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Vipac Engineers & Scientists

Alsynite

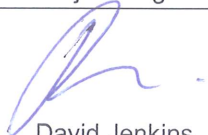
Alsynite - Roof Panel Testing

Panel Testing of 2400GSM & 3660GSM Roof Sheet

30B-13-0122-TRP-822248-0

14 Aug 2014



Report Title: Panel Testing of 2400GSM & 3660GSM Roof Sheet Job Title: Alsynite - Roof Panel Testing														
DOCUMENT NO: 30B-13-0122-TRP-822248-0 PREPARED FOR: Alsynite PO Box 10409 Hamilton New Zealand CONTACT: Craig Roulston Tel: +64 7 850 5088 Fax: +64 7 850 5003	REPORT CODE: TRP PREPARED BY: Vipac Engineers & Scientists Ltd. 279 Normanby Rd, Port Melbourne, VIC 3207, Australia Tel: +61 3 9647 9700 Fax: +61 3 9646 4370													
PREPARED BY:  Kieron Wood (for Michael Petrovic) Project Engineer, Mechanical Testing Date: 14 Aug 2014														
AUTHORISED BY:  David Jenkins Director Date: 14 Aug 2014														
REVISION HISTORY <table border="1"><thead><tr><th>Revision No.</th><th>Date Issued</th><th>Reason/Comments</th></tr></thead><tbody><tr><td>0</td><td>14/08/2014</td><td>Initial Issue</td></tr><tr><td>1</td><td></td><td></td></tr><tr><td>2</td><td></td><td></td></tr></tbody></table>			Revision No.	Date Issued	Reason/Comments	0	14/08/2014	Initial Issue	1			2		
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1														
2														
DISTRIBUTION <table border="1"><thead><tr><th>Copy No. __2__</th><th>Location</th></tr></thead><tbody><tr><td>1</td><td>Project</td></tr><tr><td>2</td><td>Client (PDF Format) Uncontrolled Copy</td></tr></tbody></table>			Copy No. __2__	Location	1	Project	2	Client (PDF Format) Uncontrolled Copy						
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EXECUTIVE SUMMARY

Vipac Engineers & Scientists Pty Ltd (Vipac) has been commissioned by Alsynite to perform mechanical testing on their 2400 & 3660 GSM roof sheeting products. Testing was carried out in accordance with the relevant ASTM and AS/NZS standards. The results of this testing are provided in the following sections of this report.



TABLE OF CONTENTS

1	INTRODUCTION	5
2	TEST SPECIMENS	5
3	VIPAC TEST RESULTS	6
3.1	Impact Strength Test Results	6
3.2	Shear Strength Test Results	7
APPENDIX A: INTERTEK TEST REPORT		9

1 INTRODUCTION

Vipac Engineers & Scientists Pty Ltd (Vipac) has been commissioned by Alsynite to perform mechanical testing on their 2400 & 3660 GSM roof sheeting products. Testing was carried out in accordance with the relevant ASTM and AS/NZS standards. The results of this testing are provided in the following sections of this report.

The following tests were carried out at the request of the client. The referenced documents are presented below. A number of the tests Vipac were unable to complete. For these tests, Vipac contracted an external lab to perform these tests. The results of these tests are presented in Appendix A: Intertek Test Report, included at the rear of this test report.

Component Test		Test Standard
1	Impact Resistance	AS/NZS 4257.6:1994
2	Shear Strength	ASTM D732-10
3	Compressive Strength	ISO 604-2003
4	Flexural Strength	ASTM D790-10
5	Specific Gravity	ASTM D792-08
6	Tensile Strength	ISO 527-1 & ISO 527-2
7	Coefficient of Linear Expansion	ASTM D696-98
8	Thermal Conductivity	C518-10

Table 1: List of tests and referenced documents required by the client

2 TEST SPECIMENS

The materials for testing were production samples as provided by the client. Two materials were submitted:

- Alsynite Topglass 2400 GSM
- Alsynite Topglass 3660 GSM Ultrasafe

The testing was carried out on each of the materials listed above.

50 x 50mm flat square specimens for testing were cut from each of the above materials. These test specimens were used for the impact strength testing and the shear strength testing as described in Sections 3.1 and 3.2 of this test report.

For the tests that Vipac were not able to complete, test specimens were provided to an external lab as supplied by the client.

3 VIPAC TEST RESULTS

3.1 Impact Strength Test Results

In order to achieve a minimum impact energy of 1.96 Joules as specified in AS/NZS 4256.3 a cylindrical mass was dropped from a predetermined height onto the impact hammer using the test apparatus shown below. The following table presents the test parameters that were used.

Parameter	Value	Units	Notes
Mass	0.223	kg	
Drop Height	0.905	m	
a_{gravity}	9.81	m/s ²	
E_{Impact}	1.98	J	$E = \text{mass} \times \text{height} \times \text{gravitational acceleration}$
Number of Samples Tested	80	-	2400GSM x40 & 3660GSM x40
Number of Failed Samples	0	-	

Table 2: Test parameters used for impact testing

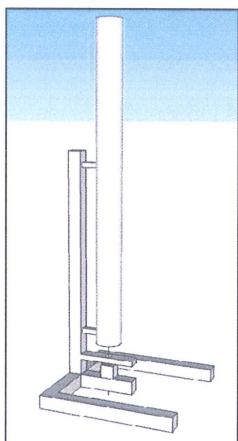


Figure 1: Representation of the test rig that was used for the impact testing

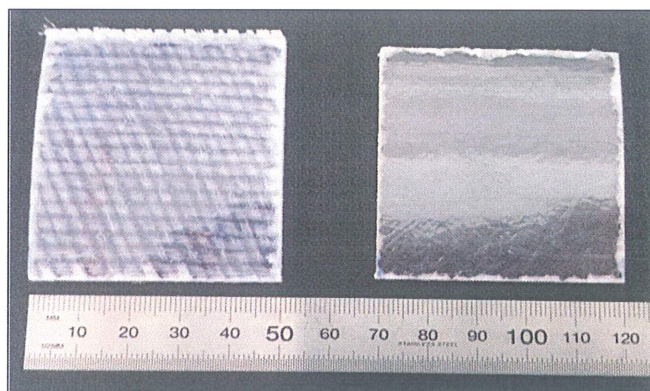


Figure 2: Typical test specimens prior to testing. 3660GSM (left) & 2400GSM (right)

40 test specimens were used for each material (2400GSM and 3660GSM). Each test specimen was subjected to one impact according to the parameters presented in **Table 2** above. Each test specimen was inspected after impact to check for fracture or rupture.

No failures were observed after the testing was completed thus the samples are considered to have passed.

3.2 Shear Strength Test Results

Shear strength testing was carried out using an Instron tensile and compressive strength testing machine. Five test specimens of each material were used for the testing. The image below represents how the testing was carried out. Testing was carried out in accordance with ASTM D732-10.

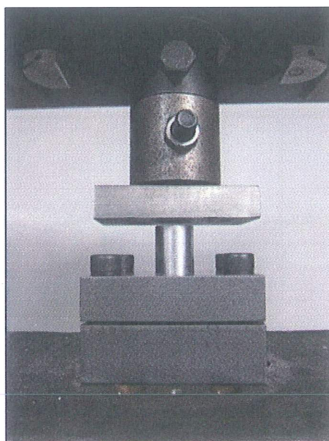


Figure 3: Punch-Type Shear Tool used for testing the material specimens

The following tables provide the results of the shear strength testing.

Test Parameters		
Material	2400	GSM
Thickness	1.47	mm
Punch Diameter	25.02	mm

Test Results		
	Max Load (N)	Shear Strength (MPa)
Sample 1	7,617	65.9
Sample 2	9,872	85.4
Sample 3	9,847	85.2
Sample 4	8,036	69.6
Sample 5	9,593	83.0
Average	8,993	77.8

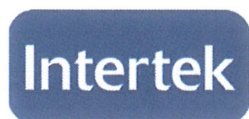
Table 3: Test Parameters and results of the 2400 GSM material shear strength tests

Test Parameters		
Material	3660	GSM
Thickness	1.47	mm
Punch Diameter	25.02	mm

Test Results		
	Max Load (N)	Shear Strength (MPa)
Sample 1	15,863	82.7
Sample 2	14,499	75.6
Sample 3	15,873	82.8
Sample 4	17,112	89.2
Sample 5	14,659	76.4
Average	15,601	81.3

Table 4: Test Parameters and results of the 3660 GSM material shear strength tests

Appendix A: INTERTEK TEST REPORT



VIPAC ENGINEERS & SCIENTISTS
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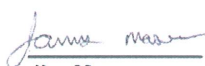
Report No.: 101528752GRR-001
Quote No.: 500495023
Page 1 of 9

Test Report For:

VIPAC ENGINEERS & SCIENTISTS

**Compressive Strength, Flexural Strength, Specific Gravity,
Water Absorption, Coefficient of Linear Expansion,
Thermal Transmission, Tensile Properties**

Roofing Profile



Jim Mason
Reviewer



Jeremy Hanson
Project Engineer

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Page 2 of 9

Attention: Mr. Michael Petrovic
VIPAC ENGINEERS & SCIENTISTS
279 Normanby Road
Private Bag 16
Phone: 03 9647 9783
Email: michaelp@vipac.com.au

DATE RECEIVED: 02/04/14
DATES TESTED: 03/19/14 – 05/28/14

DESCRIPTION OF SAMPLES:

Part Description: Roofing Profile
Material Submitted: Alsynite Topglass 2400 GSM
Alsynite Topglass 3660 GSM Ultrasafe
Material Specification: None Stated
Condition of Samples: Production

WORK REQUESTED/APPLICABLE DOCUMENTS:

Compressive Strength: ISO 604-2003
Flexural Strength: ASTM D790-10
Specific Gravity: ASTM D792-08
Coefficient of Linear Expansion: ASTM D696-98
Thermal Transmission: ASTM C518-10
Tensile Properties: ISO 527-1 & ISO 527-2

CONCLUSION:

Compressive Strength: See Corresponding Test Section
Flexural Strength: See Corresponding Test Section
Specific Gravity: See Corresponding Test Section
Coefficient of Linear Expansion: See Corresponding Test Section
Thermal Transmission: See Corresponding Test Section
Tensile Properties: See Corresponding Test Section

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PO No: 343709-0

Report No.: 101528752GRR-001

Quote No.: 500495023

Page 3 of 9

COMPRESSIVE STRENGTH TEST PROCEDURE:

Date Received: 02/04/14

Date Tested: 05/06/14

Description of Samples:

Part Description: Roofing Profile

Material Submitted: Alsynite Topglass 2400 GSM

Alsynite Topglass 3660 GSM Ultrasafe

Material Specification: None Stated

Condition of Samples: Production

Test Procedure:

Test Method: ISO 604-2003

Sample Dimensions: 10mm x 10mm

Test Speed: 1.0 mm/min

Conditioning: 40 hours at $23 \pm 2^{\circ}\text{C}$ and $50 \pm 5\%$ R.H.

Number of Specimens Tested: Ten (10); Five (5) from Two (2) materials

Acceptance Criteria:

None Stated

Results:

Material	Sample	Compressive Strength, MPa
Alsynite Topglass 2400 GSM	1	123
	2	116
	3	162
	4	136
	5	86
	Mean	124
Alsynite Topglass 3660 GSM Ultrasafe	1	127
	2	180
	3	199
	4	183
	5	141
	Mean	166



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Date: July 16, 2014

PO No: 343709-0

Report No.: 101528752GRR-001

Quote No.: 500495023

Page 4 of 9

FELXURAL STRENGTH TEST PROCEDURE:

Date Received: 02/04/14

Date Tested: 05/28/14

Description of Samples:

Part Description: Roofing Profile
Material Submitted: Alsynite Topglass 2400 GSM
Alsynite Topglass 3660 GSM Ultrasafe
Material Specification: None Stated
Condition of Samples: Production

Test Procedure:

Test Method: ASTM D790-10
Specimen Thickness: 1.52 mm Alsynite Topglass 2400 GSM
2.61 mm Alsynite Topglass 3660 GSM
Span: 24.3 mm Alsynite Topglass 2400 GSM
47.8 mm Alsynite Topglass 3660 GSM
Test Speed: 0.65 mm/minute Alsynite Topglass 2400 GSM
1.11 mm/minute Alsynite Topglass 3660 GSM
Number of Specimens Tested: Ten (10); Five (5) of each material

Acceptance Criteria:

None Stated

Results:

Material	Sample	Flexural Modulus, MPa	Flexural Strength, MPa
Alsynite Topglass 2400 GSM	1	7593	234
	2	8004	196
	3	8271	253
	4	7999	234
	5	7242	196
	Mean	7822	223
Alsynite Topglass 3660 GSM Ultrasafe	1	7705	290
	2	7696	302
	3	9036	333
	4	7057	255
	5	7154	264
	Mean	7730	289



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Date: July 16, 2014

PO No: 343709-0

Report No.: 101528752GRR-001

Quote No.: 500495023

Page 5 of 9

SPECIFIC GRAVITY TEST PROCEDURE:

Date Received: 02/04/14

Date Tested: 03/19/14

Description of Samples:

Part Description: Roofing Profile

Material Submitted: Alsynite Topglass 2400 GSM

Alsynite Topglass 3660 GSM Ultrasafe

Material Specification: None Stated

Condition of Samples: Production

Test Procedure:

Test Method: ASTM D792-08

Number of Specimens Tested: Six (6); Three(3) Samples from Two (2) materials

Acceptance Criteria:

None Stated

Results:

Material	Sample	Specific Gravity
Alsynite Topglass 2400 GSM	1	1.38
	2	1.45
	3	1.45
	Mean	1.43
Alsynite Topglass 3660 GSM Ultrasafe	1	1.46
	2	1.43
	3	1.44
	Mean	1.44



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Date: July 16, 2014

PO No: 343709-0

Report No.: 101528752GRR-001

Quote No.: 500495023

Page 6 of 9

COEFFICIENT OF LINEAR EXPANSION TEST PROCEDURE:

Date Received: 02/04/14
Dates Tested: 03/28/14 - 03/31/14

Description of Samples:

Part Description: Roofing Profile
Material Submitted: Alsynite Topglass 2400 GSM
Alsynite Topglass 3660 GSM Ultrasafe
Material Specification: None Stated
Condition of Samples: Production

Test Procedure:

Test Method: ASTM D696-98
Test Temperatures: Deflection measured between
approximately +30 and -30 °C
Conditioning: 24 hours minimum at 23 ± 2 °C and 50 ± 5% RH
prior to testing.
Number of Specimens Tested: Four(4); Two (2) samples from Two (2) materials

Acceptance Criteria:

None Stated

Results:

Material	Sample	Coefficient of Linear Thermal Expansion (X10-6 mm/mm °C)
Alsynite Topglass 2400 GSM	1	30.5
	2	27.6
	Average	29.1
Alsynite Topglass 3660 GSM Ultrasafe	1	34.1
	2	31.2
	Average	32.6



VIPAC ENGINEERS & SCIENTISTS		Report No.: 101528752GRR-001
Date: July 16, 2014		Quote No.: 500495023
PO No: 343709-0		Page 7 of 9
THERMAL TRANSMSSION TEST PROCEDURE:		
Date Received:	02/04/14	
Date Tested:	04/04/14	
<u>Description of Samples:</u>		
Part Description:	Roofing Profile	
Material Submitted:	Alsynite Topglass 2400 GSM	
	Alsynite Topglass 3660 GSM Ultrasafe	
Material Specification:	None Stated	
Condition of Samples:	Production	
<u>Test Procedure:</u>		
Test Method:	ASTM C518-10	
Number of Specimens Tested:	Two (2)	
<u>Acceptance Criteria:</u>		
None Stated		



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Date: July 16, 2014

PO No: 343709-0

Report No.: 101528752GRR-001

Quote No.: 500495023

Page 8 of 9

Thermal Transmission Test Results:

Specimen	Length (mm)	Width (mm)	Depth (mm)	Weight	Density	
	Avg.	Avg.	Avg.	(kg)	(kg/m3)	(lbs/ft3)
Topglass 2400 GSM	200.01	202.63	1.56	0.0900	1425.78	89.01
Topglass 3660 GSM	195.78	199.24	2.38	0.1416	1528.49	95.42

Test Information	Thermal Conductivity	Thermal Conductivity	Thermal Resistance	Thermal Resistance	Thermal Resistance per inch*	Thermal Resistance per meter*	Thermal Transmittance
	K Value	K Value	R Value	R Value	R/in	R/m	U
Units:	Btu-in/hr-ft2- °F	W/m-K	Hr-ft2- °F/Btu	m2-K/W	Hr-ft2- °F/Btu/in	m2-K/W/m	W/m2-K
Topglass 2400 GSM	0.249802	0.03603	0.24711	0.0435	4.01	27.77	22.98
Topglass 3660 GSM	0.357473	0.05156	0.37564	0.0662	2.80	19.39	15.12

Test Information	Duration of the measurement	Instrument Measured Thickness	Instrument Measured Thickness	Mean Temperature	Mean Temperature	Temperature Gradient	
	min	(in)	(m)	°F	°C	°F/in	°C/m
Topglass 2400 GSM	0:26:18	0.0617	0.001567	71.23	21.79	275.85	62.65
Topglass 3660 GSM	0:45:47	0.1343	0.003411	74.04	23.36	148.08	55.55

Subcontracted Testing:

The thermal transmission testing was outsourced to Intertek Middleton, 8431 Murphy Drive Middleton, Wisconsin 53562. A copy of the outsourcing documentation is available upon request.

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PO No: 343709-0

Report No.: 101528752GRR-001

Quote No.: 500495023

Page 9 of 9

TENSILE PROPERTIES TEST PROCEDURE:

Date Received: 02/04/14

Date Tested: 03/28/14

Description of Samples:

Part Description: Roofing Profile

Material Submitted: Alsynite Topglass 2400 GSM

Alsynite Topglass 3660 GSM Ultrasafe

Material Specification: None Stated

Condition of Samples: Production

Test Procedure:

Test Method: ISO 527-1 & ISO 527-2

Average Specimen Thickness: 1.44 mm Alsynite Topglass 2400 GSM

2.35 mm Alsynite Topglass 3660 GSM

Test Speed: 50.0 mm/minute

Number of Specimens Tested: Two (2)

Acceptance Criteria:

None Stated

Results:

Material	Sample	Tensile Stress at Maximum Load (Mpa)	Tensile Strain at Yield (%)
Alsynite Topglass 2400 GSM	1	66.5	0.84
	2	61.0	1.33
	3	94.9	1.25
	4	28.8	1.10
	5	23.4	0.99
	Mean	54.9	1.10
Alsynite Topglass 3660 GSM Ultrasafe	1	133	1.46
	2	154	2.22
	3	143	2.15
	4	140	2.02
	5	114	1.79
	Mean	137	1.93

