

Assessment of Silikal RU 321 Wet Area Membrane in accordance with AS/NZS 4858:2004

Materials Performance

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Prepared on behalf of CSIRO and Authorised signatory

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1 Introduction

This report describes the assessment of a waterproofing membrane in accordance with AS/NZS 4858:2004 'Wet area membranes', with compliance against the performance criteria of "Durability of Membranes" and "Requirements for Membranes Properties".

2 Specimen Description

One type of the specimen was supplied by the client.

The specimen description as provided by the client:

Product trade name: Silikal RU 321,

Manufacturer details: Silikal GmbH; Ostring 23; 63533 Mainhausen, Germany.

Description of the product:

*27 sheets 300x300mm of free cured film of waterproofing membrane, Silikal® RU 321 pigmented, (Film thickness appr. 1mm).

*10 concrete substrates (Silikal®RU 380 Primer coated) 160x100mm for bond strength test.

*500ml liquid sample of Silikal®RU 321 pigmented (waterproofing membrane) for bond strength test,

*100g Silikal®BP - powder hardener,

*Colour: RAL7031.

AS/NZS 4858:2004 Wet area application.

Type of sample: Wet membrane for internal uses.

Thickness: 1.12 mm.

Specimens received:

27 sheets of 300x300mm sheets (our measurements).

The supplied specimen for assessment is shown below in

Figure 1.

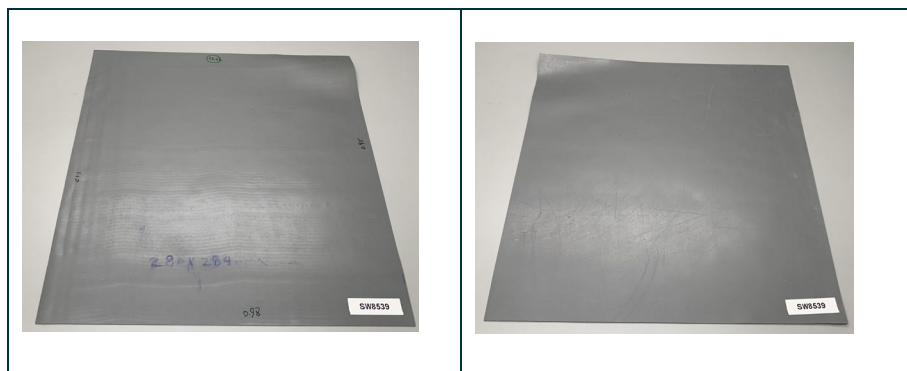


Figure 1 Top face and underside of the specimen

The specimens were received on 20/08/2024.

CSIRO were not involved in specimen selection.

The specimens were allocated with CSIRO specimen numbers SW8539-1/01 to SW8539-1/55.

3 Test Methods

3.1 Durability of Membrane

The standard outlines the method for determining resistance of the membrane's durability after conditioning in various solutions over set periods, then assessed against an unconditioned material.

The testing was carried out in accordance with AS/NZS 4858:2004 Appendix A "Durability of membranes". As specified in A3, the membrane test samples were prepared in accordance with AS 1145.3-2001, Type 5, dumb-bell samples 6mm width with a 25mm gauge length. Test specimens were exposed and conditioned to those requirements specified in Table A1 of AS/NZS 4858:2004. In accordance with A2 Testing, Instron 5585H (ERM.030.043) testing machine, fitted with a calibrated 5kN load cell, was used to record the elongation at break and tensile strength. The test rate of 50 mm/min. used for testing elongation at break of the immersed test specimens were compared to the control test specimens

The testing was undertaken by A. Menisi over the period of 11/09 – 01/11/2024 and the results relate to the specimens as supplied.

The testing was conducted under routine conditions; $23 \pm 2^{\circ}\text{C}$ and $60 \pm 15\% \text{ RH}$.

3.2 Resistance to Cyclic Movement

The resistance of membrane to cyclic movement was determined in accordance with AS/NZS 4858:2004 Appendix B.

A rectangular test sample of 65 mm x 25 mm x 1.06 mm was cut from a sheet, then held in the test grips (70(w) x 45(l) x 20(t) mm), exposing a 25 x 2 mm central portion of the sample.

An Applied Test Systems Series 904 Vertical Sealant Tester was used for testing. The vertical sealant testing machine used software for cyclic movement control. The vertical testing machine was set to elongate the clamped test sample for the cycling is 4 mm extension. Once the test piece reached full extension, it then returned to its original position, which completed one cycle of movement. The elongation and return were then repeated to complete a 50 cycles movement test, each cycle conducted over a nominal 2-hour period.

The test sample was inspected for signs of breakage or cracks and measured for any necking. A reduction in width of more than 1 mm inwards from the edge of the test sample constitutes a failure.

The testing was undertaken by A. Menisi over the period of 14/10 – 18/10/2024 and the results relate to the specimens as supplied.

The testing was conducted under routine conditions; $23 \pm 3^{\circ}\text{C}$ and $60 \pm 15\% \text{ RH}$.

3.3 Determination of Water absorption characteristic

Water absorption characteristic was determined in accordance with AS 3558.1:1999.

Three circular test samples of 80 mm diameter (5027 mm²) were cut from a sheet, before been placed in an oven set at 50 ±5°C for a duration of 24 ±0.5 hrs conditioning. Samples were removed from oven (cooled) then weighed and recorded (m¹) before insertion in a test jig. The test jig was used to expose the trafficable surface face of the samples to water to a depth of 50 mm above the surface for a duration of 24 ±0.25 hrs. After the completion of this exposure period the samples were wiped dry and then weighed and recorded (m²) again, determining the percentage increase in weight measured.

The testing was undertaken by A. Menisi over the period of 21/10 – 23/10/ 2024 and the results relate to the specimens as supplied.

3.4 Water Vapour Transmission of Materials

Water vapour transmission (WVT) through the membrane was determined in accordance with ASTM E96/E96M using the desiccant and dummy specimen method.

Four test samples were prepared by mechanical sealed using two neoprenes and a Teflon gasket placed onto the open side of the test cups. The test cups contain dried desiccant with the trafficable side facing up were placed in a climate-controlled environment with periodic weighing so that the rate of water vapour movement through the membrane to the desiccant can be determined.

The exposed area (test dish face) for each of the cups was 0.002827 m². The test cups (all except the dummy sample, no desiccant) had a 6 mm gap between the desiccant and the underside of the membrane.

All test assemblies were kept in a Steridium environmental where chamber temperature humidity is maintained at a temperature of 23 ±2°C and 50 ±5% relative humidity, material take as long as 60 days to reach equilibrium conditions . Measurements taken each afternoon (excluding weekends) over this period to determine the weight change and permeance of the membrane.

The testing was undertaken by A. Menisi over the period of 18/09 – 01/11/ 2024 and the results relate to the specimens as supplied.

4 Results

4.1 Executive Summary

Table 1 Summary of test requirements and test specimen results for AS/NZS 4858:2004

TEST	METHOD	REQUIREMENTS	RESULT
(a) Water Moisture Transmission Rate	ASTM E 96 Desiccant method for Determining Water Vapour Transmission (WVT)	State result Water Vapour transmission shall be $<8\text{ g} / \text{m}^3 / 24\text{hrs}$. If $> 8\text{ g} / \text{m}^3 / 24\text{hrs}$, additional testing will be required to establish suitability for use over particleboard.	WVT = $4.53\text{ g}/\text{m}^2/24\text{hrs}$ Permeance = 31.13 ($\text{ng}/\text{Pa.s.m}^2$)
(b) Water Absorption	AS 3558.1(sample size modified to be a 50mm x 50mm by the thickness as used in practice)	Maximum record result of percentage mass $w_m\% = (w_m^2 - w_m^1) / w_m^1 \times 100$.	Max. mass 0.93 %
(c) Acceptance of movement	AS/NZS 4858 Appendix B for assessment of cyclic movement of membrane	Compliance criteria - observing any cracking, rupture holing or extending through the thickness for more than 1 mm in from the edge of the specimen.	CLASS III No cracking, rupture observed
(d) Durability 1. Control 2. Water immersion 3. Bleach immersion 4. Detergent immersion 5. Heat ageing at 50°C	AS/NZS 4858:2004 Appendix A for assessment of membranes durability	Compliance criteria - compared to control specimens: elongation at break shall be not less than 25% for water, bleach & detergent immersion specimens, not less than 50% for heat ageing specimens.	CLASS III Complies Complies Complies Complies
(e) Suitability over particleboard	AS/NZS 4858:2004 Appendix C for assessment of membranes durability	Moisture content at al 6 locations shall be less than 10% above the average of the 2 control measurements taken on the same day. Will not be required for testing if water vapour transmission shall be $<8\text{ g} / \text{m}^3 / 24\text{hrs}$.	N/A

Note: The above is only a summary of the overall results and must be read in conjunction with the relevant sections of this report.

4.2 Durability of membrane

Table 2: Durability test results-control:

Control Specimens						
Specimen No#	Break Force (N)	Thickness (mm)	Tensile strength (F/A) (MPa)	Elongation at break		Class
				(mm)	(%)	
SW8539-1/01	46.81	1.09	7.16	78.45	314	III
SW8539-1/02	51.24	1.02	8.37	80.64	323	
SW8539-1/03	53.67	1.29	6.93	75.73	303	
SW8539-1/04	40.42	1.16	5.81	75.05	300	
SW8539-1/05	41.05	1.04	6.58	76.53	306	
Average	46.64	1.12	6.97	77.28	309	
CLASS I – Elongation at break <59%						
CLASS II – Elongation at break 60-299%						
CLASS III – Elongation at break ≥300%						
Class II membrane, a 35mm wide bond breaker/tape should be applied over a joint to accommodate the joint opening by up to 5 mm.						

Table 3: Durability test results – Water immersion:

Water Immersion Specimens						
	Average Break Force (N)	Average Thickness (mm)	Average Tensile strength (F/A) (MPa)	Average Elongation at break		Complies/ Not complying
				(mm)	(%)	
7 day period	46.23	1.13	6.85	78.66	314	Complies
28 day period	39.54	1.07	6.15	74.42	298	Complies
56 day period	42.01	1.08	6.53	74.31	297	Complies
Compliance – Elongation at break shall not be less than 50% retention of elongation at break of the controls for the bond breakers given in Table 6.1. For an elongation between 50% and 25% of the controls the membrane requires additional bond relief above.						

Table 4: Durability test results – Bleach immersion:

Bleach Immersion Specimens						
	Average Break Force (N)	Average Thickness (mm)	Average Tensile strength (F/A) (MPa)	Average Elongation at break		Complies/ Not complying
				(mm)	(%)	
7 day period	51.35	1.16	7.40	74.88	300	Complies
28 day period	52.74	1.09	8.12	81.85	327	Complies
56 day period	45.26	1.07	7.03	73.37	293	Complies
Compliance – Elongation at break shall not be less than 50% retention of elongation at break of the controls for the bond breakers given in Table 6.1. For an elongation between 50% and 25% of the controls the membrane requires additional bond relief above.						

Table 5: Durability test results – Detergent immersion:

Detergent Immersion Specimens						
	Average Break Force (N)	Average Thickness (mm)	Average Tensile strength (F/A) (MPa)	Average Elongation at break		Complies/ Not complying
				(mm)	(%)	
7 day period	42.18	1.12	6.32	76.03	304	Complies
28 day period	45.34	1.07	7.08	81.17	325	Complies
56 day period	45.50	1.07	7.11	78.59	314	Complies
Compliance – Elongation at break shall not be less than 50% retention of elongation at break of the controls for the bond breakers given in Table 6.1. For an elongation between 50% and 25% of the controls the membrane requires additional bond relief above.						

Table 6: Durability test results – Heat Ageing:

Heat Ageing @ 50°C						
	Average Break Force (N)	Average Thickness (mm)	Average Tensile strength (F/A) (MPa)	Average Elongation at break		Complies/ Not complying
				(mm)	(%)	
7 day period	49.32	1.06	7.77	85.85	343	Complies
Compliance – Elongation at break shall not be less than 50% retention of elongation at break of the controls						

4.3 Resistance to cyclic Movement

Table 7: Test sample holding during cyclic movement and test results:

Specimen No:	SW8539-1
Test Specimen:	65 (l) mm x 25 (w) mm x 1.06 (t) mm section
Membrane Classification:	CLASS III
Elongation at break:	Maximum strain used for the cycling shall be 50% the elongation at break
Observations:	No Cracks No ruptures observed
Day 1 – Day 4	No defect
Surface Defects	Not Detected
Crazing	Not Detected
Surface Tear	Not Detected
Membrane Rupture	Not Detected
Result:	Complies 50 cycles

The performance criteria set out in AS/NZS 4858 – 2004, section B4, by observing any cracking, rupture or necking of more than 1 mm down from original width.

4.4 Water absorption characteristic

Table 8: Water absorption tests results:

Specimen No#	Thickness Average	Specimens	Specimen weight after conditioning	Specimen weight after exposure	Water absorption percentage
	mm		$m^1 = \text{grams}$	$m^2 = \text{grams}$	$M \% = (m^2 - m^1) / m^1 \times 100$
SW8539-1/ Average	1.05	SW8539-1/49 SW8539-1/50 SW8539-1/51	6.3771	6.4292	0.93%

4.5 Water Vapour Transmission of Materials

Table 9: Water Vapour Transmission test results:

Specimens No.	Water Vapour Transmission (g/m ² 24hr)	Permeance (ng/Pa.s.m ²)
Average	4.53	31.13

The performance criteria set out in AS/NZS 4858 – 2004, specifies a water vapour transmission rate of less than 8 g/m² 24 hr, or 0.33 g/m² hr.

5 Conclusion

The Silikal RU 321 wet area membrane, as described herein, when subjected to the test methods of AS/NZS 4858:2004 'Wet area membranes', the properties of (a) moisture vapour transmission, (b) water absorption, (c) cyclic movement (Class III), and (d) durability, **met** the performance criteria to AS/NZS 4858:2004 Wet Area Membranes.

6 Limitations

The test results relate only to the specimen of the product in the form in which they were tested. Small differences in the composition or thickness of the product may significantly affect the performance during the test and will therefore invalidate the test results. It is the responsibility of the supplier for the product to ensure that the product which is supplied to industry is identical with the specimens which were tested. This report does not provide an endorsement by CSIRO of the actual products supplied to the industry. This report can therefore only relate to the actual prototype test specimens, testing conditions and methodology described in the supporting data, and does not imply any performance abilities of construction of subsequent manufacture.

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Appendix A Specimen Photos

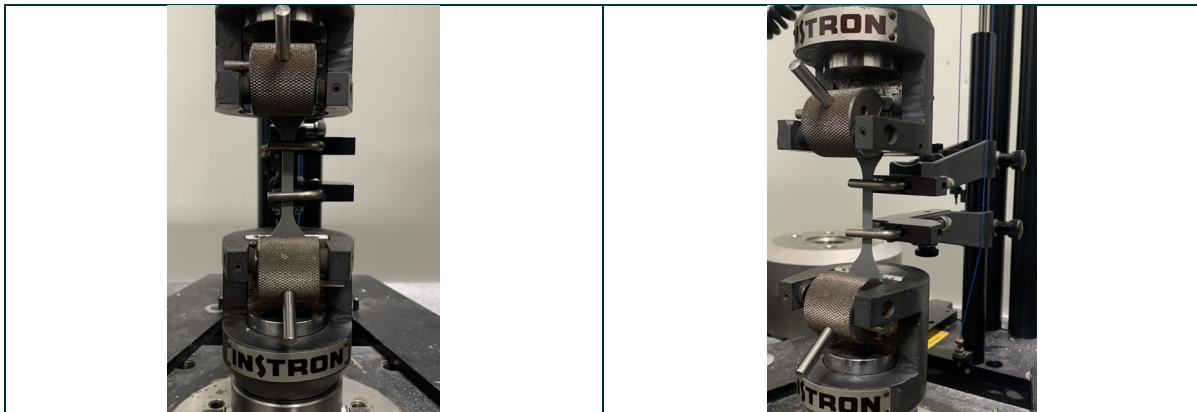


Figure 1: Photograph of Specimen – Durability test specimens.



Figure 2: Photograph of Specimen - Cyclic movement test specimens.

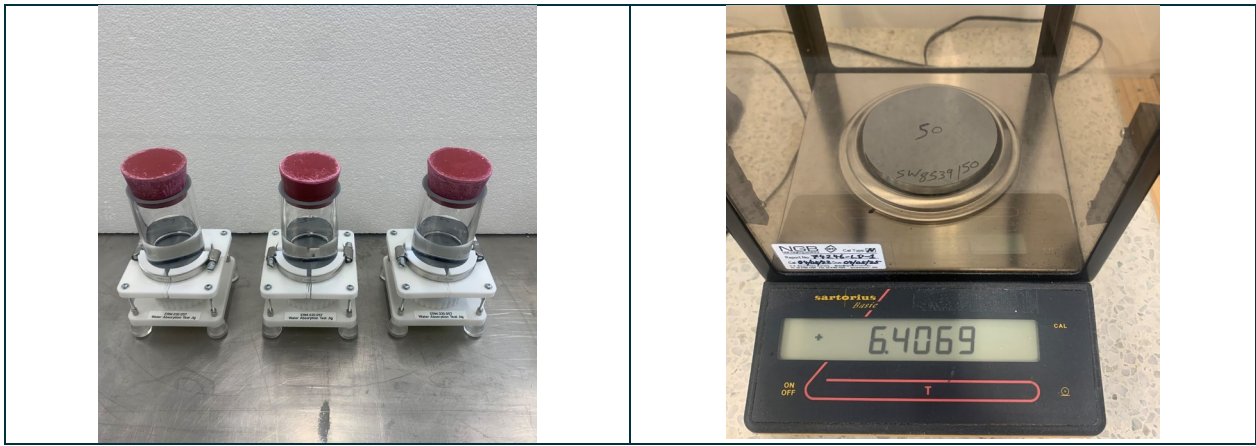


Figure 3: Photograph of Specimen - Water absorption test specimens.

FINAL PAGE OF THE REPORT

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