

Assessment of Flowfast 230 Membrane LM to: AS 4654.1:2012 Waterproofing membrane systems for exterior use

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The results reported herein relate only to the item(s) tested.

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Summary

Test

Standard:

Testing was conducted on a waterproofing membrane for external above-ground use with fully bonded membrane liquid non-exposed to assess its performance for: water vapour transmission; acceptance of cycle movement; durability; bond strength and thickness. The external waterproofing membranes properties were tested in accordance to the Australian Standard AS4654.1:2012.

All methods were carried out according to Tables 2.1 under fully bonded membrane liquid non-exposed against the performance criteria of Table A1, A3 and A4 respectively.

Test

results:

The waterproofing membrane presented for testing complied with the performance criteria set in AS4654.1:2012 waterproofing membrane for external above-ground, non-exposed. The following table shows the Flowfast 230 Membrane LM, performance as assessed from testing.

TABLE 1 SUMMARY OF TEST REQUIREMENTS AND TEST SPECIMEN RESULTS FOR AS4654.1:2012

TEST	METHOD	REQUIREMENTS	RESULT
(a) Moisture Transmission Rate	ASTM E 96 Desiccant method for Determining Water Vapour Transmission (WVT)	Record result	WVT = 9.20 g/m ² /24hrs Permeance = 63.10 ng/Pa.s.m ²
(b) Acceptance of movement	AS AS4654.1 Appendix B for assessment of cyclic movement of membrane	Pass or fail criteria by observing any cracking, rupture holing or extending through the thickness for more than 1 mm in from the edge of the specimen.	PASS
(c) Durability 1. Control 2. 1 st Revalidation control 3. 2 nd Revalidation control 4. Water immersion 5. Detergent immersion 6. 2 nd Revalidation 28 days 7. Heat ageing at 80°C 8. Temperature resistance at -15°C to +85°C	AS4654.1 Appendix A for assessment of membranes durability AS4654.2 temperature resistance section 2.4.2 (c)	Pass or fail criteria; compared to control samples: elongation at break shall be not less than 25 % for water and detergent immersion. Whereas elongation at break shall be not less than 50 % for heat ageing samples.	1. Class III 2. Class III 3. Class II 4. PASS 5. PASS 6. PASS 7. PASS 8. -15°C: 396% +85°C: 408%
(d) Bond strength to concrete flooring substrate	ASTM C794 Standard test method for adhesion-in- peel of elastomeric joint sealants	Test samples exposed to dry conditions, then tested for adhesion-in-peel strength.	162N with 0% cohesive failure loss for concrete.
(e) Membrane thickness	AS/NZS 4347.9:1995 (Reconfirmed) 2014 Damp- proof courses and flashings.	The film thickness shall be measured at a minimum of five points and a maximum of 10 points, equally spaced across the strip.	1.07mm

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

SUMMARY OF RESULTS

AS 4654.1:2012 Waterproofing membranes for external above-ground use, non-exposed:

Appendix A: Assessment of Durability of waterproof membranes

Test Report No.	8250	8479	SW8564	SW8639
	Original Report	1 st Rev	Rebranding	2 nd Rev
Year of test	2019	2023	2024	2026
Control	531% (III)	319% (III)		277% (II)
Water Immersion(56 DAYS)	486%			PASS
Detergent Immersion	432%			228% (28 days) PASS
Heat Ageing @80°C(14 days)	301%			PASS
Temperature Resistance				PASS
7 Days @-15°C	396%			
7 Days @+85°C	408%			

Introduction

CSIRO Services was engaged by Tremco CPG Australia Ltd trading as Flowcrete Australia to assess a waterproofing membrane for compliance against the AS4654.1:2012 according to Tables 2.1 under fully bonded membrane liquid with compliance confirmed against the performance criteria of Table A1, A3 and A4 respectively. The details for this assessment are listed in Table 2 below.

TABLE 2 DETAILS OF SUBMITTED TEST SPECIMEN

Job Number.:	8250, The main report	SW8639, 2 nd Revalidation report
TEST SPONSOR:	Flowcrete Australia	Tremco CPG Australia Ltd trading as Flowcrete Australia
PRODUCT DESCRIPTION:	PDS Membrane, Polyurethane Methyl Methacrylate Hybrid Membrane	Flowfast 230 Membrane LM.
Specimen Received Date:	May 2019	27/03/2026

Note: CSIRO accepts no responsibility for the selection of specimens. The results in this report apply to the specimens tested and may not be applicable to other specimens of the same product.

This report details the performance, testing conditions and outcomes of the specimen assessed in accordance with waterproofing membrane system for exterior use - above ground level, non-exposed.

Table 3 details the sponsor's specified schedule of tests for the product.

TABLE 3 DETAILS OF THE SCHEDULE FOR TESTING OF THE SUBMITTED SPECIMEN

Job Number.:	8250
TEST SCHEDULE:	AS4654.1 Clause A2, A4 Table A1, A3 & A4: a) Moisture vapour transmission rate - ASTM Designation E96/E96M – 16, 'Standard Test Methods for Water Vapour Transmission'; b) Acceptance of cyclic movement; Appendix B 'Assessment of resistance of waterproofing membranes to cyclic movement'; c) Durability - Appendix A 'Assessment of durability of waterproofing membranes: - Table A4 (a) Controls - Table A4 (b) Water immersion - Table A4 (c) Detergent immersion - Table A1 & A4 (e) Heat aging at 80°C (g) Temperature resistance at -15°C to +85°C d) Bond strength to concrete substrate - ASTM C794:2018 Standard test method for adhesion-in-peel of elastomeric joint sealants. e) Membrane thickness – AS/NZS 4347.9:1995 (Reconfirmed) 2014 Damp-proof courses and flashings.
Job Number.:	SW8639
TEST SCHEDULE:	Durability - Appendix A 'Assessment of durability of waterproofing membranes Table A1 : 2nd Revalidation of Elongation strength of Control, And after 28 days immersion in Detergents Solution.

Test specimen description

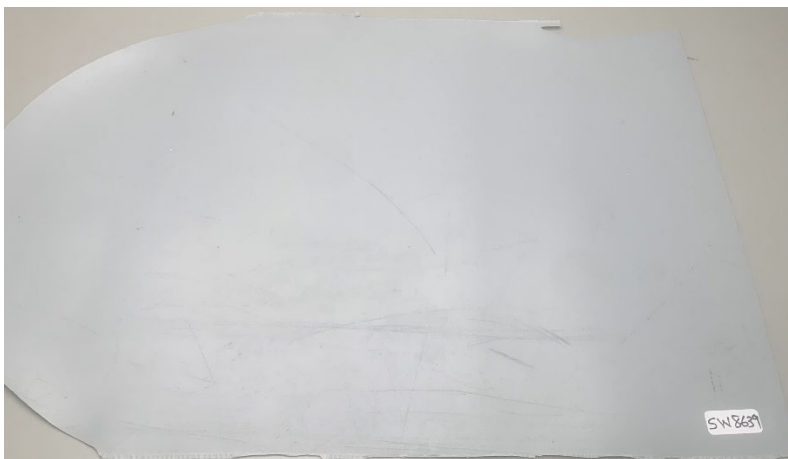
Flowfast 230 Membrane LM, supplied by Tremco CPG Australia Ltd trading as Flowcrete Australia is a highly elastomeric 100% solids heavy duty seamless waterproofing membrane system.

The supplied specimen for assessment is shown below in Figures 1 and 2.

FIGURE 1 TOP FACE OF FLOWFAST 230 MEMBRANE LM



FIGURE 2 UNDERSIDE OF FLOWFAST 230 MEMBRANE LM



Test Methodology

ASTM E96/E96M – 16 Water Vapour Transmission of materials

This Standard outlines the method for determining water vapour transmission (WVT) through the membrane using the desiccant and dummy sample method.

Four test samples were prepared and mechanical sealed using two neoprene and a Teflon gasket, onto the open side of the test cups containing dried desiccant, with the trafficable side facing up. The cups were then placed in a climate controlled environment, with periodic weighing to determine the rate of water vapour movement through the membrane to the desiccant.

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 conditioning room maintained at a temperature of 23 ±2°C and 65 ±5% relative humidity, for the 30 days duration. Measurements taken each afternoon (excluding weekends) over this period to determine the weight change and Permeance of the membrane.

AS4654.1-2012 Appendix B Resistance to cyclic movement

This Standard outlines the method for determining resistance of membrane to cyclic movement set at 4mm extension of the materials break strength.

A rectangular test sample of 65 mm x 25 mm was cut from the underlay mat specimen, 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 up to 50% of its measured elongation at break (see Table 5 of this report). Once the test piece reached full extension, it then returned to its original position, which completed one cycle of movement. The elongation and return was then repeated to complete a 50 cycle movement test, each cycle conducted over a nominal 2 hour period.

The test sample was inspected for any signs of breaking 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.

AS 4654.1&2-2012 Appendix A Durability of membrane and Temperature Resistance

This 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.

Test samples were prepared in accordance with AS 1145:2001 'dumb-bell sample type 5' (6 mm narrow width and 25 mm gauge length). Five test samples of the Flowfast 230 Membrane LM, Polyurethane Methyl Methacrylate Hybrid Membrane for each test requirement of Table A1 and A4 in AS4654.1:2012 and

Testing to AS 4654.1:2012 Waterproofing membrane systems for exterior use - Above ground level, non-exposed.

AS4654.2:2012 Temperature resistance (-15°C to +85°C). Test samples were exposed and conditioned to those requirements specified in Table A1, A4 & Temperature Resistance respectively.

A universal testing machine, fitted with a calibrated 5kN load cell, was used for the durability tests. The universal testing machine used software for applying the load rate of 200mm/min for the stress and strain profile of each test sample, as well as collect and display the tensile strength and elongation at break for each test sample.

The elongation at break of the immersed test samples were compared to the unconditioned (control) test samples.

ASTM C794:2018 Standard test method for adhesion-in-peel of elastomeric joint sealants

This test method consists of preparing four strip test specimens of 25mm width and 250mm in length. The used of embedding a wire mesh screen between two thin layers of the membrane on test concrete substrate already apply a thick coat of Flowfast Standard Primer and 3% Flowfast Catalyst BPO 50 GHS by weight. The Flowfast 230 Membrane LM, Polyurethane Methyl Methacrylate Hybrid Membrane also mixed with 3% Flowfast Catalyst BPO 50 GHS by weight to the resin as specified by the manufacturer. Then remix briefly before applying strips only 100mm in length on to the surface of concrete flooring substrate to ensure good initial bond. All test specimens were kept in a conditioning room maintained at a temperature of $23 \pm 2^{\circ}\text{C}$ and $65 \pm 5\%$ relative humidity, for the 21days duration, then placing the specimen in a tension-testing machine in such a way the test sample is peeled back from the substrates at 180° , while measuring the force exerted as well as the mode of failure of the sealant from the concrete substrate at the test rate of 50mm/min for 1 minute.

AS/NZS 4347.9:1995 (Reconfirmed) 2014 Damp-proof courses and flashings—Methods of test, Method 9: Determining thickness

This Standard sets out a means to determining the thickness of polyethylene film. All three rectangular test strip of 290 mm x 50 mm was cut across middle width of supplied full sheets. The sheet thickness measured three points, equally spaced across the strip. The specimens tested in a conditioning room maintained at a temperature of $23 \pm 2^{\circ}\text{C}$ and $65 \pm 5\%$ relative humidity.

Results

AS 4654.1:2012 Appendix A Durability of membrane

The tensile strength and elongation at break were recorded for the control and immersed test samples. Criteria for pass or failure of the immersed test samples were then compared to the control samples. AS 4654.1:2012 Table A2 joint movement bond breaker was also referenced in Table 6, below.

TABLE 4 DURABILITY TEST RESULTS FOR CONTROL SW8639 - 2ND REVALIDATION OF 8250 REPORT: 10/04/2026

Flowfast 230 Membrane LM		Tensile Strength and Elongation		
Control samples	Break Force (N)	Tensile strength (F/A) (MPa)	Elongation at break (%)	Passed/Failed
SW8639/01	91.00	8.50	291	Class II
SW8639/02	78.61	7.56	281	
SW8639/03	95.67	8.54	278	
SW8639/04	85.50	7.70	269	
SW8639/05	79.59	7.30	267	
Average	86.07	7.92	277	

TABLE 5 DURABILITY TEST RESULTS FOR CONTROL 8479 - 1ST REVALIDATION OF 8250 REPORT: 17/02/2023

Flowfast 230 Membrane LM, Polyurethane Methyl Methacrylate Hybrid Membrane		Tensile Strength and Elongation		
Control samples	Break Force (N)	Tensile strength (F/A) (MPa)	Elongation at break (%)	Passed/Failed
8479/01	66.95	10.05	317	Class III
8479/02	78.19	11.53	324	
8479/03	61.02	10.59	310	
8479/04	64.31	10.61	319	
8479/05	63.95	11.34	325	
Average	66.88	10.83	319	

Date of test(8250): 26 June 2019; 16-23 August 2019; 16 August 2019 – 04 October 2019.

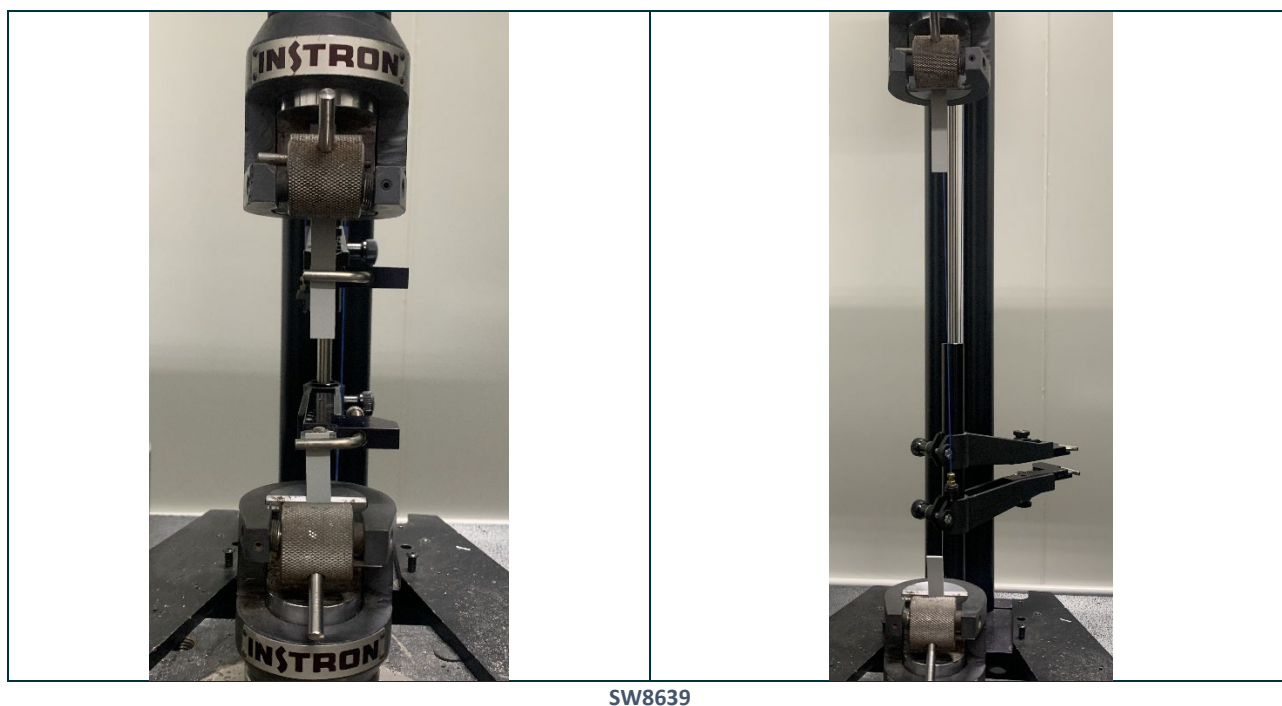
TABLE 6 DURABILITY TEST RESULTS FOR 8250:

Flowfast 230 Membrane LM, Polyurethane Methyl Methacrylate Hybrid Membrane		Tensile Strength and Elongation		
Control samples	Break Force (N)	Tensile strength (F/A) (MPa)	Elongation at break (mm) & (%)	Passed/Failed
8250/01	40.20	6.7	139.34 & 557	Class III
8250/02	34.88	5.7	127.34 & 509	
8250/03	42.22	6.6	141.01 & 564	
8250/04	39.00	6.4	140.34 & 561	
8250/05	32.15	5.2	115.67 & 463	

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Average	37.69	6.1	132.74 & 531	
Water Immersion	Average (N)	Average (MPa)	Average (mm) & (%)	-
7-day period	33.28	5.0	153.90 & 616	Passed*
28-day period	30.74	5.1	103.09 & 412	Passed*
56-day period	33.54	5.6	121.56 & 486	Passed*
Detergent Immersion	Average (N)	Average (MPa)	Average (mm) & (%)	-
7-day period	25.48	4.2	128.56 & 514	Passed*
28-day period:2nd Rev	42.27	3.75	57.07 & 228	Passed*
28-day period	32.37	5.4	119.78 & 479	Passed*
56-day period	25.80	4.2	108.01 & 432	Passed*
Heat Ageing @ 80°C	Average (N)	Average (MPa)	Average (mm) & (%)	-
14-day period	29.27	4.5	75.23 & 301	Passed*
Temperature Resistance	Average (N)	Average (MPa)	Average (mm) & (%)	
7 Days @-15°C	30.17	5.1	96.45 & 396	Passed*
7 Days @+85°C	38.79	6.0	101.90 & 408	Passed*
Table A4: Pass / Fail and Criteria compared with control samples		*Passed – Elongation at break was above the 25% limit; and all immersed samples were above the 25% criteria for elongation at break Control samples. Class I, II and III of Table A1.		
		* Passed – Elongation at break for heat ageing at 80°C shall be not less than 50% of the results recorded for the controls.		

The performance criteria set out in AS 4654.1:2012, Table A4 specifies a comparison of the immersed test samples to the unconditioned (control) test samples shall be greater than 25% elongation at break.



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FIGURE 3 DURABILITY ELONGATION TEST FOR FLOWFAST 230 MEMBRANE LM.

ATSM E96/E96M - 16 Water Vapour Transmission of materials

The periodic measurements of the membrane test samples were recorded as shown in Table 4, below.

Date of test: 24 July 2019 – 23 August 2019

TABLE 7 WATER VAPOUR TRANSMISSION TEST RESULTS

Periodic weighing	Sample 8250/51	Sample 8250/52	Sample 8250/53	Periodic weighing	Sample 8250/51	Sample 8250/52	Sample 8250/53
Day 0	437.44	439.87	438.47	Day 16	437.92	440.29	438.87
Day 1	437.47	439.89	438.49	Day 19	438.00	440.36	438.92
Day 2	437.50	439.92	438.51	Day 20	438.03	440.38	438.96
Day 5	437.59	439.99	438.59	Day 21	438.06	440.41	438.97
Day 6	437.62	440.02	438.62	Day 22	438.09	440.43	438.99
Day 7	437.65	440.04	438.64	Day 23	438.12	440.46	439.03
Day 8	437.68	440.07	438.66	Day 26	438.19	440.53	439.08
Day 9	437.71	440.10	438.69	Day 27	438.22	440.56	439.11
Day 12	437.80	440.18	438.77	Day 28	438.26	440.59	439.15
Day 13	437.82	440.20	438.79	Day 29	438.28	440.60	439.17
Day 14	437.86	440.23	438.81	Day 30	438.31	440.63	439.18
Day 15	437.89	440.26	438.83				

Product	Samples	Weight change	Water Vapour Transmission	Permeance
		$G/t = g / s$	$(G/t)/A = g / m^2 \text{ 24hr}$	$WVT/S(R1-R2) = ng/Pa.s.m^2$
Flowfast 230 Membrane LM, Polyurethane Methyl Methacrylate Hybrid Membrane	8250/51 8250/52 8250/53	3.4×10^{-7} 2.9×10^{-7} 2.7×10^{-7}	10.26 8.96 8.37	70.38 61.49 57.44
	Average	3.0×10^{-7}	9.20	63.10

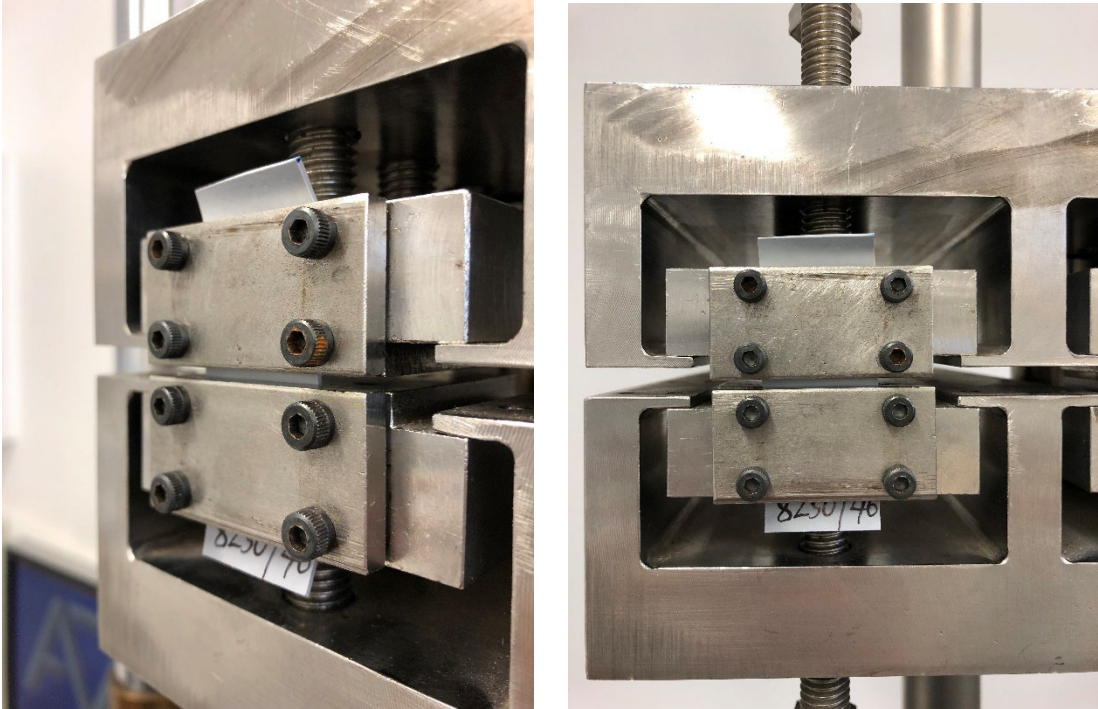
The performance criteria set out in AS4654.1 – 2012, Table A3 to record result, specifies a water vapour transmission rate shall determine if material is a moisture suppressant coating.

AS 4654.1:2012 Appendix B Resistance of waterproofing membranes to cyclic movement

The test result for cyclic movement of the waterproofing membrane test sample is shown in Table 5 below. The test sample completed 50 cycles for the nominal 2 hour period.

Date of test: 13 August 2019 – 19 August 2019

TABLE 8 TEST SAMPLE HOLING DURING CYCLIC MOVEMENT AND TEST RESULTS

Specimen:	Flowfast 230 Membrane LM, Polyurethane Methyl Methacrylate Hybrid Membrane	
Test sample and elongation at break:	Test sample 65 (l) mm x 25 (w) mm x 1.06 (t) mm section; Maximum strain used for the cycling shall be 4 mm extension – Class III.	
Clamped test sample of cyclic test:		
Observation and measurement:	<u>Observations:</u> At test completion the specimen showed no signs of rupture holing or cracking.	

The performance criteria set out in AS4654.1:2012, Table A3, specifies no material rupture or extending through the thickness for more than 1 mm in from the edge of the specimen.

ASTM C794:2018 Standard test method for adhesion-in-peel of elastomeric joint sealants

The measured dimensions of the test samples placed in the test rig stand are shown in Table 7, below.

Date of test: 18 October 2019 – 08 November 2019

TABLE 9 ADHESION-IN-PEEL STRENGTH TESTS RESULTS

Product	Samples	Length and Width of test samples	Concrete	
			Peel Adhesion strength in Dry condition	Cohesive Failure Loss
		mm	N	%
Flowfast 230 Membrane LM, Polyurethane Methyl Methacrylate Hybrid Membrane	8250/57	25x250	155.50	0
	8250/58	25x250	157.90	0
	8250/59	25x250	184.89	0
	8250/60	25x250	150.56	0
			Average = 162 N	0%

AS/NZS 4347.9:1995 (Reconfirmed) 2014 Damp-proof courses and flashings—Methods of test, Method 9: Determining thickness

The sheet thickness measured three points, equally spaced across the strip. The specimens tested in a conditioning room maintained at a temperature of $23 \pm 2^\circ\text{C}$ and $65 \pm 5\%$ relative humidity are shown in Table 8, below.

Date of test: 13 August 2019

TABLE 10 DETERMINING THICKNESS TEST RESULTS

Product	Samples	Length and Width of test samples	Thickness
		mm	mm
Flowfast 230 Membrane LM, Polyurethane Methyl Methacrylate Hybrid Membrane	8250/54	290 x 50	1.07
	8250/54	290 x 50	1.07
	8250/54	290 x 50	1.06
	8250/55	290 x 50	1.05
	8250/55	290 x 50	1.06
	8250/55	290 x 50	1.09
	8250/56	290 x 50	1.06
	8250/56	290 x 50	1.17
	8250/56	290 x 50	0.96
		Average	1.07

Comments

The Flowfast 230 Membrane LM, as described herein, when subjected to the test methods of AS 4654.1:2012 the properties of (a) moisture vapour transmission, (b) cyclic movement (Class III), (c) durability, (d) Bond strength to concrete substrate and (e) membrane thickness met the performance criteria to AS 4654.1:2012 waterproofing membrane for Non-exposed to external above-ground use.

The 2nd Revalidation for elongation at break test was implemented for the control specimens with Classification of Class (II) and after immersion in Detergent solution for 28 days, with PASS results.

End of report