r	Calculated R value based on certified R value of blanket	Calculated R value based on measured R value of blanket in-situ.	% Reduction of total R value, based on certified and measured R value of blanket
100 mm Blanket	3.1*	3.2*	1.8	44%
75 mm Blanket	2.5	2.6	1.6	38%
50 mm Blanket	2.0	2.1	1.6	24%

*Blanket R value is unspecified and has been calculated based on the thermal conductivity determined from the specified R values of the 75 and 50 mm blankets as provided by the certificate of compliance (Appendix).

The temperature distribution shown in Figures 10 – 12 clearly show that thermal bridging is occurring at the C channels. To determine the R value at the C channel requires direct measurement of the heat flow which was not conducted in these tests. However, by applying the parallel method and assuming 1 dimensional heat flow, the R value of the thermal bridge can be estimated. This method provides the maximum R value of the thermal bridge. Table 4 shows the calculated surface to surface R value of the thermal bridge for each blanket. At the thermal bridge the R value is 30 – 37% lower than the measured surface to surface total R value presented in Table 1.

Table 4. Surface to surface R value at C channel

Material	Average Temperature Difference across roof at C channel, °C	Average Temperature difference across roof at Insulation, °C	Total measured R value, m^2K/W	Local R value at C channel, m^2K/W	% Reduction of local to total R value
100 mm Blanket	15.3	22.1	0.95	0.67	30%
75 mm Blanket	12.6	20.5	0.74	0.46	37%
50 mm Blanket	11.5	17.0	0.77	0.53	31%

CONCLUSIONS

The R value of a flat metal roof arrangement with blanket foil was measured to an accuracy of better than +/-5%. The measurement was achieved by directly measuring the heat flow and the surface to surface temperature difference across the roof. With each blanket foil tested the surface to surface R value was found to be 41% to 60% lower than the certified R value of the blanket. This translates to a 24% to 56% reduction in the overall R value of the entire roof. The reduction in R value can be attributed to the significant level of compression as well as thermal bridging at the C channel. The R value of the thermal bridge was estimated to be 30 – 37% lower than the measured surface to surface R value of the blanket in-situ.

APPENDIX

CERTIFICATE OF COMPLIANCE

This is to certify that Fletcher Insulation manufactures Vapa-Chek™ building blankets in Australia under ISO 9001 quality manufacturing standards and is supplied free of material defects.

Fletcher Insulation Vapa-Chek™ aluminium foil faced blankets have two components:

- FBS-1 Bio-Soluble glasswool blanket in various thicknesses;
- Sisalation® in light, medium or heavy duties that is adhered to cover one side of the blanket.

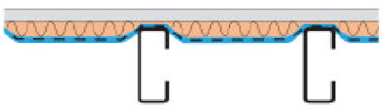
Vapa-Chek™ building blankets achieve the following Declared Material R-values at the following FBS-1 glasswool thicknesses when tested in accordance with AS/NZ 4859.1:

BLANKET THICKNESS	MATERIAL R-VALUE
55mm	R 1.3
75mm	R 1.8

The thermal performance of the reflective air space will vary depending on the installation method. Listed below are several standard applications. The BCA requires commercial buildings in Climate Zones 1 to 6 to be designed for a 'Summer' (heat flow down) condition, while commercial buildings in Climate Zones 7 and 8 are required to be designed for a 'Winter' (heat flow up) condition. For further information on climate zoning please contact Fletcher Insulation.

Application: Flat metal roof with no ceiling

Vapa-Chek™ building blanket draped over purlin support located between cladding & safety mesh. Metal roof at 0 to 5° pitch, purlins may be at various centres.

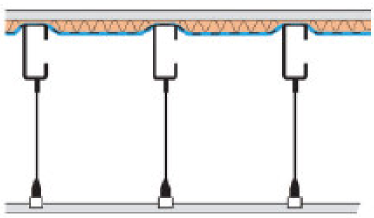


TOTAL R-value 55mm = R 1.7 (Winter) R 2.0 (Summer)

TOTAL R-value 75mm = R 2.2 (Winter) R 2.5 (Summer)

Application: Flat metal roof with suspended ceiling

Vapa-Chek™ building blanket draped over purlin support located between cladding & safety mesh. Reflective foil faces downwards. Air space below foil assumed to be unventilated 100mm to 600mm air space. (Flat metal roof at 0 to 12° pitch)

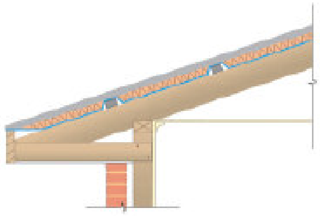


TOTAL R-value 55mm = R 2.2 (Winter) R 3.3 (Summer)

TOTAL R-value 75mm = R 2.7 (Winter) R 3.8 (Summer)

Application: Metal roof at 22.5° pitch with flat ceiling

Vapa-Chek™ building blanket draped over battens allowing full recovery between battens of the product's nominal thickness. Reflective foil faces the attic space.



TOTAL R-value 55mm = R 2.1 (Winter) R 2.6 (Summer)

TOTAL R-value 75mm = R 2.6 (Winter) R 3.1 (Summer)

Compliance: This performance report is based on thermal resistance tests and calculations conducted in accordance with AS/NZS 4859.1 (2002) – Amendment 1 (2006).

Fletcher Insulation

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VAPA-CHEK
Australia's favourite building blanket

Taken from AS 4859.1:2002

TABLE K1

THERMAL RESISTANCE OF AIR FILMS

Surface orientation	Direction of heat flow	Resistance (High emittance surface)	Resistance (Low emittance surface)
Horizontal	Up Down	0.11 m^2K/W 0.16 m^2K/W	0.23 m^2K/W 0.80 m^2K/W
45° slope	Up Down	0.11 m^2K/W 0.13 m^2K/W	0.24 m^2K/W 0.39 m^2K/W
22.5° slope	Up Down	0.11 m^2K/W 0.15 m^2K/W	0.24 m^2K/W 0.60 m^2K/W
Vertical	Horizontal	0.12 m^2K/W	0.30 m^2K/W

NOTE: Low emittance refers to reflective foil materials with emittance of 0.05 or less and high emittance refers to an emittance of 0.9. Intermediate values of emittance will result in thermal resistances, which may be approximated by linear interpolation using these end values.

PURPOSE

To determine a representative thickness for 75mm (nom.) thick foil backed fibrous insulation blankets when installed on wire safety mesh under a metal roof in commercial buildings.

SCOPE

To measure the installed insulation thickness at 6 locations in the roof of 5 separate projects in Perth. Four of the five chosen survey sites had insulation with a nominal insulation thickness of 55mm and not the 75mm as originally proposed.

The site locations and Builder names have been recorded by AEEBC. All records will be kept private and no mention of these recordings will be included in the publication of this report.

METHOD

1) AEEBC selected 5 sites in Perth. The type of buildings surveyed were commercial or industrial buildings with metal roof sheeting and nominally 75mm thick foil backed bulk fibrous blanket insulation on wire support mesh.
2) The thickness of the insulation at six representative locations in the roof was measured using a graduated metal pin to push through the insulation to make contact with the roof sheeting.
   Note: Care was taken so that the measurement was taken at the bottom of the roof sheet profile (i.e. at the point of thinnest insulation) and in some cases several attempts were required to determine this.
3) Two measurements were taken between the purlins at each representative location. One in mid span and one 150mm to the purlin.
4) On each of the selected 5 sites in Perth, 12 such measurements were taken of the final installed thickness of the insulation blanket.

Results

Results of the Survey are listed in Tables 1-5. It was determined that the 75mm insulation blanket installed under wire mesh at site five was compressed to an average thickness of 38mm (see table 5). This result was replicated at sites 1 - 4 installed with 55mm insulation, which was also compressed to an average thickness of 38mm under wire mesh. (see table 1-4). This represents a 17mm (30%) loss of thickness of a 55mm thick foil backed fibrous blanket insulation and a 37mm (49%) loss of thickness of a 75mm thick foil backed fibrous blanket insulation.

The average thickness over the 5 sites at the measurements 150 mm from purlin was 25.6mm. Project 5 outfitted with 75mm insulation blanket represented an average thickness of 25.5. This represents a 29.4mm (53%) loss of thickness of a 55mm thick foil backed fibrous blanket insulation and a 49.5mm (66%) loss of thickness of a 75mm thick foil backed fibrous blanket insulation.

Summary

The results showed a substantial loss in insulation thickness and increased compression when installed under wire mesh. Bulk insulation works by trapping pockets of still air within its structure, providing resistance to heat. This compression of air reduces the volume of air, hence reducing total R-value (see graph 1.1).

It is assumed that the results from this survey maybe replicated across many of the building sites in the Perth district. The results demonstrate a false representation of actual total R value for 75mm thick foil backed fibrous insulation blankets when installed on wire mesh under a metal roof in commercial buildings

References

1. Trethowen H.A , 5 Nov 2004, Project Report for the Australian Building Codes Board; 'Effects of Thermal Bridging on Heat Losses of Roofs in Australian Houses"

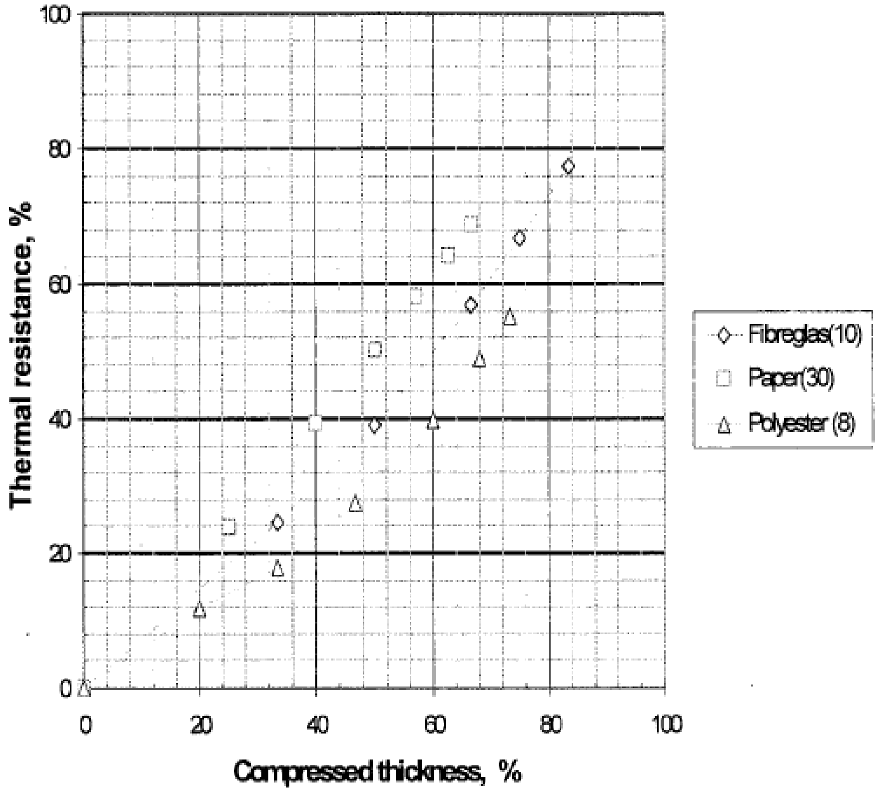

Figure 1.1 Loss of R-Value for Compressed insulants
(Source: H.A Trethowen, 5 Nov 2004)

AUSTRALIAN ENERGY EFFICIENT
BUILDING CONSULTANTS
ABN No. 79 060 988 767

Table 1. Project 1- Summary of Insulation Thickness

Date:		10-Mar-08
Project:	Project 1	
Type of Building:	Warehouse	
Nominated insulation: thickness	55	
Insulation brand name:	Permastop	
Roof sheet profile/type:	Trimdeck	
Measured Thickness:	Mid Point (mm)	Adjacent to Purlin (150mm from purlin)
Location A	48	35
Location B	39	19
Location C	34	20
Location D	37	22
Location E	42	17
Location F	33	24
Average Thickness	**38.8**	**22.8**
Name of Surveyor	Evan Logan	

Table 2. Project 2- Summary of Insulation Thickness

Date:	10-Mar-08	
Project:	Project 2	
Type of Building:	Warehouse / Office	
Nominated insulation: thickness	55	
Insulation brand name:	Permastop	
Roof sheet profile/type:	Trimdeck	
Measured Thickness:	Mid Point (mm)	Adjacent to Purlin (150mm from purlin)
Location A	52	37
Location B	40	28
Location C	44	33
Location D	41	46
Location E	49	41
Location F	45	29
Average Thickness	**45.2**	**35.7**
Name of Surveyor	Evan Logan	

Note: Distance Between Purlins = 1.5m

Table 3. Project 3- Summary of Insulation Thickness

Date:	10-Mar-08	
Project:	Project 3	
Type of Building:	Warehouse / Office	
Nominated insulation: thickness	55	
Insulation brand name:	Anticon	
Roof sheet profile/type:	Trimdeck	
Measured Thickness:	Mid Point (mm)	Adjacent to Purlin (150mm from purlin)
Location A	34	27
Location B	36	23
Location C	36	19
Location D	33	25
Location E	41	25
Location F	38	21
Average Thickness	**36.3**	**23.3**
Name of Surveyor	Evan Logan	

Note: Distance Between Purlins = 1.4m

Table 4. Project 4- Summary of Insulation Thickness

Date:		20-Mar-08
Project:	Project 4	
Type of Building:	Office / Retail	
Nominated insulation: thickness	55	
Insulation brand name:	Anticon	
Roof sheet profile/type:	Trimdeck	
Measured Thickness:	Mid Point (mm)	Adjacent to Purlin (150mm from purlin)
Location A	30	19
Location B	42	19
Location C	45	19
Location D	27	21
Location E	23	18
Location F	23	28
Average Thickness	**31.7**	**20.7**
Name of Surveyor	Evan Logan	

Note: Distance Between Purlins = 1150mm (A-C & F) & 900mm (D & E)

Table 5. Project 5- Summary of Insulation Thickness

Date:		20-Mar-08
Project:	Project 5	
Type of Building:	College	
Nominated insulation: thickness	75	
Insulation brand name:	Anticon	
Roof sheet profile/type:	Custom Orb	
Measured Thickness:	Mid Point (mm)	Adjacent to Purlin (150mm from purlin)
Location A	36	20
Location B	43	41
Location C	45	29
Location D	39	22
Location E	35	24
Location F	30	17
Average Thickness	**38.0**	**25.5**
Name of Surveyor	Evan Logan	