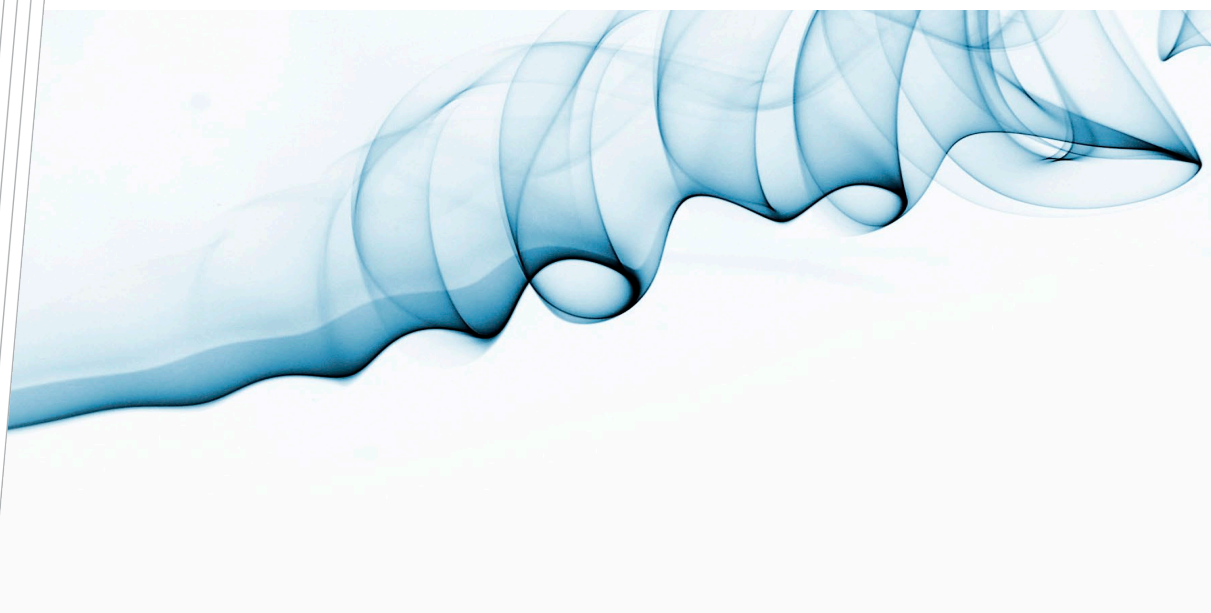




# Thermal Transmission Properties of 50MM EPS-FR BOARD (SL grade)

Status: Final Issue (Rev C)

Commercial-in-Confidence



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## Test Report XC3945/R1 – Final Issue (Rev C)

Thermal transmission properties of 50mm EPS-FR board (SL grade)

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### Report Status and Revision History

VERSION	STATUS	DATE	DISTRIBUTION	COMMENT
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## Client

Delta Panels Pty Ltd

## Summary

This is a report of measurements in a CSIRO laboratory at Clayton to determine a declared thermal performance for a 50mm EPS board supplied by Delta Panels Pty Ltd. Results are based on thermal transmission measurements of 10 specimens. Table 1 below gives summary results which apply only in conjunction with the conditions and limitations that are stated on the following pages of this report.

**Table 1.** Summary of Measurements on 10 specimens of 50mm EPS board

Specimen Description	Mean Thickness (mm)	Test Thickness (mm)	Density at test thickness (kg/m <sup>3</sup> )	Thermal Resistance (m <sup>2</sup> .K/W)	Apparent Thermal Conductivity (W/m.K)
231010- A	51.1	51	15.0	1.33	0.0383
231010- B	51.0	51	13.7	1.25	0.0407
231010- C	51.3	51	13.5	1.26	0.0408
231010- D	51.0	51	14.5	1.31	0.0390
231010- E	50.9	51	13.4	1.23	0.0413
231010- F	50.9	51	12.7	1.20	0.0425
231010- G	50.8	51	12.8	1.19	0.0427
231010- H	51.6	52	12.9	1.27	0.0406
231010- I	51.6	52	12.8	1.27	0.0405
231010- J	51.1	51	12.2	1.19	0.0428

**Table 1.** Declared Thermal Performance of the product at 23°C mean temperature

Product Description	Declared Thermal Resistance (m <sup>2</sup> .K/W)	Declared Thermal Conductivity (W/m.K)
EPS-FR (SL-grade) with a nominal thickness of 50 mm	1.20	0.041

The measurements have been performed using a heat flow meter apparatus and are in general accordance with **ASTM C 518-21 Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus**. This is one of the allowable test methods for the measurement of thermally insulating materials for compliance with **AS/NZS 4859.1:2018 Thermal Insulation Materials for Buildings Part 1: General criteria and technical provisions**. However, compliance with AS/NZS 4859.1:2018 also requires measurement of 10 specimens of a single product and the derivation of “declared” values of thermal properties which take specimen variability, aging and temperature into account. This report describes such a derivation in compliance with AS/NZS 4859.1:2018.

The CSIRO laboratory has accreditation for thermal measurements in Australia through NATA, the National Association of Testing Laboratories. Accreditation also extends to other countries through mutual recognition arrangements with their accreditation bodies, including IANZ, International Accreditation New Zealand.

## 1 BACKGROUND TO MEASUREMENTS

### 1.1 Specimen Description and Identification

This report relates to measurements of the thermal properties of 50mm EPS-FR board (SL grade). Test results apply only to the specific items tested.

The test specimens were described as in Table 1 above. The specimens were also given laboratory Specimen ID numbers which are indicated on the following pages. Product thickness was nominated as 50 mm.

Appendix A of this report provides images of the specimens.

## 1.2 Apparatus

The measurements were performed using a FOX600 heat flow meter apparatus which has 600 mm square plates and fully encloses the test specimen. The apparatus incorporates two heat flow meters, one in each plate. Each heat flow meter is 254 mm square.

Calibration checks traceable to IRMM or NIST Standard Reference Materials have been performed within 30 days of the reported measurements.

## 1.3 Specimen Preparation and Measurement Details

Each specimen was conditioned at 23°C and 50% RH for a period of at least 24 hrs prior to measurement. During measurement, laboratory ambient temperature was 23 °C.

Due to the uniformity and rigidity of the EPS board, the mean thickness of the specimen was determined from the average of 4 corner measurements obtained from the FOX 600 instrument.

## 1.4 Methodology

The specimens were measured in accordance with ASTM C518-21

The apparatus was horizontal with heat flow direction upwards and the cold plate at the top.

Monitoring continued for the stated measurement duration, by which time heat flow through the specimen had stabilized.

## 1.5 Operational Test Range

The FOX600 apparatus and the test method ASTM C 518-21 place limitations on the measurement range for thermal resistance, thickness, and temperature. Measurement uncertainty is affected according to where in the range the measured properties occur. Uncertainties for thermal values have been calculated and are given adjacent.

## 2 MEASUREMENTS

**Table 2.** Results for 10 specimens. Uncertainties are for a 95% confidence (coverage factor  $k=2$ )

No.	Customer Description	CSIRO Specimen ID	Measurement number-	Mean thickness (mm)	Thickness std. dev. (%)	Test thickness (mm)
1	50mm EPS-FR SL Grade	231010- A	FX6-1661	51.1	0.4	51.1
2		231010- B	FX6-1662	51.0	0.8	51.0
3		231010- C	FX6-1663	51.3	0.6	51.3
4		231010- D	FX6-1664	51.0	0.6	51.0
5		231010- E	FX6-1665	50.9	0.8	50.9
6		231010- F	FX6-1666	50.9	0.8	50.9
7		231010- G	FX6-1667	50.8	0.6	50.8
8		231010- H	FX6-1668	51.6	1.0	51.6
9		231010- I	FX6-1669	51.6	0.6	51.6
10		231010- J	FX6-1671	51.1	0.5	51.1

No.	Length (mm)	Width (mm)	Weight (kg)	Test density (kg/m <sup>3</sup> )	Measurement duration (min)	Temperature difference (K)	Mean temperature (°C)	Mean heat flow (W/m <sup>2</sup> )
1	600	600	0.277	15.0	81	20.0	23.0	14.94
2	600	600	0.251	13.7	65	20.0	23.0	15.89
3	599	600	0.249	13.5	59	20.0	23.0	15.88
4	599	601	0.266	14.5	65	20.0	23.0	15.24
5	599	602	0.245	13.4	65	20.0	23.0	16.17
6	600	597	0.232	12.7	65	20.0	23.0	16.65
7	600	597	0.234	12.8	65	20.0	23.0	16.77
8	599	599	0.238	12.9	35	20.0	23.0	15.68
9	598	599	0.237	12.8	65	20.0	23.0	15.66
10	598	600	0.224	12.2	41	20.0	23.0	16.70

No.	Mean thermal conductance (W/m <sup>2</sup> .K)	Uncert (± %)	Apparent thermal conductivity (W/m.K)	Uncert (± %)	Mean thermal resistance (R value) (m <sup>2</sup> .K/W)	Uncert (± %)
1	0.749	3	0.0383	3	1.33	3
2	0.797	3	0.0407	3	1.25	3
3	0.796	3	0.0408	3	1.26	3
4	0.764	3	0.0390	3	1.31	3
5	0.811	3	0.0413	3	1.23	3
6	0.835	3	0.0425	3	1.20	3
7	0.841	3	0.0427	3	1.19	3
8	0.786	3	0.0406	3	1.27	3
9	0.785	3	0.0405	3	1.27	3
10	0.838	3	0.0428	3	1.19	3

### 3 CALCULATION OF DECLARED VALUES

Declared values of thermal properties may be calculated in accordance with AS/NZS 4859.1:2018 by applying statistical derating factors to achieve 90 % confidence level of a value the median exceeds (for thermal resistance) or falls below (for thermal conductivity).

AS/NZS 4859.1:2018 provides that where 10 measurements have been performed, a defined multiplier of 0.44 is applied to the sample standard deviation and is subtracted (in the case of thermal resistance) or added (in the case of thermal conductivity) to the mean value.

AS/NZS 4859.1:2018 also imposes rounding requirements on calculated properties. These have been incorporated in results that are presented in Table 3.

**Table 3.** Calculated mean and declared values of thermal properties for measurements of 10 specimens at 23 °C mean temperature

Mean Thermal Resistance	1.25 m <sup>2</sup> .K/W
Standard Deviation in 10 Thermal Resistance Values	3.9 %
Declared Thermal Resistance (R-value)	1.20 m <sup>2</sup> .K/W
Apparent Thermal Conductivity	0.0408 W/m.K
Standard Deviation in 10 Thermal Conductivity Values	3.4 %
Declared Thermal Conductivity	0.041 W/m.K

### 4 LABELLING

AS/NZS 4859.1:2018 requires that a thermal value report also includes product labelling details. There are two specific safety advice requirements, as well as the requirements listed in Table 4 below, which are derived from Table 3.1 of the standard for the case of compressible fibrous insulation. Product labelling was provided by the client. Evaluation against the requirements of the Standard is as follows:

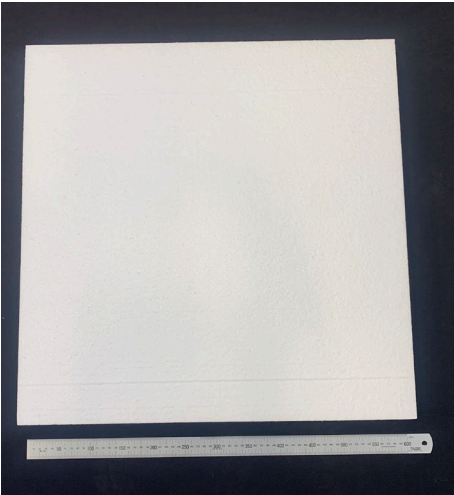
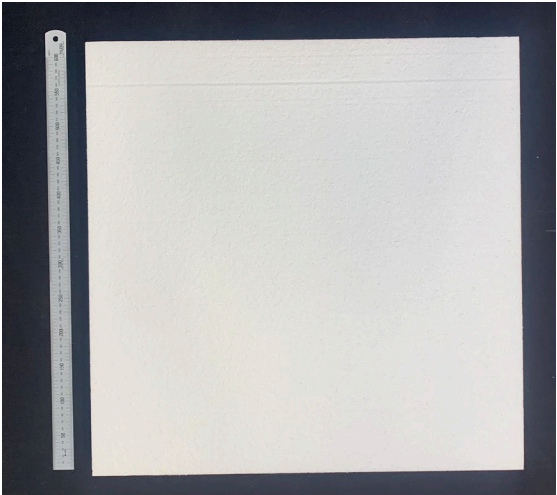


**Table 4. Labelling Requirements**

Requirement	Evaluation	Complies
Product name	Expanded Polystyrene – Fire Retardant Grade	Yes
Description of contents	EPS-FR (SL Grade)	Yes
Name and address of manufacturer or supplier	Delta Panels Pty Ltd 731 Boundary Road, Richlands QLD Australia	Yes
Identification of manufacturing plant	Delta Insulation Systems	Yes
Batch identification or other traceability information	92372205-008 (28/09/23 – Run 19)	Yes
Safety guidance – safe handling and installation	Identified on Safety Data Sheet (available on company website)	Yes
Safety guidance – electrical cable overheating (as per AS4859.1 – Table 3.1 for bulk insulation)	Caution: Electrical cables and equipment partially or completely surrounded with bulk thermal insulation may overheat and fail	Yes
A statement of conformance with AS/NZS 4859.1:2018	Provided	Yes
Material declared R-value and the temperature at which it applies	R 1.2 (m <sup>2</sup> K/W) at 23°C	Yes
Number of pieces	10	Yes
Nominal total area	3.6 m <sup>2</sup> or 0.18m <sup>3</sup>	Yes
Nominal length, width and thickness of each piece	Variable	Yes
Nominal net weight of contents or supplied quantity	2.5 kg	Yes



## APPENDIX A

### Photographs of test specimens

"50mm EPS-FR (SL grade) – showing CSIRO Specimen ID: 231010 – A)	
	
Length	Width
	
Thickness	Close up view of surface