

Date of issue: 2 December 2019

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SEALCO Ltd  
Christchurch.

## BTS1793-1 CERTIFICATE OF TEST: TR-191108-1

### A measurement of the thermal conductivity of 50mm Lexboard for SEALCO Ltd

#### 1. Objective:

- 1.1 BEAL Testing Services were contracted by SEALCO Ltd. to verify that use of 50mm thick Lexboard will contribute to a building meeting the “building performance index” requirement of the New Zealand Building Code.
- 1.2 Testing was carried out to measure the thermal conductivity ( $\lambda$ ) and calculated thermal resistance (R) of the 50mm thick Lexboard.

#### 2. Methodology:

- 2.1 BEAL TP-117 Ver 2.1, Thermal Conductivity of Solid Insulation Materials, is test procedure in conformance with:

<b>ISO 8302</b>	Thermal Insulation Determination of Steady-State Thermal Resistance and Related Properties - Guarded Hot Plate Apparatus
<b>ASTM C177</b>	Test method for steady-State Heat Flux Measurements And Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus

- 2.2 Reference documents,

<b>AS/NZS 4859.1:2002</b>	Materials for thermal insulation of buildings Part 1: General criteria and technical provisions
<b>ASTM C 168</b>	Standard Terminology Relating to Thermal Insulation

- 2.3 The result from testing is a measurement of the thermal conductivity of the selected material.

#### 3. Test Equipment:

- 3.1 All the measuring equipment used had a valid calibration.

3.2 Use was made of a Lambda thermal conductivity tool EP500e, SHIMADZU balance and other measuring devices.

3.3 Test equipment conforms to the requirement set out in Section 6 of ASTM C177-10

#### **4. Test Specimen:**

4.1 Samples/specimens were supplied by the client according to METHOD A of BEAL's Sampling Procedure TP115.

4.2 Samples were prepared in accordance with the tool manufacturer's instructions, described in the Lambda-Meßtechnik GmbH's (Tool) Instruction Manual.

4.3 The relevant test temperature(s) selected were 10°, 15° and 23° C with 15°K difference.

4.4 The outer "skin" of the Lexboard was removed to ensure the measurements represented the inner insulation material only.

#### **5. Specimen Conditioning – if any:**

5.1 Specimens were prepared at room conditions.

#### **6. Test Criterion:**

6.1 Unless specified by the client or selected by BEAL, the results obtained from this test procedure were assessed by a person with appropriate experience and skills.

#### **7. Limitations – if any:**

7.1 This method is based on use of the Lambda Thermal Conductivity Test Tool EP500e, capable of providing thermal testing for flat, homogeneous specimens at a dimension of up to 500 x 500mm or 200mm x 200mm (WxL). Thickness can be varied from 10mm to 200mm depending on specimen size.

#### **8. Specimen Preparation:**

8.1 Initially specimens of 500 mm x 500 mm were tested. Owing to the non-linearity of results, specimens of 200 mm x 200 mm were then prepared and tested.

#### **9. Test Conditions:**

9.1 Testing was conducted at room temperature.

**10. Test Result:**

**11.**

Specimen#	Specimen Size	Measured thermal conductivity: mW/(m°K)
S1086-2	500 mm x 500 mm	24.06
S1086-3	500 mm x 500 mm	22.85
S1086-3A	200 mm x 200 mm	23.34
S1086-3B*	200 mm x 200 mm	23.40
S1086-5A	200 mm x 200 mm	24.68
S1086-5B*	200 mm x 200 mm	23.24
* different orientation		Average 23.60; SD = 0.66

$\lambda_{Avg}$ @ 15 °C	23.60
R-Value@ 50mm	2.12

**12. Comment:**

- 12.1 The non-linearity of thermal measurements covering 10°, 15° and 23°C was found in both 500 mm x 500 mm and 200 mm x 200 mm size specimens.
- 12.2 On the other hand, it was noted that the standard deviation for measurements made at 15°C was relatively small.

**13. Attachments:**

- 13.1 Test Report generated by the Lambda machine

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**Date** 15/11/2019  
**Report no.** S1086-2-TR191114-1  
**Test owner** BEAL Testing Services  
**Test tool** Thermal Conductivity Meter 'lambda-Meter EP500e' acc. to EN 1946-2 by Lambda-Messtechnik GmbH Dresden  
**Test arrangement** Sensor plates horizontal, hot plate on top

**Standards** Thickness measurement acc. to EN 823  
 Thermal conductivity measurement acc. to ISO 8302 and EN 12667

**Tester**

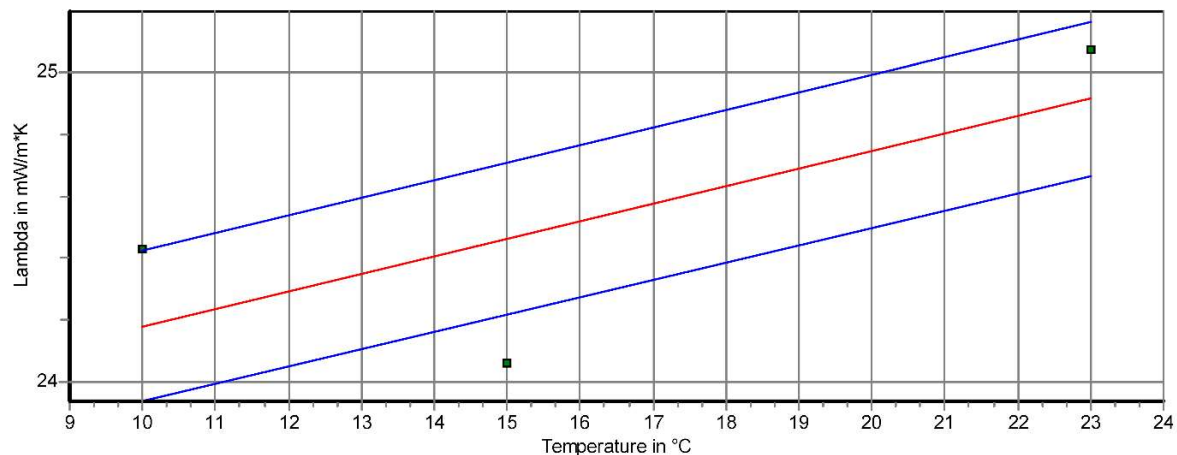
<b>Specimen designation</b>	S1086-2	<b>Specimen dimension</b>	
<b>Origin of specimen</b>	Samples supplied by client	<b>Area</b>	500 mm x 500 mm
<b>Date of manufact.</b>		<b>Thickness</b>	51.8 mm
<b>Material name</b>	Polyurethane Foam Insulation	<b>Nominal thickness</b>	50 mm
<b>Material description</b>	Lexboard	<b>Specimen mass</b>	592.3 g
		<b>Raw density</b>	45.7 kg/m <sup>3</sup>

**Spec. pre-conditioning**

**Change in mass during:**  
 drying  
 test

**Humidity before test**

**Pressure** 500 Pa



	1. Test	2. Test	3. Test
<b>Test no.</b>	TR191114-	TR191114-	TR191114-
<b>Meas.temp. in °C</b>	10	15	23
<b>Diff.temp. in K</b>	15	15	15
<b>Lambda in mW/m*K</b>	24.43	24.06	25.07
<b>R in m<sup>2</sup>K/W</b>	2.1203	2.153	2.0662

**Polynomial**  
 $y = f(T) = 0.0564 * T + 23.62$

**Lambda-10** 24.18 mW/(m\*K)  
**R-10** 2.1423 m<sup>2</sup>K/W  
**TC** 0.0564 mW/(m\*K<sup>2</sup>)

**Date** 19/11/2019  
**Report no.** S1086-3A-TR191118-1  
**Test owner** BEAL Testing Services  
**Test tool** Thermal Conductivity Meter 'lambda-Meter EP500e' acc. to EN 1946-2 by Lambda-Messtechnik GmbH Dresden  
**Test arrangement** Sensor plates horizontal, hot plate on top

**Standards** Thickness measurement acc. to EN 823  
 Thermal conductivity measurement acc. to ISO 8302 and EN 12667

**Tester**

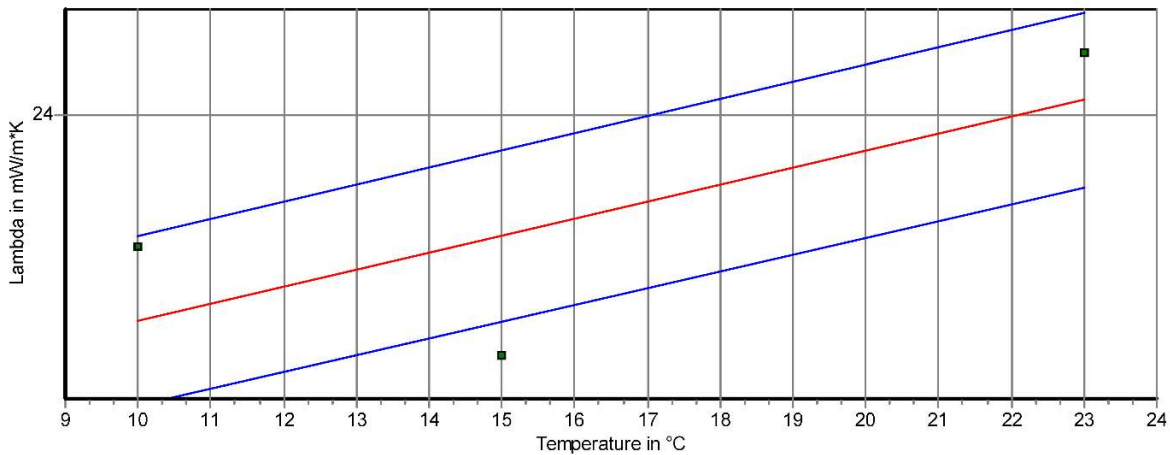
<b>Specimen designation</b>	S1086-3A	<b>Specimen dimension</b>	
<b>Origin of specimen</b>	Samples supplied by client	<b>Area</b>	200 mm x 200 mm
<b>Date of manufact.</b>		<b>Thickness</b>	50.77 mm
<b>Material name</b>	Polyurethane Foam Insulation	<b>Nominal thickness</b>	50 mm
<b>Material description</b>	Lexboard	<b>Specimen mass</b>	92.81 g
		<b>Raw density</b>	45.7 kg/m <sup>3</sup>

**Spec. pre-conditioning**

**Change in mass during:**  
 drying  
 test

**Humidity before test**

**Pressure** 2500 Pa



	1. Test	2. Test	3. Test
<b>Test no.</b>	TR191118-	TR191118-	TR191118-
<b>Meas.temp. in °C</b>	10	15	23
<b>Diff.temp. in K</b>	15	15	15
<b>Lambda in mW/m²K</b>	23.64	23.34	24.17
<b>R in m²K/W</b>	2.1476	2.1752	2.1005

**Polynomial**  
 $y = f(T) = 0.0466 * T + 22.97$

**Lambda-10** 23.44 mW/(m²K)  
**R-10** 2.1660 m²K/W  
**TC** 0.0466 mW/(m²K²)

Date 22/11/2019  
 Report no. S1086-3B-TR191119-1  
 Test owner BEAL Testing Services  
 Test tool Thermal Conductivity Meter 'lambda-Meter EP500e' acc. to EN 1946-2 by Lambda-Messtechnik GmbH Dresden  
 Test arrangement Sensor plates horizontal, hot plate on top

Standards Thickness measurement acc. to EN 823  
 Thermal conductivity measurement acc. to ISO 8302 and EN 12667

Tester

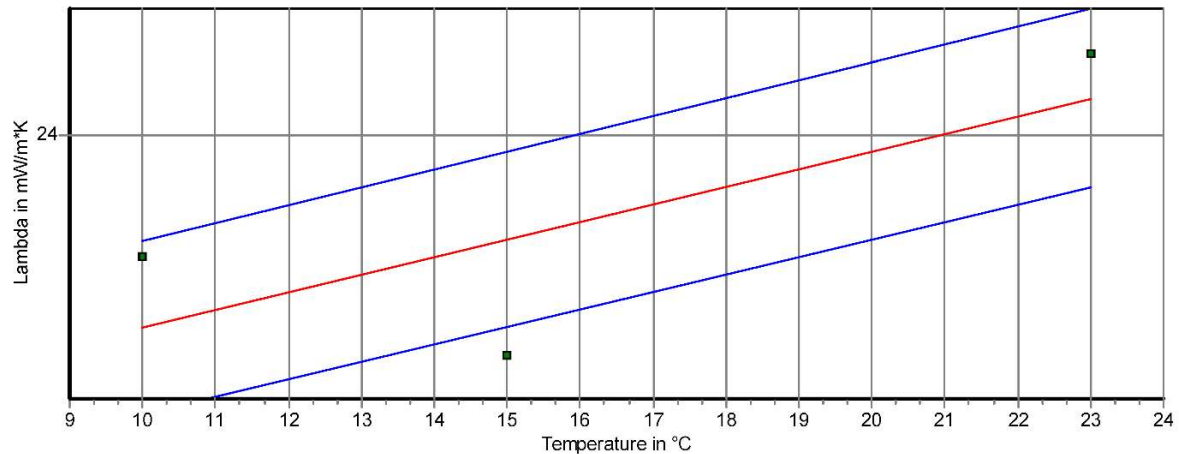
<b>Specimen designation</b>	S1086-3B	<b>Specimen dimension</b>	
<b>Origin of specimen</b>	Samples supplied by client	<b>Area</b>	200 mm x 200 mm
<b>Date of manufact.</b>		<b>Thickness</b>	50.53 mm
<b>Material name</b>	Polyurethane Foam Insulation	<b>Nominal thickness</b>	50 mm
<b>Material description</b>	Lexboard	<b>Specimen mass</b>	92.81 g
		<b>Raw density</b>	45.9 kg/m <sup>3</sup>

Spec. pre-conditioning

Change in mass during:  
 drying  
 test

Humidity before test

Pressure 2500 Pa



	1. Test	2. Test	3. Test
Test no.	TR191119-	TR191119-	TR191119-
Meas.temp. in °C	10	15	23
Diff.temp. in K	15	15	15
Lambda in mW/m*K	23.67	23.4	24.22
R in m <sup>2</sup> K/W	2.1348	2.1594	2.0863

Polynomial  
 $y = f(T) = 0.0479 * T + 23.00$

Lambda-10 23.48 mW/(m\*K)  
 R-10 2.1520 m<sup>2</sup>K/W  
 TC 0.0479 mW/(m\*K<sup>2</sup>)

# Test report



Test report acc. EN 12667 and EN12664 paragraph 9

**Date** 25/11/2019  
**Report no.** S1086-5B-TR191125-1  
**Test owner** BEAL Testing Services  
**Test tool** Thermal Conductivity Meter 'lambda-Meter EP500e' acc. to EN 1946-2 by Lambda-Messtechnik GmbH Dresden  
**Test arrangement** Sensor plates horizontal, hot plate on top

**Standards** Thickness measurement acc. to EN 823  
 Thermal conductivity measurement acc. to ISO 8302 and EN 12667

**Tester**

<b>Specimen designation</b>	S1086-5B	<b>Specimen dimension</b>	
<b>Origin of specimen</b>	Samples supplied by client	<b>Area</b>	200 mm x 200 mm
<b>Date of manufact.</b>		<b>Thickness</b>	49.62 mm
<b>Material name</b>	Polyurethane Foam Insulation	<b>Nominal thickness</b>	50 mm
<b>Material description</b>	Lexboard	<b>Specimen mass</b>	g
		<b>Raw density</b>	kg/m <sup>3</sup>

**Spec. pre-conditioning**

**Change in mass during:**  
 drying  
 test

**Humidity before test**

**Pressure** 2500 Pa

## 1. Test

<b>Test no.</b>	TR191125-1_15
<b>Meas.temp. in °C</b>	15
<b>Diff.temp. in K</b>	15
<b>Lambda in mW/m*K</b>	23.24
<b>R in m<sup>2</sup>K/W</b>	2.1351

<b>Lambda-10</b>	0.00 mW/(m*K)
<b>R-10</b>	0.0000 m <sup>2</sup> K/W
<b>TC</b>	0.0000 mW/(m*K <sup>2</sup> )