



Industrial Research Services

Manufacturing & Materials Technology, 37 Graham Road (PO Box 56), Highett, Victoria 3190, Australia
Telephone: 61 3 9252 6000 Facsimile: 61 3 9252 6244 Web: <http://www.cmmt.csiro.au>

Registered Testing Authority - Building Code of Australia

14 May 2007

Our Ref: EN13 / 1497 03/0211

TEST REPORT No. 3795

Requested by: Rhino Linings Australasia
Denis Baker
on (date): 2 March 2007
Product Descriptions: TUFF STUFF, waterproofing membrane
Manufacturer: Rhino Linings Australasia

Sampling Details Supplied
Date: 2 March 2007
How (methods): Delivered to Highett

While CSIRO takes care in preparing the reports it provides to clients, it does not warrant that the information in this particular report will be free of errors or omissions or that it will be suitable for the client's purposes. CSIRO will not be responsible for the results or any actions taken by the client or any other person on the basis of the information contained in the report or any opinions expressed in it.

The reproduction of this test report is only authorised in the form of a complete photographic facsimile. Our written approval is necessary for any partial reproduction.

This test report consists of 11 pages.

SUMMARY OF ASSESSMENTS REPORTED

AS 4858:2004 Appendix A, Durability of waterproof membranes
AS 4858:2004 Appendix B, Resistance of Waterproofing Membranes to Cyclic Movement
AS 3558.-1999 Water Absorption
ASTM E96 Moisture Vapour Transmission



Industrial Research Services

Manufacturing & Materials Technology, 37 Graham Road (PO Box 56), Highett, Victoria 3190, Australia
Telephone: 61 3 9252 6000 Facsimile: 61 3 9252 6244 Web: <http://www.cmmt.csiro.au>

REPORT NO: 3795
ISSUE DATE: 14 May 2007
MANUFACTURER: Rhino Linings Australasia
PRODUCT DESC: TUFF STUFF, waterproofing membrane

Page 2 of 11

SUMMARY OF RESULTS

AS4858:2004 Wet Area Membranes

Appendix A: Assessment of Durability of waterproof membranes

The sample requires an elongation at break strain percentage greater than 215% at 56 days.
Note: (215% equates to 50% of control elongation at break strain percentage).

Durability of membranes: Elongation to break	Strain %	
Control	431%	Class III
Water Immersion	397%	PASS
Detergent Immersion	416%	PASS
Bleach Immersion	318%	PASS
Heat Ageing	455%	PASS

Rhino Linings Australasia test sample, TUFF STUFF, waterproofing membrane achieves the performance requirements of Class III
AS 4858: 2004 Durability of Membranes for **Class III** membrane.

Appendix B: Assessment of resistance of waterproofing membranes to cyclic movement

Class III type membrane: 2mm gauge length for a 4mm extension, repeated 50 cycles.

Requirement: PASS No Fatigue cracking exhibited.
Result: **PASS**

The Water Vapour Transmission (WVT) in accordance to ASTM E96: 4.09g/m²/24h

Appendix C: Suitability of waterproofing membranes when used over particle board

Appendix C **will not be** required as the TUFF STUFF has a water vapour transmission below 8g/m²/24h.

AS 3558.1 Methods of testing plastics & composite materials sanitary plumbing fixtures:

Method 1: Determination of water absorption characteristics **Mean 4.09%**

Conclusion: TUFF STUFF, waterproofing membrane complies with Class III waterproofing membrane according to AS4858.



Industrial Research Services

Manufacturing & Materials Technology, 37 Graham Road (PO Box 56), Highett, Victoria 3190, Australia
Telephone: 61 3 9252 6000 Facsimile: 61 3 9252 6244 Web: <http://www.cmmt.csiro.au>

REPORT NO: 3795
ISSUE DATE: 14 May 2007
MANUFACTURER: Rhino Linings Australasia
PRODUCT DESC: TUFF STUFF, waterproofing membrane

Page 3 of 11

TEST CARRIED OUT IN ACCORDANCE WITH
AS4858:2004 Wet Area Membranes
Appendix A: Assessment of Durability of waterproof membranes

Test Date: 8 March 2007

RESULTS: Location: Ceramic Tile Laboratory
Conditions: 7 days at 23°C 55%RH
Sample Number: 3795 - 1 (Numbered 1 to 5)
Samples: Average of 5 samples
Load rate: 150mm/min

Elongation at Break

CONTROL SET

Sample Number	Sample Thickness Mean (mm)	Maximum Load (N)	Maximum Extension (mm)	Maximum Stress MPa	Maximum Strain %
3795 - 1 1 to 5	2.8	118.81	142.33	7.07	431

Requirement for Class I:

The specimens have an average percentage strain of <70%.

Requirement for Class II:

The specimens have an average percentage strain of ≥70% & ≤299%.

Requirement for Class III:

The specimens have an average percentage strain of ≥300%.

Classification:

431% Class III (High Extensibility)



Industrial Research Services

Manufacturing & Materials Technology, 37 Graham Road (PO Box 56), Highett, Victoria 3190, Australia
Telephone: 61 3 9252 6000 Facsimile: 61 3 9252 6244 Web: <http://www.cmmt.csiro.au>

REPORT NO: 3795
ISSUE DATE: 14 May 2007
MANUFACTURER: Rhino Linings Australasia
PRODUCT DESC: TUFF STUFF, waterproofing membrane

Page 4 of 11

TEST CARRIED OUT IN ACCORDANCE WITH
AS4858:2004 Wet Area Membranes
Appendix A: Assessment of Durability of waterproof membranes

Test Date: 26 April 2007

RESULTS: Location: Ceramic Tile Laboratory
Conditions: 7 days at 23°C 55%RH
Sample Number: 3795 - 3 (Numbered 1 to 12)
Samples: Average of 3 samples
Load rate: 150mm/min
Solution: 1L of deionised water

Elongation at Break

WATER IMMERSION

Period & Sample Number	Sample Thickness Mean (mm)	Maximum Load (N)	Maximum Extension (mm)	Maximum Stress MPa	Maximum Strain %
7 Days 3795 - 3 1 to 3	2.8	104.09	149.82	6.20	454
28 Days 3795 - 3 4 to 6	2.8	102.95	139.37	6.13	422
56 Days 3795 - 3 7 to 9	2.8	99.40	131.00	5.92	397

Requirement: The sample requires an elongation at break strain greater than 215% at 56 days.

Result: 397% **PASS**



Industrial Research Services

Manufacturing & Materials Technology, 37 Graham Road (PO Box 56), Highett, Victoria 3190, Australia
Telephone: 61 3 9252 6000 Facsimile: 61 3 9252 6244 Web: <http://www.cmmt.csiro.au>

REPORT NO: 3795
ISSUE DATE: 14 May 2007
MANUFACTURER: Rhino Linings Australasia
PRODUCT DESC: TUFF STUFF, waterproofing membrane

Page 6 of 11

TEST CARRIED OUT IN ACCORDANCE WITH
AS4858:2004 Wet Area Membranes
Appendix A: Assessment of Durability of waterproof membranes

Test Date: 26 April 2007

RESULTS: Location: Ceramic Tile Laboratory
Conditions: 7 days at 23°C 55%RH
Sample Number: 3795 - 4 (Numbered 1 to 12)
Samples: Average of 3 samples
Load rate: 150mm/min
Solution: 1L of 2% solution N8 detergent

Elongation at Break

DETERGENT IMMERSION

Period & Sample Number	Sample Thickness Mean (mm)	Maximum Load (N)	Maximum Extension (mm)	Maximum Stress MPa	Maximum Strain %
7 Days 3795 - 4 1 to 3	2.8	93.09	145.55	5.54	441
28 Days 3795 - 4 4 to 6	2.8	101.39	149.46	6.03	453
56 Days 3795 - 4 7 to 9	2.8	100.1	137.3	5.98	416

Requirement: The sample requires an elongation at break strain greater than 215% at 56 days. Between 138% and 277% additional bond strength is required.

Result: 4160% **PASS**



Industrial Research Services

Manufacturing & Materials Technology, 37 Graham Road (PO Box 56), Highett, Victoria 3190, Australia
Telephone: 61 3 9252 6000 Facsimile: 61 3 9252 6244 Web: <http://www.cmmt.csiro.au>

REPORT NO: 3795
ISSUE DATE: 14 May 2007
MANUFACTURER: Rhino Linings Australasia
PRODUCT DESC: TUFF STUFF, waterproofing membrane

Page 5 of 11

TEST CARRIED OUT IN ACCORDANCE WITH
AS4858:2004 Wet Area Membranes
Appendix A: Assessment of Durability of waterproof membranes

Test Date: 26 April 2007

RESULTS: Location: Ceramic Tile Laboratory
Conditions: 7 days at 23°C 55%RH
Sample Number: 3795 - 5 (Numbered 1 to 12)
Samples: Average of 3 samples
Load rate: 150mm/min
Solution: 1L of 10.5 g/L sodium hypochlorite &
2.25 g/L of sodium hydroxide

Elongation at Break

BLEACH IMMERSION

Period & Sample Number	Sample Thickness Mean (mm)	Maximum Load (N)	Maximum Extension (mm)	Maximum Stress MPa	Maximum Strain %
7 Days 3795 - 5 1 to 3	2.8	97.40	153.42	5.80	465
28 Days 3795 - 5 4 to 6	2.8	106.79	144.97	6.36	439
56 Days 3795 - 5 7 to 9	2.8	68.1	104.9	4.10	318

Requirement: The sample requires an elongation at break strain greater than 215% at 56 days.

Result: 318% **PASS**



Industrial Research Services

Manufacturing & Materials Technology, 37 Graham Road (PO Box 56), Highett, Victoria 3190, Australia
Telephone: 61 3 9252 6000 Facsimile: 61 3 9252 6244 Web: <http://www.cmmt.csiro.au>

REPORT NO: 3795
ISSUE DATE: 14 May 2007
MANUFACTURER: Rhino Linings Australasia
PRODUCT DESC: TUFF STUFF, waterproofing membrane

Page 7 of 11

TEST CARRIED OUT IN ACCORDANCE WITH
AS4858:2004 Wet Area Membranes
Appendix A: Assessment of Durability of waterproof membranes

Test Date: 8 April 2007

RESULTS: Location: Ceramic Tile Laboratory
Conditioning: 7 days 23°C 55%RH
5 days 50°C
2 days 23°C 55%RH
Sample Number: 3779 - 2 (Numbered 1 to 4)
Samples: Average of 3 samples
Load rate: 150mm/min

Elongation at Break

HEAT AGEING

Sample Number	Sample Thickness Mean (mm)	Maximum Load (N)	Maximum Extension (mm)	Maximum Stress MPa	Maximum Strain %
3795 - 2 1 to 4	3.0	137.77	150.04	7.65	455

Requirement: The sample requires an elongation at break strain greater than 277% at 7 days.

Result: 455% **PASS**

CSIRO



Industrial Research Services

Manufacturing & Materials Technology, 37 Graham Road (PO Box 56), Highett, Victoria 3190, Australia
Telephone: 61 3 9252 6000 Facsimile: 61 3 9252 6244 Web: <http://www.cmmt.csiro.au>

REPORT NO: 3795
ISSUE DATE: 14 May 2007
MANUFACTURER: Rhino Linings Australasia
PRODUCT DESC: TUFF STUFF, waterproofing membrane

Page 8 of 11

TEST CARRIED OUT IN ACCORDANCE WITH
AS4858:2004 Wet Area Membranes
Appendix B: Assessment of Resistance of waterproofing membranes to Cyclic Movement

Test Date: 20 March 2007

RESULTS:	Location:	Laboratory
	Test Rig:	Applied Test Systems Series 904 Vertical Sealant Tester
	Number of Cycles:	50
	Type of Cycle:	Full cycle
	Cycle Time:	2 hours to complete full cycle
	Cycle expansion:	50% of Control elongation at break
	Sample Size:	65mm x 25mm
	Sample Span:	2mm between header plates
	Sample Thickness:	2.8 mm

The test sample achieved a control Elongation of Break of 431% as per AS4858 Appendix A. For a Class III membrane type the extension movement used for cycling is 4.00mm extension.

Number of Cycles completed	50
Surface Crazing	Nil
Surface Tears	Nil
Membrane Rupture	Nil

Result: Meets the requirement for Moving Joint Test

CSIRO



Industrial Research Services

Manufacturing & Materials Technology, 37 Graham Road (PO Box 56), Highett, Victoria 3190, Australia
Telephone: 61 3 9252 6000 Facsimile: 61 3 9252 6244 Web: <http://www.cmmt.csiro.au>

REPORT NO: 3795
ISSUE DATE: 14 May 2007
MANUFACTURER: Rhino Linings Australasia
PRODUCT DESC: TUFF STUFF, waterproofing membrane

Page 9 of 11

TEST CARRIED OUT IN ACCORDANCE WITH AS4858:2004 Wet Area Membranes
Appendix C: Assessment of the suitability of waterproofing membranes when used over Particle Board
Test Date: 10 May 2007

Water Vapour Transmission to ASTM E96

RESULTS: Location: Ceramic Tile Laboratory
Sample Thickness: 2.8mm
Open mouth dish: Diameter 100mm
Test Period: 480 hours
Conditions: 23°C / RH 50%
Membrane to dish sealant: silicon sealant
Desiccant: Silica gel

Desiccant Method (Procedure A)

Sample	Thickness mm	Water Vapour Transmission	
		g/m ² /hr	g/m ² /24/hr
Specimen 1	2.8	0.007	3.65
Specimen 2	2.8	0.008	4.33
Specimen 3	2.8	0.008	4.27
Mean	2.8	0.007	4.09

Requirement: If > 8g/m²/24 hours, additional testing referred to in (e) of Table A1 will be required to establish suitability for use over particleboard.

Result: 4.09g/m²/24 hours **PASS**

The sample passes E96 WVT, thus a test to suitability over particle board is not required.



Industrial Research Services

Manufacturing & Materials Technology, 37 Graham Road (PO Box 56), Highett, Victoria 3190, Australia
Telephone: 61 3 9252 6000 Facsimile: 61 3 9252 6244 Web: <http://www.cmmt.csiro.au>

REPORT NO: 3795
ISSUE DATE: 14 May 2007
MANUFACTURER: Rhino Linings Australasia
PRODUCT DESC: TUFF STUFF, waterproofing membrane

Page 10 of 11

TEST CARRIED OUT IN ACCORDANCE WITH
AS4858:2004 Wet Area Membranes
Appendix A: Assessment of Durability of waterproof membranes

Test Date: 19 April 2007

RESULTS: Location: Ceramic Tile Laboratory
Sample Thickness: 0.8 mm
Test Period: 24 hours
Conditions: 23°C / RH 50%

Sample	Thickness (mm)	Water Absorption		% Water Absorption
		Mass (m1)	Mass (m2)	
Specimen 1	2.8	138.42	138.91	2.3
Specimen 2	2.8	137.19	137.83	3.0
Specimen 3	2.8	136.23	136.61	1.7
Maximum	2.8			2.3

Requirement: Determine maximum water absorption as mean difference 2.3%

Result: 2.3%

CSIRO



Industrial Research Services

Manufacturing & Materials Technology, 37 Graham Road (PO Box 56), Highett, Victoria 3190, Australia
Telephone: 61 3 9252 6000 Facsimile: 61 3 9252 6244 Web: <http://www.cmmt.csiro.au>

REPORT NO: 3795
ISSUE DATE: 14 May 2007
MANUFACTURER: Rhino Linings Australasia
PRODUCT DESC: TUFF STUFF, waterproofing membrane

Page 11 of 11

Date and Place 14 May 2007 Highett, Vic

Name, Title and Signature:



**PETER WETSGATE
PROJECT LEADER
SLIPS, SURFACES & FINISHES
INDUSTRIAL RESEARCH SERVICES**

CSIRO