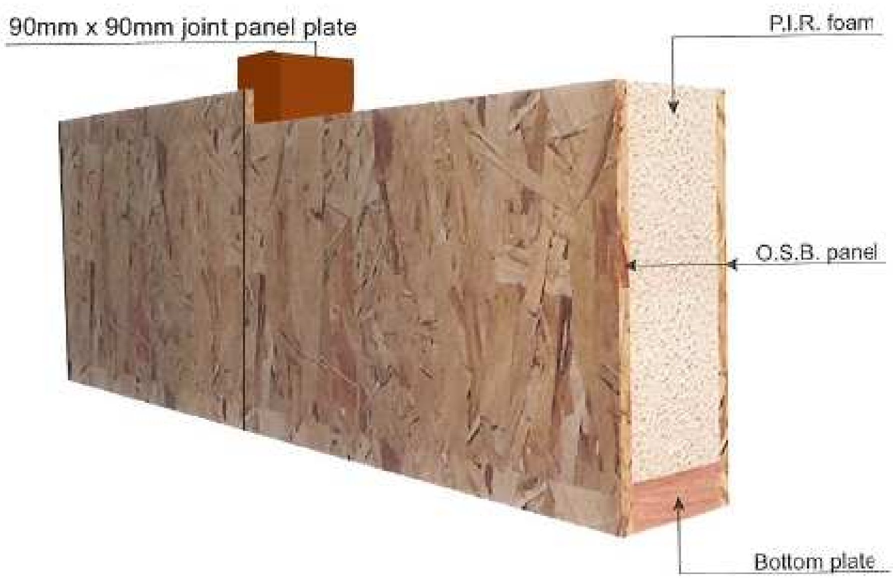
Ozone Panel

Ozone Panel Thermal Analysis

Test Report



Vipac Engineers & Scientists Ltd

279 Normanby Road, Private Bag 16
Port Melbourne VIC 3207
Australia
t. +61 3 9647 9700 | **f.** +61 3 9646 4370
www.vipac.com.au

Document No.
30B-12-0004-TRP-259616-0

17 Aug 2012

DOCUMENT CONTROL

Ozone Panel Thermal Analysis
Test Report

DOCUMENT NO.: 30B-12-0004-TRP-259616-0

LIBRARY CODE: TRP

PREPARED FOR:
Ozone Panels
Level 31
367 Collins Street
Melbourne VIC 3000
Contact: Haydn Wright
☎: +61 (0) 438 172 005
Fax:

PREPARED BY:
Vipac Engineers & Scientists Ltd
279 Normanby Road, Private Bag 16
Port Melbourne VIC 3207
Contact: Michael Petrovic
☎: +61 3 9647 9700
Fax: +61 3 9646 4370

PREPARED BY:

Michael Petrovic — Project Engineer — 21 August 2012 — michaelp@vipac.com.au

REVIEWED BY:

Tom Neudorfl — Team Leader — 21 August 2012 — tomn@vipac.com.au

PREPARED BY:

Michael Petrovic — Project Engineer — 21 August 2012 — michaelp@vipac.com.au

REVISION HISTORY:

Revision No.	Date Issued	Reason/Comments
0	21 August 2012	Initial Issue

DISTRIBUTION:

Copy No.______	Location
1	Vipac - Project/Client File
2	Original

KEYWORDS:

NOTE: This is a controlled document within the document control system. If revised, it must be marked SUPERSEDED and returned to the Vipac QA Representative.

TABLE OF CONTENTS

1. INTRODUCTION

Document Type: Thermal R-Value Test Report

Client: Ozone Panel

Project: Ozone Panel Thermal Analysis

Vipac Engineers & Scientists Ltd has been retained by Ozone Panel to calculate the thermal resistance value of a polyisocyanurate foam (PIR) sandwich panel as specified in Section 2 of this report. The aim of the analysis was to physically test the thermal resistance value of the complete construction, and use this result to validate the theoretical calculation for its individual components.

2. SPECIMEN

The test specimen was an approximately 600 mm square section of the PIR sandwich panel with a mean thickness of approximately 120 mm as shown in Figure 1.

The PIR sandwich panel consisted of three layers:

1. 15 mm Egger Eurostrand Oriented Strand Board (OSB)
2. 90 mm Baymer® PP2484 2-Component Polyisocyuanurate (PIR) Rigid Foam
3. 15 mm Oriented Strand Board (OSB)

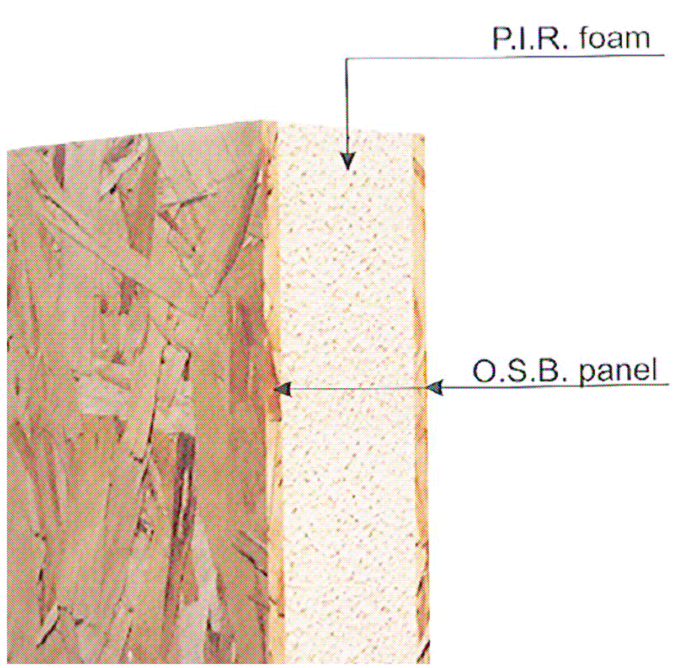


Figure 1: PIR foam sandwich panel

The test specimen was presented as shown in Figure 1 without an external panel finish.

3. METHOD

By physical testing, thermal resistance was found to be 3.99 m²·K/W [1] for the complete panel and 0.190 m²·K/W [2] for the oriented strand board. The thermal resistance of the polyisocyanurate (PIR) rigid foam insulation component of the system can be calculated.

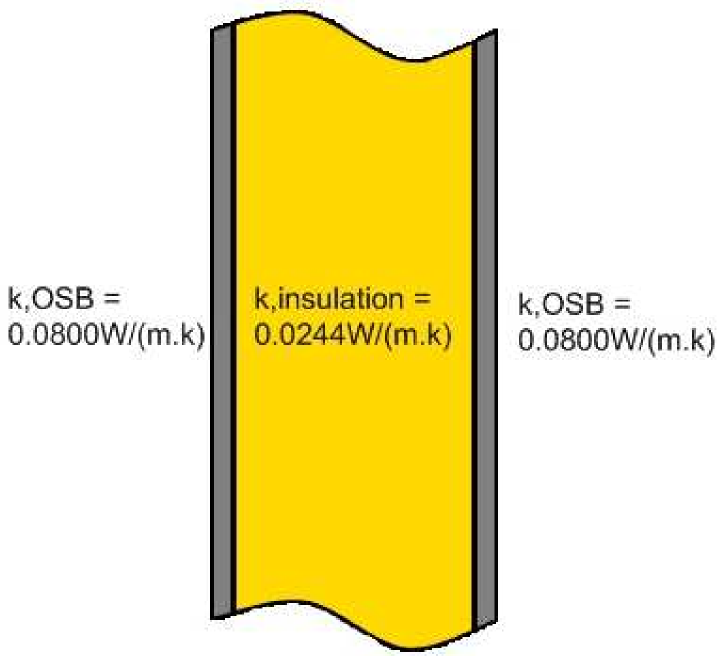


Figure 2: Thermal resistance analysis

[1] CSIRO Test Report No. XC3143, Issued: June 2012

[2] CSIRO Test Report No, XC3143 R1, Issued: July 2012

4. CALCULATED THERMAL RESISTANCE

Table 1: Calculated Thermal Resistance – 120 mm Thick Specimen Components

Material	Thickness [mm]	Thermal Conductivity [W/(m·K)]	Thermal Resistance [(m²·K)/W]
Oriented Strand Board	15.2	0.0800	0.190
PIR Foam Insulation	88.2	0.0244	3.61
Oriented Strand Board	15.2	0.0800	0.190
Total	**118.6**	**0.0298**	**3.99**

Table 2: Calculated Thermal Resistance – 90 mm Thick Specimen Components

Material	Thickness [mm]	Thermal Conductivity [W/(m·K)]	Thermal Resistance [(m²·K)/W]
Oriented Strand Board	11	0.0800	0.138
PIR Foam Insulation	68	0.0244	2.78
Oriented Strand Board	11	0.0800	0.138
Total	**90**	**0.0298**	**3.06**

APPENDIX A

Client Supplied Documentation – Insulating Foam

Document Received: 17/07/2012

Technical data sheet – Baymer® PP 2484
Page 1 of 2

BaySystems

BAYER

Baymer® PP 2484

Material	2-component Polyisocyanurate [PIR] rigid foam
Application	Discontinue; B2
Blowing agent	HFC / Water
A-component	Baymer® PP 2484
B-component	Desmodur® 44V20L
Mixing ratio [A : B]	By volume 100 : 133
	By weight 100 : 135

Components

		Baymer® PP 2484	Desmodur® 44V20L
Density	[kg/m^3; 20℃]	1208	1230
Viscosity	[mPa.s; 25℃]	80	200
Appearance		Green	Dark brown
Storage stability (In closed drums and containers)	[months]	3	12
Storage temperature	[℃]	15-25	15-25
Packaging		Drum, IBC, Bulk	Drum, IBC, Bulk

System: handmix (R17; Typical values)

Test recipe: N.A.

Temperature	[℃]	20
Cream time	[s]	19
Gel time	[s]	102
Tack free time	[s]	255
(Core-) density	[kg/m^3]	30,8

Application

Machine	Low- and high pressure foam dispensing machines	
Component temperature	[℃]	18-23
Mould temperature	[℃]	≥ 40

Foam properties

Thickness of panel: 50 mm; Metal facings

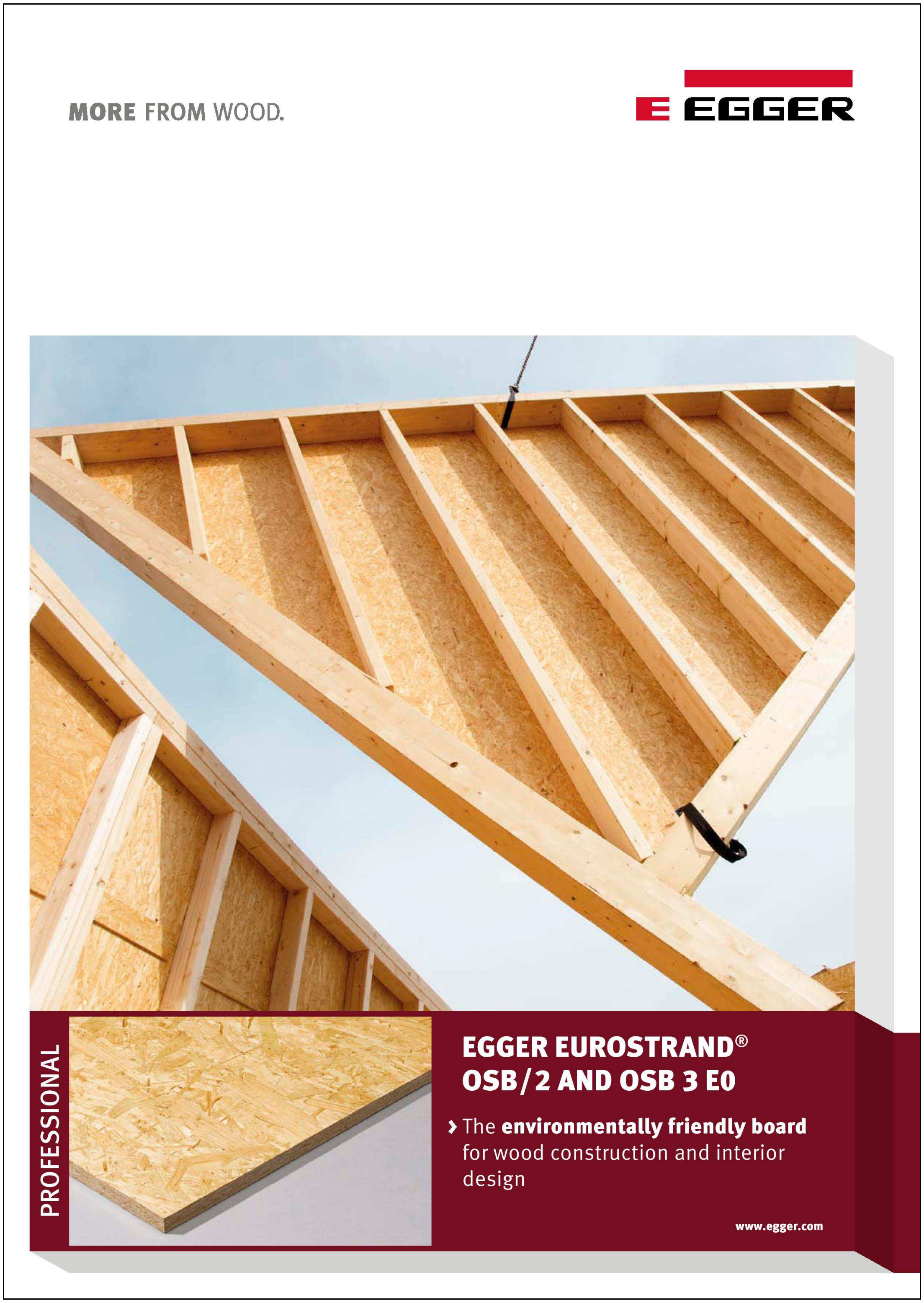
Property		*Standard*	*Unit*	*Value*
Density	Overall	EN1602	kg/m^3	45,6
	Core			40,4
Dim. stability	Length	EN1604	%	0,4
24 h. at +100 ℃	Width			0,6
	Thickness			3,0
Dim. stability	Length	EN1604	%	0,1
24 h. at -25 ℃	Width			0,0
	Thickness			0,0
Dim. stability	Length	EN1604	%	0,3
48 h. at +70 ℃	Width			0,0
95% R.H.	Thickness			3,0
Compression strength [at 10%]		EN826	kPa	180
E-modulus		EN826	N/mm^2	3,8
Adhesion strength	Upper facing	DIN53292	kPa	>120
	Lower facing			>120
Lambda-10	Initial	DIN52612	W/m.K	0,021
	Aged			-
Fire-classification		DIN4102 part 1	-	B2

BaySystems B.V.
Korte Groningerweg 1A
NL-9607 PS FOXHOL-HOLLAND

Tel +31 598 317911 / Fax +31 598 317944
Emergency: +31 6 53355029

Client Supplied Documentation – Oriented Strand Board

Document Received: 20/07/2012




EUROSTRAND® OSB 3 E0 has outstanding technical characteristics and good dimensional stability.

EUROSTRAND® OSB 3 E0

THE ENVIRONMENTALLY FRIENDLY BOARD FOR WOOD CONSTRUCTION AND INTERIOR DESIGN

PRODUCT DESCRIPTION

PRODUCTION

EUROSTRAND® OSB is a flat hardboard with a three-layer structure of oriented distributed strands (micro-veneers) according to DIN EN 300. The special strand geometry (length up to 160 mm) has a high degree of strand orientation in the grain direction of the outer layer which assures outstanding technical characteristics and very good inherent stability. EUROSTRAND® OSB boards for use in humid conditions are made with 100% formaldehyde-free adhesives.

RAW MATERIALS USED

- Debarked softwood from domestic forestry
- Paraffin wax emulsion
- PU resin
- Water
- MUF resin, only in the outer layer of EUROSTRAND® OSB/2 EN 300

OSB BOARD TYPES

EGGER EUROSTRAND® OSB boards are available from inventory in three technical classes according to EN 13986.

- EGGER EUROSTRAND® OSB/2 EN 300, CE
- EGGER EUROSTRAND® OSB 3 E0, CE
- EGGER EUROSTRAND® OSB 4 TOP, CE, Z-9.1-566

Additional information on EUROSTRAND® OSB 4 TOP can be found in our separate OSB product brochure.

The materials are available:

- in board thicknesses from 6 to 25 mm
- with 2-sided and 4-sided asymmetrical tongue and groove
- with sanded and unsanded surface

Usage class

According to ENV 1995-1-1 (EC5), EUROSTRAND® OSB 3 E0 can be used for applications in usage class 1 (dry conditions) and 2 (humid conditions), EUROSTRAND® OSB/2 EN 300 in usage class 1.

3

EUROSTRAND® OSB AREAS OF APPLICATION

IN WOOD AND RESIDENTIAL CONSTRUCTION AS

- load-bearing, reinforcing sheathing for wood frame construction
- airtight vapour barrier in roofs and walls
- floor to ceiling sheathing for thermal-bridge-reducing components in passive houses
- OSB 3 E0 load-bearing sheathing for metal siding and roof waterproofing

INTERIOR DESIGN AND DECORATIVE APPLICATIONS

- for floor renovations
- as ball-impact-resistant wall and sports facility sheathing
- for trade fair and store construction and interior design (decorative applications)
- for sturdy sub structures in the furniture industry

IN INDUSTRIAL APPLICATIONS AS

- For load-bearing and shaping components used in the car industry
- load-bearing flooring in stage and warehouse construction
- robust construction site fencing
- durable, long-lasting packaging material

OSB 3 E0 IN CONCRETE CONSTRUCTION AS

- Sheathing for repeated use
- Structured facework
- Ceiling edge formwork and foundation formwork
- Low-cost alternative to lost formwork and as a fitted board

EUROSTRAND® OSB – The features speak for themselves

- straightforward and fast processing without special tools
- high static loading capacity for the greatest possible application versatility
- dry, clean processing for shorter construction times

4

STRUCTURAL-PHYSICAL CALCULATION VALUES

EUROSTRAND® OSB/2 and OSB 3 E0 according to EN 300:2006

Characteristic	Standard	Unit	EUROSTRAND® OSB OSB/2	OSB 3 E0
Raw density	EN 323	kg/m³	≥ 580	≥ 600
μ-value	EN ISO 12572	–	200	200
Thermal conductivity λ_R	EN 13986	W/(mK)	0.13	0.13
Specific thermal capacity c	DIN 4108-4	J/(kgK)	1,700	1,700
Reaction to fire	EN 13986	–	E, D-s1, d0	(≥ 9 mm) D-s2, d0
24h thickness swelling	EN 317	%	≥ 20	≥ 15
Linear expansion per 1 % change of moisture content	EN 318	%/%	0.04	0.03
Formaldehyde emission	EN 717-1	ppm	0.1	‹ 0.03

We will gladly provide you with material values for additional moisture dynamics calculations.

CHARACTERISTIC STRENGTH VALUES AND STIFFNESS

EUROSTRAND® OSB/2 and OSB 3 E0 according to EN 300:2006
The typical static rating calculation values are based on EN 12369-1.

Thickness (mm)	Strength values (N/mm²) Bending		Tension		Compression		Panel shear	Planar shear
t_{nom}	f_m		f_t		f_c		f_v	f_r
	0° 1)	90° 2)	0°	90°	0°	90°	–	–
8 – 10	18.0	9.0	9.9	7.2	15.9	12.9	6.8	1.0
› 10 ‹ 18	16.4	8.2	9.4	7.0	15.4	12.7	6.8	1.0
18 – 25	14.8	7.4	9.0	6.8	14.8	12.4	6.8	1.0

Thickness (mm)	Stiffness values (N/mm²) Bending		Tension		Compression		Panel shear	Planar shear
t_{nom}	E_m		E_t		E_c		G_v	G_r
	0°	90°	0°	90°	0°	90°	–	–
8 – 10	4,930	1,980	3,800	3,000	3,800	3,000	1,080	50
› 10 ‹ 18	4,930	1,980	3,800	3,000	3,800	3,000	1,080	50
18 – 25	4,930	1,980	3,800	3,000	3,800	3,000	1,080	50

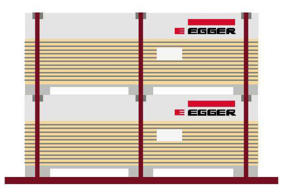
1) 0°-major axis
2) 90°-minor axis

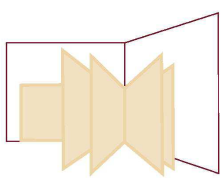
For load-bearing, reinforcing construction with elevated static requirements and / or construction where board thicknesses in the range › 25 mm are used. Only EUROSTRAND® OSB 4 TOP boards with building authority approval (Z-9.1-566) are suitable for this application.

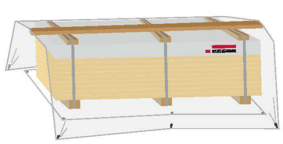
5

THE CERTIFICATES

- OSB/2, OSB 3 E0 and OSB 4 TOP CE certification by WKI Braunschweig
- F30/F60 test certificate for load-bearing, space-enclosing wall construction
- Environmental product declaration (EPD) including ecological balance sheet according to ISO 14040, Institut für Bauen und Umwelt e.V.
- FSC Controlled wood (CW) certificate
- Test certificate for ball-impact-resistant wall construction
- Food-safe test report
- ISO 9001 certification







WHAT TO WATCH FOR

STORAGE AND TRANSPORTATION

- Store in a dry place, lying flat on several squared timbers of uniform height - the maximum spacing between the squared timbers is 80 cm.
- The steel bands around the packages must be removed promptly upon reaching the fabricator.
- The boards should be installed under moisture conditions equivalent to their use. We expressly recommend a 48-hour acclimatisation period.
- The absorption of additional moisture, e.g. due to weather, is not recommended and must be prevented.

PACKAGING

EUROSTRAND® OSB boards are covered in cardboard as a package and secured with steel bands. Sanded tongue and groove boards are also packaged in stretch film or with protective edges.

UTILISATION AND DISPOSAL

Untreated wood-based materials may be used for material or thermal applications. Wood-based materials are assigned to the waste codes (EWC codes) 030105, 150103 and 170201.

6

DELIVERY PROGRAMME

EUROSTRAND® OSB 3 E0

Product / length × width (mm)	Board thickness d (mm)													
	6	8	9	10	11	12	15	18	20	22	25	30	35	40
Straight edge unsanded														
5,000 × 2,500						• *	• *	• *		• *				
5,000 × 1,250							• *			• *				
2,800 × 1,250						•	• *							
2,070 × 2,770						• *								
2,500 × 1,250	•	•	•	•	• **	•	•	•	• **	•	•			
T&G 4 sides unsanded														
2,500 × 1,250							•			•				
2,500 × 675						•	•	•		•	•			
1,830 × 675						• **	•	•		•				
T&G 4 sides sanded														
2,500 × 675						•	•	•		•	•			
1,830 × 675						• **	•	•		•				
T&G 2 sides unsanded														
2,440 × 1,205						•	•	•						

* per truck load minimum 24 to

** delivery on request, minimum order quantity = 250 m³

EUROSTRAND® OSB/2 EN 300

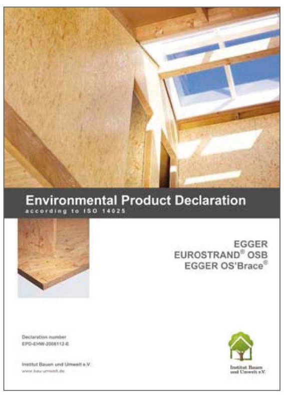
Product / length × width (mm)	Board thickness d (mm)													
	6	8	9	10	11	12	15	18	20	22	25	30	35	40
Straight edge unsanded														
2,440 × 1,220			•		•		•	•						
2,070 × 2,770								•						

Changes to the delivery programme reserved.

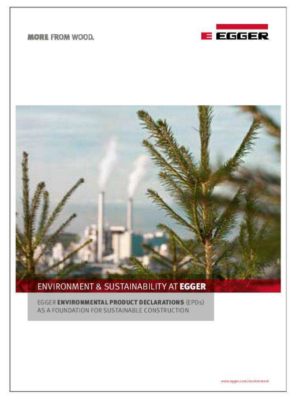
7

SUSTAINABLE

ENVIRONMENTAL PRODUCT DECLARATION
EUROSTRAND® OSB/2 AND OSB 3 E0



1 m³ (35 ⅓ cubic feet) of OSB from EGGER binds approximately 864 kg CO_2 (calculation based on GWP 100 production)

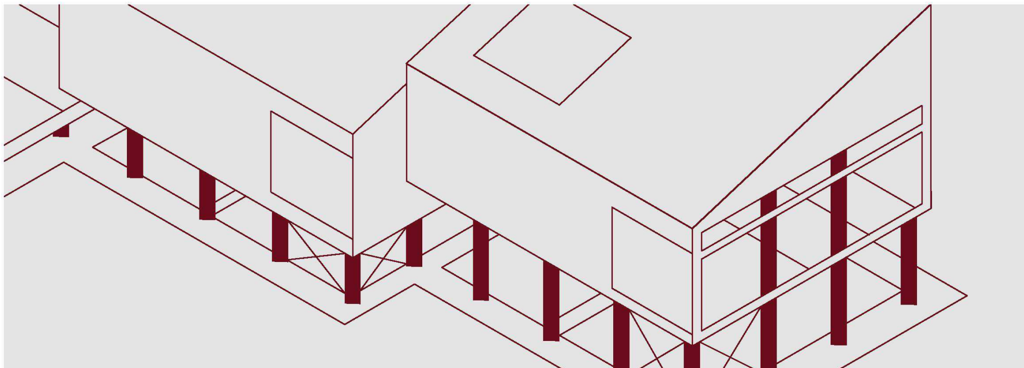


We had the sustainability and environmental compatibility of our products confirmed through independent tests and have disclosed this information in our environmental product declarations (EPDs).

These are used in certifying the sustainability of buildings. EPDs are available for all key EGGER product groups.

This corresponds to the average CO_2 emissions for a mid-size car over a distance of 6,647 km (calculation based on the planned European standard of 130 g – 4 ½ oz – CO_2 /km).

For more information, please consult the EGGER Environment & Sustainability brochure or visit www.egger.com



www.egger.com

TECHNICAL HOTLINE

T +49 3841 301-21260
F +49 3841 301-20222
construction@egger.com

EGGER Holzwerkstoffe Wismar
GmbH & Co. KG
Am Haffeld 1
23970 Wismar
Germany
T +49 3841 301-0
F +49 3841 301-20222
info-wis@egger.com

FRITZ EGGER GmbH & Co. OG
Holzwerkstoffe
Weiberndorf 20
6380 St. Johann in Tirol
Austria
T +43 50 600-0
F +43 50 600-10111
info-sjo@egger.com

Institut Bauen und Umwelt e.V.

qualityaustria SYSTEMZERTIFIZIERT ISO 9001:2000

APPENDIX B

Thermal Test Report – Complete Panel

TEST
REPORT
XC3143

Thermal Resistance Testing
For Vipac Engineers & Scientists Ltd

CSIRO Materials Science and Engineering
37 Graham Rd (PO Box 56) Highett VIC 3190 Australia tel +61 3 9252 6000 fax +61 3 9252 6011 http://www.cmmt.csiro.au/
QF-MST.004 revision 5 18/09/2006 http://www.csiro.au

CMSE Report XC3143

CSIRO

This Report is subject to binding obligations under which it was prepared. In particular, the Report must not be used:

- as a means of endorsement; or
- in a company prospectus or notification to a Stock Exchange document for capital raising, without the prior written consent of CSIRO.

The Report may be published verbatim and in full, provided that a statement is included on the publication that it is a copy of the Report issued by CSIRO.

Excerpts of the Report may not be published without the prior written consent of CSIRO

Client: Vipac Engineers & Scientists Ltd

ABN:

Contact: Michael Petrovic
Project engineer

Address: 279 Normanby Road
Port Melbourne Vic 3201

Tel: +61 3 9647 9783

Email: michaelp@Vipac.com.au

Report Author: **R E Clarke & G Eccleston**

Tel: 03 9252 6362

Fax: 03 9252 6011

Date of Report: 19 June 2012

CMSE Report XC3143

Measurement Report XC 3143- Thermal Transmission Properties of an Ozone Building Panel

Summary

This is a report of measurements performed in a CSIRO laboratory at Highett to determine the thermal properties of a timber-faced building panel with a foamed-polyurethane core.

The measurements have been performed using a heat flow meter apparatus and are in general accordance with **ASTM C 518 Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus**.

This is one of the allowable test methods for the measurement of formed shape (panel or sheet) material for compliance with **AS/NZS 4859.1 Materials for the Thermal Insulation of Buildings Part 1: General criteria and technical provisions**. However, building authorities might require that testing laboratories are formally accredited by the National Association of Testing Laboratories (NATA) for such measurements. The CSIRO Highett Laboratory does not have accreditation for this type of measurement.

Table 1 below summarizes results. It is provided for convenience and is not intended to be used as a certificate or in isolation without the full details. These are given on the listed page and may describe special provisions or limitations that apply.

Table 1. *Measurement results of a Ozone Building Panel*

Page	Measurement Number	Thickness (mm)	Thermal Resistance (m^2.K/W)	Thermal Conductivity (W/m.K)
5	FX6-0064	118.6	3.99	0.0298

CMSE Report XC3143

Background to Measurements

The measurements and procedures reported herein are in generally accordance with the Australian and New Zealand standard **AS/NZS 4859.1 Materials for the Thermal Insulation of Buildings Part 1: General criteria and technical provisions**. However, this standard states that testing shall be performed by a recognized laboratory. The CSIRO laboratories at Highett do not have NATA accreditation and may therefore not be regarded as having this recognition.

AS/NZS 4859.1 requires measurement of formed shapes (panels or sheets) to be in accordance with one of a number of acceptable standard test methods. The method that has been used for the measurements described in this report is the American (USA) standard **ASTM C 518 Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus**. CSIRO test methods and apparatus may include minor modifications to improve practicality and accommodate a wider range of test samples or test conditions. Whilst these may be outside of **ASTM C 518**, CSIRO believes that effective compliance with the standard has been retained.

Older existing standards or specifications may call for compliance with obsolete Australian Standards **AS 2464.5-1985 or AS 2464.6-1983**, or standards that employ other test methods, such the “guarded hot plate method” specified in **ASTM C 177.** For all practical purposes **ASTM C 518** may be regarded as a satisfactory alternative to all of these methods.

CSIRO Highett Laboratories maintain several apparatus complying with **ASTM C 518**. The measurement process involves locating the sample between two flat plates with adjustable spacing, maintained at different temperatures. Thermal properties are derived from measured heat flow through a metering area at the centre of the plates. The largest apparatus has plates 610 mm square with heat flow meters in both top and bottom plates. The use of multiple heat flow meters improves precision and accuracy. The smallest apparatus has a 305 mm square plate assembly and a single 100 mm square heat flow meter. Both apparatus operate with the plates horizontally. Plate temperature may be varied between approximately 10°C and 60°C. Usually 13 °C and 33 °C are used for the cold and hot plates respectively, giving the standard mean sample temperature of 23 °C.

Sample size may range from 2 mm thick and 200 mm square to 200 mm thick and 620 mm square. Thermal resistance should lie between approximately 0.05 and 6.0 m^2.K/W. Uncertainty may be as low as ± 3% for uniform homogeneous material of intermediate thermal resistance. This may increase to ± 25% for non-uniform samples or those at the measurement extremes.

Heat flow meter and hot plate methods are both unsuitable for materials that are non-uniform on a scale larger than the size of the metered area. This includes many typical built-up products, including those with reflecting or non-reflecting airspaces larger than the metered area, which may additionally include loose fill materials. Such products or assemblies should be measured by the guarded hot box or calibrated hot box methods.

AS/NZS 4859 includes numerous requirements that are outside the scope of this report. This report deals only with thermal performance requirements.

CMSE Report XC3143

Lab Measurement FX6-0064

Sample Description and Identification

The Ozone panel consists of two panels of 15mm Oriented Strand Board bonded to either side of a 90mm core of closed cell polyester foam.

Apparatus

The measurements were performed using a calibrated Fox 600 heat flow meter apparatus, incorporating two 254 mm-square heat flow meters.

Preparation and Measurement Details

The sample was not conditioned before measurement. The existence of the oriented strand board facings precluded independent measurement of the density of either the chipboard material or the foam core. Density values are therefore not presented/

The heat flow direction was upwards, with the cold plate at the top. Monitoring was continued for approximately 4 hours, at which time heat flow through the test sample had stabilized.

There was almost 6% difference between upper and lower heat flows, suggesting some non-uniformity in the density and thermal conductivity of the foam.

Measurements

Date of measurement	19 June 2012
Ambient temperature & humidity	22°C, 37 %
Mean thickness	118.6 mm
Length x width	600 mm x 600 mm
Weight	8.46 kg (including chipboard facings)
Plate spacing	118.6 mm
Sample hot surface temperature	33.0 °C
Sample cold surface temperature	13.0 °C
Sample temperature difference	20.0 K
Sample mean temperature	23.0 °C
Mean heat flow	5.02 W/m^2
Mean variation between upper and lower heat flows	5.9 %
Mean thermal conductance	0.2519 W/m^2.K ± 5 %
Apparent thermal conductivity	0.0298 W/m.K ± 8 %
Mean thermal resistance (R value)	3.99 m^2.K/W ± 5 %

CMSE Report XC3143

Validity of Test Results

All of the material characteristics and test conditions that have been quoted in association with the preceding measurements may affect the value of the measured properties to some degree. In relation to thermal properties of the samples tested, the characteristics that are most critical are the thickness, the density and composition of the material.

Results for the particular sample or samples given in this report might be used to infer the performance properties of products or materials that the samples are said to represent. This intent is presumed in **AS/NZS 4859**, where it states that any changes made by the manufacturer to formulation or design that may affect the performance shall invalidate these test results. In fact, such changes do not invalidate the test results but they do invalidate the inference that the results apply to those products or materials. Whilst this stipulation in **AS/NZS 4859** is reasonable, it does not mean that the results given in this report apply to particular products or materials simply because the test samples are said to have been taken from a production run or have the same formulation or design. On the contrary, reported properties apply only to test samples as measured. It would be outside the scope of this report and the work that has been performed to make any inference concerning the properties of other products or materials. Such inference requires an additional process such as a quality assurance, accreditation or compliance scheme, of which this report may be part. This is likely to involve statistical sampling and multiple testing to assess variability and to set confidence levels. These matters are the responsibility of the client.

Thermal Test Report – OSB

CSIRO

TEST REPORT

XC3143R1

Thermal Resistance Testing
For Vipac Engineers & Scientists Ltd

CSIRO Materials Science and Engineering
37 Graham Rd (PO Box 56) Highett VIC 3190 Australia tel +61 3 9252 6000 fax +61 3 9252 6011 http://www.cmmt.csiro.au/
QF-MST.004 revision 5 18/09/2006 http://www.csiro.au

CMSE Report XC3143R1

This Report is subject to binding obligations under which it was prepared. In particular, the Report must not be used:

- as a means of endorsement; or
- in a company prospectus or notification to a Stock Exchange document for capital raising, without the prior written consent of CSIRO.

The Report may be published verbatim and in full, provided that a statement is included on the publication that it is a copy of the Report issued by CSIRO.

Excerpts of the Report may not be published without the prior written consent of CSIRO

Client: Vipac Engineers & Scientists Ltd

ABN:

Contact: Michael Petrovic
Project engineer

Address: 279 Normanby Road
Port Melbourne Vic 3201

Tel: +61 3 9647 9783

Email: michaelp@Vipac.com.au

Report Author: **R E Clarke & G Eccleston**

Tel: 03 9252 6362

Fax: 03 9252 6011

Date of Report: 26 Ju;y 2012

Note Peport XC3143R1 is a supplement to XC3143 as requested by client to obtain the R Value of the chipboard facing

CMSE Report XC3143R1

**Measurement Report XC 3143- Thermal Transmission
Properties of a single layer of 15 mm Orientated Strand board from previously tested
Ozone Building Panel**

Summary

This is a report of measurements performed in a CSIRO laboratory at Highett to determine the thermal properties of 15 mm Orientated Strand board from previously tested Ozone Building Panel.

The measurements have been performed using a heat flow meter apparatus and are in general accordance with **ASTM C 518 Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus**.

This is one of the allowable test methods for the measurement of formed shape (panel or sheet) material for compliance with **AS/NZS 4859.1 Materials for the Thermal Insulation of Buildings Part 1: General criteria and technical provisions**. However, building authorities might require that testing laboratories are formally accredited by the National Association of Testing Laboratories (NATA) for such measurements. The CSIRO Highett Laboratory does not have accreditation for this type of measurement.

Table 1 below summarizes results. It is provided for convenience and is not intended to be used as a certificate or in isolation without the full details. These are given on the listed page and may describe special provisions or limitations that apply.

Table 1. *Measurement results of a 15 mm Orientated Strand board from previously tested Ozone Building Panel*

Page	Measurement Number	Thickness (mm)	Thermal Resistance (m^2.K/W)	Thermal Conductivity (W/m.K)
5	FX6-0070	15.2	0.190	0.0800

CMSE Report XC3143R1

Background to Measurements

The measurements and procedures reported herein are in generally accordance with the Australian and New Zealand standard **AS/NZS 4859.1 Materials for the Thermal Insulation of Buildings Part 1: General criteria and technical provisions**. However, this standard states that testing shall be performed by a recognized laboratory. The CSIRO laboratories at Highett do not have NATA accreditation and may therefore not be regarded as having this recognition.

AS/NZS 4859.1 requires measurement of formed shapes (panels or sheets) to be in accordance with one of a number of acceptable standard test methods. The method that has been used for the measurements described in this report is the American (USA) standard **ASTM C 518 Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus**. CSIRO test methods and apparatus may include minor modifications to improve practicality and accommodate a wider range of test samples or test conditions. Whilst these may be outside of **ASTM C 518**, CSIRO believes that effective compliance with the standard has been retained.

Older existing standards or specifications may call for compliance with obsolete Australian Standards **AS 2464.5-1985 or AS 2464.6-1983**, or standards that employ other test methods, such the "guarded hot plate method" specified in **ASTM C 177.** For all practical purposes **ASTM C 518** may be regarded as a satisfactory alternative to all of these methods.

CSIRO Highett Laboratories maintain several apparatus complying with **ASTM C 518**. The measurement process involves locating the sample between two flat plates with adjustable spacing, maintained at different temperatures. Thermal properties are derived from measured heat flow through a metering area at the centre of the plates. The largest apparatus has plates 610 mm square with heat flow meters in both top and bottom plates. The use of multiple heat flow meters improves precision and accuracy. The smallest apparatus has a 305 mm square plate assembly and a single 100 mm square heat flow meter. Both apparatus operate with the plates horizontally. Plate temperature may be varied between approximately 10°C and 60°C. Usually 13 °C and 33 °C are used for the cold and hot plates respectively, giving the standard mean sample temperature of 23 °C.

Sample size may range from 2 mm thick and 200 mm square to 200 mm thick and 620 mm square. Thermal resistance should lie between approximately 0.05 and 6.0 m^2.K/W. Uncertainty may be as low as ± 3% for uniform homogeneous material of intermediate thermal resistance. This may increase to ± 25% for non-uniform samples or those at the measurement extremes.

Heat flow meter and hot plate methods are both unsuitable for materials that are non-uniform on a scale larger than the size of the metered area. This includes many typical built-up products, including those with reflecting or non-reflecting airspaces larger than the metered area, which may additionally include loose fill materials. Such products or assemblies should be measured by the guarded hot box or calibrated hot box methods.

AS/NZS 4859 includes numerous requirements that are outside the scope of this report. This report deals only with thermal performance requirements.

CMSE Report XC3143R1

Lab Measurement FX6-0070

Sample Description and Identification

The sample was an oriented strand board, approximately 15 mm thick, forming a test panel 600 mm x 600 mm. It was given the laboratory identification number 120724A.

The 15 mm Orientated Strand board was removed from the previously tested Ozone Building Panel, which CSIRO had previously tested (refer to report XC3143).

Apparatus

The measurements were performed using a calibrated Fox 600 heat flow meter apparatus, incorporating two 254 mm-square heat flow meters.

Preparation and Measurement Details

The sample was not conditioned before measurement.

The heat flow direction was upwards, with the cold plate at the top. Monitoring was continued for approximately 2 hours, at which time heat flow through the test sample had stabilized.

There was about 3% difference between upper and lower heat flows, suggesting reasonable uniformity in the density and thermal conductivity of the material.

Measurements

Date of measurement	24 July 2012
Ambient temperature & humidity	20°C, 45 %
Mean thickness	15.2 mm
Length x width	600 mm x 600 mm
Weight	3.26 kg
Density	596 kg/m^3
Plate spacing	15.2 mm
Sample hot surface temperature	33.0 °C
Sample cold surface temperature	13.0 °C
Sample temperature difference	20.0 K
Sample mean temperature	23.0 °C
Mean heat flow	106.7 W/m^2
Mean variation between upper and lower heat flows	3.3 %
Mean thermal conductance	5.25 W/m^2.K ± 5 %
Apparent thermal conductivity	0.0800 W/m.K ± 8 %
Mean thermal resistance (R value)	0.190 m^2.K/W ± 5 %

CMSE Report XC3143R1

Validity of Test Results

All of the material characteristics and test conditions that have been quoted in association with the preceding measurements may affect the value of the measured properties to some degree. In relation to thermal properties of the samples tested, the characteristics that are most critical are the thickness, the density and composition of the material.

Results for the particular sample or samples given in this report might be used to infer the performance properties of products or materials that the samples are said to represent. This intent is presumed in **AS/NZS 4859**, where it states that any changes made by the manufacturer to formulation or design that may affect the performance shall invalidate these test results. In fact, such changes do not invalidate the test results but they do invalidate the inference that the results apply to those products or materials. Whilst this stipulation in **AS/NZS 4859** is reasonable, it does not mean that the results given in this report apply to particular products or materials simply because the test samples are said to have been taken from a production run or have the same formulation or design. On the contrary, reported properties apply only to test samples as measured. It would be outside the scope of this report and the work that has been performed to make any inference concerning the properties of other products or materials. Such inference requires an additional process such as a quality assurance, accreditation or compliance scheme, of which this report may be part. This is likely to involve statistical sampling and multiple testing to assess variability and to set confidence levels. These matters are the responsibility of the client.