



# Assessment of Nitoproof 750 to: AS 4654.1:2012 Waterproofing membranes for external above- ground use Part 1: Materials

Report number SW8554 Rev.B

CSIRO Job No.: SW8554

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## *Client*

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**The Report number SW8554 Rev B-AS4654.1 valid until 9<sup>th</sup> October 2027**

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VERSION	STATUS	DATE	DISTRIBUTION	COMMENT
Revision A	Final	10 October 2024	CSIRO, Parchem Construction Supplies Pty Ltd	
Revision B	Final	14 October 2024	CSIRO, Parchem Construction Supplies Pty Ltd	Typographical error in Report validity

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

# Contents

Introduction.....	7
Test specimen description.....	8
Test Methodology .....	9
<i>ASTM E96/E96M – 16 Water Vapour Transmission of materials.....</i>	<i>9</i>
<i>AS4654.1:2012 Appendix B Resistance to cyclic movement .....</i>	<i>9</i>
<i>AS 4654.1:2012 Appendix A Durability of membrane and Temperature Resistance .....</i>	<i>9</i>
<i>ASTM C794:2018 Standard test method for adhesion-in-peel of elastomeric joint sealants.....</i>	<i>10</i>
<i>AS/NZS 4347.9:1995 (Reconfirmed) 2014 Damp-proof courses and flashings—Methods of test, Method 9:     Determining thickness.....</i>	<i>10</i>
Results .....	11
<i>ATSM E96/E96M - 16 Water Vapour Transmission of materials .....</i>	<i>11</i>
<i>AS 4654.1:2012 Appendix B Resistance of waterproofing membranes to cyclic movement .....</i>	<i>12</i>
<i>AS 4654.1:2012 Appendix A Durability of membrane .....</i>	<i>13</i>
<i>ASTM C794:2018 Standard test method for adhesion-in-peel of elastomeric joint sealants.....</i>	<i>15</i>
<i>AS/NZS 4347.9:1995 (Reconfirmed) 2014 Damp-proof courses and flashings—Methods of test, Method 9:     Determining thickness.....</i>	<i>16</i>
Comments .....	17

## Figures

Figure 1 Top face of Nitoproof 750 .....	8
Figure 2 Underside of Nitoproof 750 .....	8
Figure 3 Images of test sample performing durability load / elongation test .....	14
Figure 4 Images OF test sample performing Adhesion-In-Peel.....	15

## Tables

Table 1 Summary of test requirements and test specimen results for AS4654.1:2012.....	5
Table 2 Details of submitted test specimen.....	7
Table 3 Details of the schedule for testing of the submitted specimen .....	7
Table 4 Water Vapour Transmission test results .....	11
Table 5 Test sample holing during cyclic movement and test results.....	12
Table 6 Durability test results .....	13
Table 7 Adhesion-in-Peel Strength tests results .....	15
Table 8 Determining Thickness test results.....	16

# 1 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; water absorption; 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 Tables A1, A3 and A4.

**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 Nitoproof 750 performance as assessed from testing.

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

TEST	METHOD	REQUIREMENTS	RESULT	STATUS
<b>(a) Moisture Transmission Rate</b>	ASTM E 96 Desiccant method for Determining Water Vapour Transmission (WVT)	Record result	WVT 15.62 g/m <sup>2</sup> /24hrs Permeance 107.50 ng/Pa.s.m <sup>2</sup>	
<b>(b) Acceptance of movement</b>	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.	Class III	Complied
<b>(c) Durability</b> 1. <b>Control</b> 2. <b>Water immersion</b> 3. <b>Detergent immersion</b> 4. <b>Heat ageing at 80°C</b> 5. <b>Temperature resistance at -15°C to +85°C</b>	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 III 4. Class III 5. Class III	Complied
<b>(d) Bond strength to concrete substrate</b>	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.	93.61N with 100% adhesive failure loss for concrete.	Complied
<b>(e) Membrane thickness</b>	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	1.53mm	Complied

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.	8369	SW8554.Rev.B (1 <sup>st</sup> Revalidation)
Year of test	2021	2024
Control	327% (Class III)	308% (Class III)
Water Immersion@56d	289%	PASS
Detergent Immersion@56d	278%	PASS
Heat Ageing @ 80 °C	393%	PASS
Temperature Resistance	250% @-15°C	PASS
	338 % @+85°C	PASS

**Full Description:** (Inc. All layers); Single component polyurethane waterproofing membrane, with grey color\*

Parchem Construction Supplies Pty Ltd, test sample - the Fosroc Nitoproof 750, Waterproofing Membrane achieves the performance requirements of AS 4654.1:2012 Waterproofing membranes for external above-ground use, Non-exposed, Class III membrane installation.

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

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.

Result: No fatigue cracking exhibited. PASS

#### ASTM E96: Water Vapour Transmission of Materials

Result 15.62 g/m<sup>2</sup>/24 PASS

AS 4347.9:2002 Thickness 1.53mm

ASTM C794:2015 Bond Strength – Concrete, Dry Condition 158.38 N

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

\*Mentioned in product description' form by Client as a black colour not grey.

## 2 Introduction

CSIRO Services was engaged by Parchem Construction Supplies Pty Ltd to assess a waterproofing membrane for compliance against the AS4654.1:2012 according to Table 2.1 under fully bonded membrane liquid, non-exposed with compliance confirmed against the performance criteria of Tables A1, A3 and A4. The details for this assessment are listed in Table 3 below.

**TABLE 2 DETAILS OF SUBMITTED TEST SPECIMEN**

<b>CSIRO Job No.:</b>	SW8554
<b>TEST SPONSOR:</b>	Parchem Construction Supplies Pty Ltd
<b>PRODUCT DESCRIPTION:</b>	Nitoproof 750

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

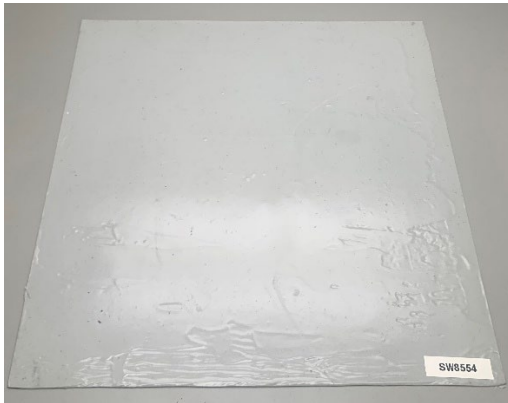
**TABLE 3 DETAILS OF THE SCHEDULE FOR TESTING OF THE SUBMITTED SPECIMEN**

<b>CSIRO Job No.:</b>	SW8554
<b>TEST SCHEDULE:</b>	<p>AS4654.1 Clause A2, A4 Tables A1, A3 &amp; A4:</p> <ul style="list-style-type: none"> <li>a) Moisture vapour transmission rate - ASTM Designation E96/E96M – 16, ‘Standard Test Methods for Water Vapour Transmission’;</li> <li>b) Acceptance of cyclic movement; Appendix B ‘Assessment of resistance of waterproofing membranes to cyclic movement’;</li> <li>c) Abrasion resistance AS 1580.403.2.1-2006 Paints and related materials;</li> <li>d) Durability - Appendix A ‘Assessment of durability of waterproofing membranes:                      Table A4 (a) Controls, 1<sup>st</sup> Revalidation.                      Table A4 (b) Water immersion                      Table A4 (c) Detergent immersion                      Table A1 &amp; A4 (d) Heat aging at 80°C</li> <li>e) Temperature resistance at -15°C to +85°C</li> <li>f) Bond strength to concrete substrate - ASTM C794:2018 Standard test method for adhesion-in-peel of elastomeric joint sealants.</li> <li>g) Membrane thickness – AS/NZS 4347.9:1995 (Reconfirmed) 2014 Damp-proof courses and flashings.</li> </ul>

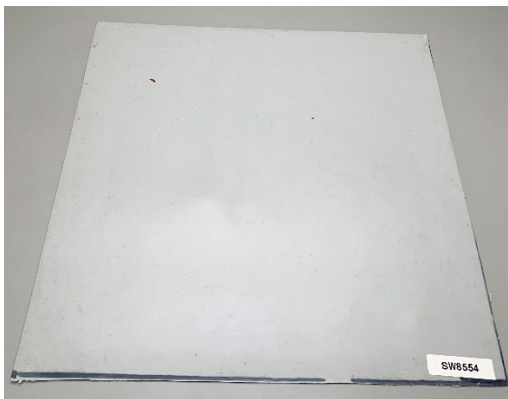
### 3 Test specimen description

The Nitoproof 750 supplied by Parchem Construction Supplies Pty Ltd is a single component polyurethane liquid which cures by reaction with atmospheric moisture to give a tough elastomeric waterproof membrane. The nominal size of the supplied membrane sheets for testing was 300 mm wide, 302 mm length and 1.54 mm thick.

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



**FIGURE 1 TOP FACE OF NITOPROOF 750**



**FIGURE 2 UNDERSIDE OF NITOPROOF 750**



## 4 Test Methodology

### 4.1 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 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 m<sup>2</sup>. 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 are maintained at a temperature of 23 ±2°C and 60 ±5% relative humidity, for the 46 days duration. Measurements taken each afternoon (excluding weekends) over this period to determine the weight change and permeance of the membrane.

### 4.2 AS4654.1-2012 Appendix B Resistance to cyclic movement

This Standard outlines the method for determining resistance of membrane used for the cycling shall be 4 mm extension.

A rectangular test sample of 65 mm x 25 mm x 1.39 mm was cut from the Nitoproof 750, 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 50% of the elongation a break. 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 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.

### 4.3 AS 4654.1-2012 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.

Testing of the Nitoproof 750 was in accordance with Appendix A4.2 Durability of membranes. As specified in A2.2.1 the membrane test samples were prepared in accordance with AS 1145.3-2001, Type 2, strip samples 10mm width with a 50mm gauge length. Test samples were exposed and conditioned to those requirements specified in Table A1, A4 & Temperature Resistance of AS4654.1-2012.

In accordance with A4.2.2.2 Testing, a universal testing machine, fitted with a calibrated 5kN load cell, was used to record the elongation at break and tensile strength. The elongation at break of the immersed test samples were compared to the control test samples.

#### **4.4 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 by embedding a wire mesh screen between two thin layers of Nitoproof 750. For each coating, remix briefly before applying strips only 100mm in length on to the surface of concrete 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  $60 \pm 5\%$  relative humidity, for the 21 days duration. Then the specimens were placed in a tension-testing machine in such a way the test sample is peeled back from the substrates at  $180^{\circ}$  to the face of the sample. The exerted force was measured as well as the mode of failure of the membrane from both substrates at the test rate of 50mm/min for 1 minute.

#### **4.5 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 strips of 290 mm x 50 mm was cut across middle width of supplied sheets. The sheet thickness measured a three points, equally spaced across the strip. The specimens were tested in a conditioning room maintained at a temperature of  $23 \pm 2^{\circ}\text{C}$  and  $60 \pm 5\%$  relative humidity.

## 5 Results

### 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: 22<sup>nd</sup> February 2021 – 09<sup>th</sup> April 2021

**TABLE 4 WATER VAPOUR TRANSMISSION TEST RESULTS**

Product	Samples	Weight change	Water Vapour Transmission	Permeance
		G/t = g / s	(G/t)/A = g / m <sup>2</sup> 24hr	WVT/S(R1-R2) = ng/Pa.s.m <sup>2</sup>
Nitoproof 750	8369/57	5.1 x 10 <sup>-7</sup>	15.68	106.23
	8369/58	5.4 x 10 <sup>-7</sup>	16.12	112.57
	8369/59	4.9 x 10 <sup>-7</sup>	15.07	103.70
	Average	5.1 x 10 <sup>-7</sup>	<b>15.62</b>	<b>107.50</b>


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.

## 5.1 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: 26<sup>th</sup> February 2021 – 02<sup>nd</sup> March 2021

**TABLE 5 TEST SAMPLE HOLING DURING CYCLIC MOVEMENT AND TEST RESULTS**

Specimen:	Nitoproof 750
Test sample and elongation at break:	Test sample 65 (l) mm x 25 (w) mm x 1.39 (t) mm section; Maximum extension movement used for the cycling is 4mm extension – Class III.
Clamped test sample of cyclic test:	
Observation and measurement:	<p><u>Observations:</u></p> <p>At test completion the specimen showed no signs of rupture holing or cracking.</p>

The performance criteria set out in AS4654.1:2012, Table A3 and section B4, pass or fail criteria by observing any cracking, rupture or necking of more than 1 mm down from original width.

## 5.2 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.

Date of test: 18<sup>th</sup>- 19<sup>th</sup> February 2021, 08<sup>th</sup> March 2021, 11<sup>th</sup> March 2021 and 08<sup>th</sup>- 09<sup>th</sup> April 2021.

25<sup>th</sup> September 2024, 1<sup>st</sup> Revalidation.

**TABLE 6 DURABILITY TEST RESULTS**

Nitoproof 750			Tensile Strength and Elongation		
Control samples	Break Force (N)	Thickness (mm)	Tensile strength (F/A) (MPa)	Elongation at break (mm) & (%)	Passed/Failed
SW8554/01	29.54	1.56	1.89	163.95&328	
SW8554/02	28.66	1.50	1.91	158.22&316	
SW8554/03	29.26	1.55	1.89	154.24&308	
SW8554/04	29.73	1.56	1.91	152.63&305	
SW8554/05	28.34	1.55	1.83	141.47&283	
<b>Average</b>	<b>29.11</b>	<b>1.54</b>	<b>1.89</b>	<b>154.10&amp;308</b>	<b>III</b>
8369/01	19.84	1.50	1.32	189.18 & 378	-
8369/02	18.64	1.56	1.19	173.78 & 348	-
8369/03	16.39	1.47	1.11	157.30 & 315	-
8369/04	13.92	1.49	0.93	151.68 & 303	-
8369/05	14.35	1.50	0.96	146.23 & 292	-
Average	<b>16.63</b>	<b>1.50</b>	<b>1.10</b>	<b>163.63 &amp; 327</b>	-
Tensile Strength	<b>16.63</b>	<b>1.50</b>	<b>1.10</b>	<b>163.63 &amp; 327</b>	-
Water Immersion	Average (N)		Average (MPa)	Average (mm) & (%)	-
7 day period	17.63	1.54	1.15	189.20 & 378	Passed*
28 day period	14.34	1.53	0.94	151.78 & 304	Passed*
56 day period	12.20	1.51	0.81	144.46 & 289	Passed*
Detergent Immersion	Average (N)		Average (MPa)	Average (mm) & (%)	-
7 day period	13.05	1.51	0.87	153.50 & 307	Passed*
28 day period	9.64	1.44	0.67	160.71 & 321	Passed*
56 day period	11.49	1.50	0.77	139.16 & 278	Passed*
Heat Ageing @ 80°C	Average (N)		Average (MPa)	Average (mm) & (%)	-
14 day period	16.59	1.52	1.09	196.72 & 393	Passed**
Temperature Resistance	Average (N)		Average (MPa)	Average (mm) & (%)	
7 Days @-15°C	13.34	1.49	0.89	124.82 & 250	Passed*
7 Days @+85°C	15.36	1.44	1.07	169.18 & 338	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 and II 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.

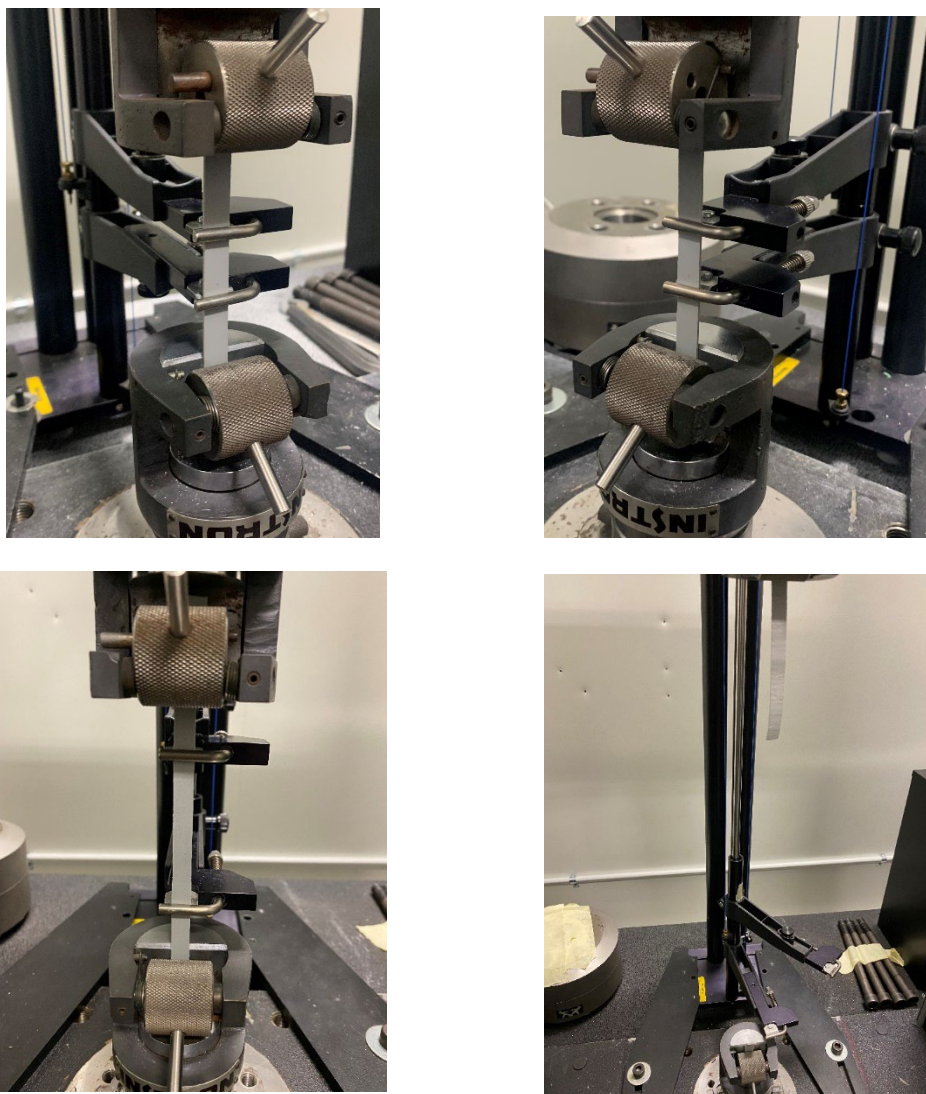


FIGURE 3 IMAGES OF TEST SAMPLE PERFORMING DURABILITY LOAD / ELONGATION TEST

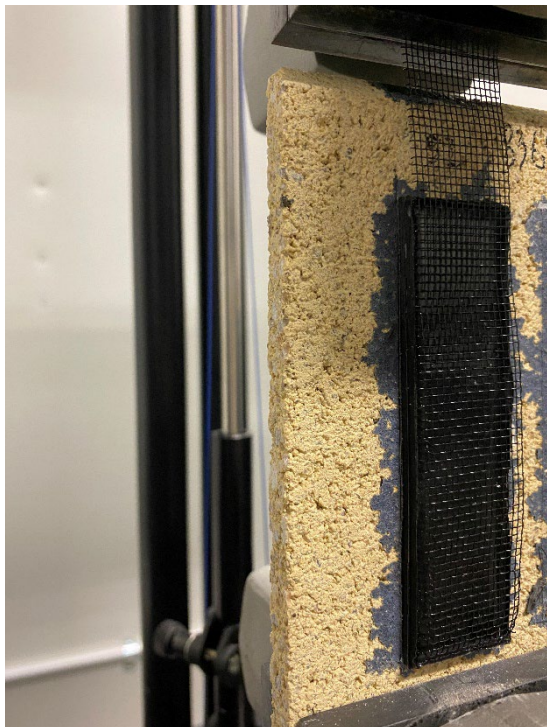
### 5.3 ASTM C794:2018 Standard test method for adhesion-in-peel of elastomeric joint sealants

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

Date of test: 02 July 2021 – 23 July 2021

**TABLE 7 ADHESION-IN-PEEL STRENGTH TESTS RESULTS**

Product	Samples	Length and Width of test samples mm	Concrete	
			Peel Adhesion strength in Dry condition N	Adhesive Failure Loss %
Nitoproof 750	8369/52	25x250	190.91	100
	8369/53	25x250	150.69	100
	8369/54	25x250	162.91	100
	8369/55	25x250	129.02	100
			Average = 158.38 N	100%



**FIGURE 4 IMAGES OF TEST SAMPLE PERFORMING ADHESION-IN-PEEL**

### 5.4 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 ±2°C and 60 ±5% relative humidity are shown in Table 8, below.

Date of test: 19<sup>th</sup> March 2021

**TABLE 8 DETERMINING THICKNESS TEST RESULTS**

Product	Samples	Length and Width of test samples	Thickness
		mm	mm
Nitoproof 750	8369/49	290 x 50	1.57
	8369/49	290 x 50	1.41
	8369/49	290 x 50	1.59
	8369/50	290 x 50	1.60
	8369/50	290 x 50	1.53
	8369/50	290 x 50	1.44
	8369/51	290 x 50	1.42
	8369/51	290 x 50	1.54
	8369/51	290 x 50	1.66
		Average	1.53



## 6 Comments

The Nitoproof 750, 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 (Class III), (d) Bond strength to concrete substrate and (e) membrane thickness met the performance criteria to AS 4654.1:2012 Waterproofing membranes for external above-ground use Part 1: Materials.

- 1<sup>st</sup> Revalidation, applied for Control, and the Tensile strength 308% - Class III

	<b>Author</b>	<b>Reviewer</b>
Name	Ahmed Menisi	Ms Money Arora
Position	Technical Officer- Materials Performance	Team leader- Materials Performance
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# End of report