

TEST REPORT



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20678

TEST SUMMARY

Objective

Assessment of supplied sample to AS4654.1

Project

Evaluation of Skyrise Protect to AS 4654.1

Report Number

414-1 AS4654.1

Customer

NAME	TWS Corporation Pty Ltd
ADDRESS	Unit 1, 92 York St, Tahmoor 2573
CONTACT PERSON	Russell Parkinson
EMAIL	russell@twswater.com.au
TELEPHONE	0409 083 594

Name of test material

Skyrise Protect

Description of test material

Fibreglass reinforced bitumen membrane

Date of receipt of test material

21/01/2025

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Report number	Issue Date	Expiry Date
414-1 AS 4654.1	09/04/2025	09/04/2028

TEST REPORT



WORLD RECOGNISED
ACCREDITATION

Accredited for compliance with ISO/IEC 17025 – Testing
20678

Testing Facility and Location

NAME	XTec Gen Pty Ltd
ADDRESS	30-32 Park Avenue Woodville North 5012
ABN	22634729294

LIMITATION

The test results reported here relate only to the items tested.

CUSTOMER SUPPLIED INFORMATION & DATA

N/A

TERMS AND CONDITIONS

This report is issued in accordance with the Terms and Conditions as detailed and agreed in the *XTecGen Test Request and Sample Submission Form*.

SIGNATORIES

Author

Ruby Scardigno

Laboratory Technician

Reviewer

Eric Scardigno

Laboratory Manager

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Report number
414-1 AS 4654.1

Issue Date
09/04/2025

Expiry Date
09/04/2028

TEST REPORT



Accredited for compliance with ISO/IEC 17025 – Testing
20678

SUMMARY OF TESTS

AS4654.1 Requirements:

PROPERTY	METHOD	RESULT	ASSESSMENT CRITERIA	ASSESSMENT
Abrasion Resistance: non-trafficable	AS 1580.403.2	0.114 mm	AS 4654.1 Paragraph 2.3	Meets requirement for non-trafficable membrane
Abrasion Resistance: trafficable	AS 1580.403.2	1.534 mm	AS 4654.1 Paragraph 2.3	Does not meet requirement for regular, occasional or pedestrian traffic
Bond Strength	ASTM C794	19.12 N	State result	
Acceptance of Cyclic movement	AS 4654.1 Appendix B	Failure not observed	AS 4654.1 Appendix B, Paragraph B4	PASS
Dimensional Stability	†ASTM D6207	No changes observed	State result	
Durability: Control Elongation at Break	AS1145.3	12%	AS 4654.1 Appendix A, Table A1	CLASS I
Durability: Control Tensile Strength		3.82MPa	State result	
Durability ¹ : Water Immersion Elongation at Break	AS 4654.1 Appendix A	31%	AS 4654.1 Appendix A, Table A4	PASS
Durability: Water Immersion Tensile Strength		3.73MPa	State result	
Durability: Detergent Immersion Elongation at Break		31%	AS 4654.1 Appendix A, Table A4	PASS
Durability: Detergent Immersion Tensile Strength		2.66MPa	State result	
Durability: Heat Aging Elongation at Break	N/A	8%	AS 4654.1 Appendix A, Table A4	PASS

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Report number
414-1 AS 4654.1

Issue Date
09/04/2025

Expiry Date
09/04/2025

TEST REPORT



WORLD RECOGNISED
ACCREDITATION

Accredited for compliance with ISO/IEC 17025 – Testing
20678

Durability: Heat Aging Tensile Strength	UV Lamp	4.45MPa	State result	PASS
Durability: UV Exposure Elongation at Break		9%	AS 4654.1 Appendix A, Table A4	
Durability: UV Exposure Tensile Strength		6.22MPa	State result	
Field Seam Strength	AMTM005	501.46 N/25mm	State result	
Temperature Resistance	AMTM004	0.07 g/m²/24 hours	State result	
Water Vapour Transmission	ASTM E96	0.69 g/m²/24 hours	State result	

† XTecGen Laboratory was not NATA accredited for at time of testing.

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Laboratories”*

Report number
414-1 AS 4654.1

Issue Date
09/04/2025

Expiry Date
09/04/2025

TEST REPORT



Accredited for compliance with ISO/IEC 17025 – Testing
20678

ABRASION RESISTANCE: NON-TRAFFICABLE

Testing: Test carried out in accordance with AS 1580.403.2.

Additions, deviations and/or exclusions from AS1580.403.2:

Determination of abrasive wear performed as per AS4654.1, Paragraph 2.3.1

Results

Date of test: 31/03/2025

PARAMETER	VALUE
Abrasion assessment method	Depth of abrasion
Abrasive wheels: Model	CS-10
Panel 1 Abrasive wheels: Serial Number & Expiry Date	LR14C1 – JULY 2026
Panel 2 Abrasive wheels: Serial Number & Expiry Date	LR14C1– JULY 2026
Mass applied to abrasive wheels	1000g
Model of abraser	Gester GT-C14B-2
Number of cycles per test panel	500

PANEL	READING	THICKNESS BEFORE ABRASION (mm)	THICKNESS AFTER ABRASION (mm)	LOSS OF MEMBRANE BUILD (mm)
1	1	4.430	4.272	0.158
	2	4.342	4.213	0.129
	3	4.342	4.290	0.052
2	1	4.804	4.719	0.085
	2	4.790	4.711	0.079
	3	4.648	4.468	0.180
Mean		4.559	4.446	0.114
Standard Deviation		0.215	0.225	0.050

Passing Requirement: “When tested in accordance with AS 1580.403.2 using the CS-10 wheel with 500 cycles, for areas subjected only to maintenance access, the depth of abrasion shall be less than 0.2mm”

Result: 0.114mm. This sample is suitable for areas subjected only to maintenance access.

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Report number	Issue Date	Expiry Date
414-1 AS 4654.1	09/04/2025	09/04/2025

TEST REPORT



Accredited for compliance with ISO/IEC 17025 – Testing
20678

ABRASION RESISTANCE: TRAFFICABLE

Testing

Test carried out in accordance with AS 1580.403.2.

Additions, deviations and/or exclusions from AS 1580.403.2:

Determination of abrasive wear performed as per AS4654.1, Paragraph 2.3.2

Results

Date of test: 31/03/2025

PARAMETER	VALUE
Abrasion assessment method	Depth of abrasion
Abrasive wheels: Model	H-22
Panel 1 Abrasive wheels: Serial Number	NA22B1
Panel 2 Abrasive wheels: Serial Number	NA22B1
Mass applied to abrasive wheels	1000g
Model of abraser	Gester GT-C14B-2
Number of cycles per test panel	1000

PANEL	READING	THICKNESS BEFORE ABRASION (mm)	THICKNESS AFTER ABRASION (mm)	LOSS OF MEMBRANE BUILD (mm)
1	1	4.623	3.186	1.437
	2	4.777	3.297	1.480
	3	4.816	3.570	1.246
2	1	4.516	2.882	1.634
	2	4.819	2.940	1.879
	3	4.633	3.104	1.529
Mean		4.697	3.163	1.534
Standard Deviation		0.125	0.252	0.212

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Report number
414-1 AS 4654.1

Issue Date
09/04/2025

Expiry Date
09/04/2025

TEST REPORT



Accredited for compliance with ISO/IEC 17025 – Testing
20678

Passing Requirement:

“Abrasion resistance for trafficable shall be as follows:

- a) When tested in accordance with AS 1580.403.2 using the H-22 wheel with 1000 cycles, for areas subjected only to pedestrian traffic, the depth of abrasion shall be less than 0.2mm.
- b) When tested in accordance with AS1580.403.2 using the H-22 wheel with 1000 cycles, for areas subjected only to occasional service vehicle traffic, the depth of abrasion shall be less than 0.1mm.
- c) When tested in accordance with AS 1580.403.2 using the H-22 wheel with 1000 cycles, for areas subjected to regular vehicle traffic, the depth of abrasion shall be less than 0.05mm.”

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Report number	Issue Date	Expiry Date
414-1 AS 4654.1	09/04/2025	09/04/2025

TEST REPORT



Accredited for compliance with ISO/IEC 17025 – Testing
20678

BOND STRENGTH

Date of test: 4/03/2025

Testing

Testing carried out in accordance with ASTM C794.

Additions, deviations and/or exclusions from ASTM C794:

Nil

Specimen Preparation:

PARAMETER	VALUE
Substrate	Concrete block
Substrate preparation	Wiped down, torch applied
Substrate primer	N/A
Mesh preparation	N/A
Mesh primer	N/A

Test Results:

READING	PEAK PEEL FORCE (N)	MODE OF FAILURE			
		SUBSTRATE FAILURE (%)	ADHESIVE FAILURE (%)	COHESIVE FAILURE (%)	SCREEN DELAMINATION (%)
Specimen 1 Reading 1	5.12	100			
Specimen 1 Reading 2	7.20	100			
Specimen 1 Reading 3	4.78	100			
Specimen 1 Reading 4	14.28	100			
Specimen 2 Reading 1	30.49			100	

"This report shall not be reproduced except in full without prior approval of XTec Gen Laboratories"

Report number
414-1 AS 4654.1

Issue Date
09/04/2025

Expiry Date
09/04/2025

TEST REPORT



Accredited for compliance with ISO/IEC 17025 – Testing
20678

Specimen 2 Reading 2	46.57			100	
Specimen 2 Reading 3	40.71			100	
Specimen 2 Reading 4	28.90			100	
Specimen 3 Reading 1	9.18	100			
Specimen 3 Reading 2	22.25	50		50	
Specimen 3 Reading 3	6.54	50		50	
Specimen 3 Reading 4	13.45	50		50	
Average	19.12				
Std Dev	14.49				

Result: 19.12N

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Report number
414-1 AS 4654.1

Issue Date
09/04/2025

Expiry Date
09/04/2025

TEST REPORT



Accredited for compliance with ISO/IEC 17025 – Testing
20678

CYCLIC MOVEMENT

Date of test: 21-25/03/2025

Testing:

Testing carried out in accordance with AS 4654.1 Appendix B “Assessment of resistance of waterproofing membranes to cyclic movement”

Additions, deviations and/or exclusions from AS 4654.1 Appendix B:

Nil

Test Parameters:

PARAMETER	VALUE
Membrane class	I
Number of cycles	50
Cycle time	2 Hours
Cycle expansion	0.12 mm
Sample Size	65 mm x 25 mm
Sample span	2 mm between plates
Sample thickness	4.256 mm

Test Results:

TEST RESULT	VALUE
Number of cycles completed	50
Surface crazing	Nil
Surface tears	Nil
Membrane rupture	Nil

Test Observations:

DAY	DATE	NUMBER OF CYCLES	Failure Observed	
			RUPTURE/HOLING	OTHER
1	21/03/2025	0	☐ Yes ☒ No	
2	22/03/2025	12	☐ Yes ☒ No	
3	23/03/2025	24	☐ Yes ☒ No	
4	24/03/2025	35	☐ Yes ☒ No	
5	25/03/2025	50	☐ Yes ☒ No	

Passing requirement: “Any rupture holing the specimen or extending through the thickness for more than 1mm in from the edge of the specimen shall be taken as a failure and the number of cycles to failure shall be reported. If failure does not occur after 50 cycles it shall be reported together with the

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Report number
414-1 AS 4654.1

Issue Date
09/04/2025

Expiry Date
09/04/2025

TEST REPORT



Accredited for compliance with ISO/IEC 17025 – Testing
20678

types of any surface defects that have been induced and the number of cycles at which onset of the defect occurred”

Result: PASS. Meets the requirement for CSIRO moving joint test as per AS 4654.1 Appendix B.

“This report shall not be reproduced except in full without prior approval of XTec Gen Laboratories”

Report number	Issue Date	Expiry Date
414-1 AS 4654.1	09/04/2025	09/04/2025

TEST REPORT



WORLD RECOGNISED
ACCREDITATION

Accredited for compliance with ISO/IEC 17025 – Testing
20678

DIMENSIONAL STABILITY

Date of test: 3-6/03/2025

Testing:

Testing carried out in accordance with ASTM D6207 “Standard Test Method for Dimensional Stability of Fabrics to Changes in Humidity and Temperature”

Additions, deviations and/or exclusions from ASTM D6207:

Nil

Test Parameters:

PARAMETER	MEASUREMENT INSTRUMENT	
Preconditioning temperature at 24Hrs	32°C	AMTE042A
Precondition humidity at 24Hrs	15%RH	AMTE042A
Method of sampling used	Test Specimens 150 by 1000mm from lengthwise direction and width wise direction of the roll	

MEASUREMENT

			Cycle 1				Cycle 2			
	Initial Pointer Setting	Date	Pointer Reading at 95% RH & 20°C	Date	Pointer Reading at 15% RH & 32°C	Date	Pointer Readin g at 95% RH & 20°C	Date	Pointer Reading at 15% RH & 32°C	Date
Width wise	700	3/03 /25	700	4/03 /25	700	4/03 /25	700	5/03 /25	700	5/03 /25
Length wise	700	3/03 /25	700	4/03 /25	700	4/03 /25	700	5/03 /25	700	5/03 /25

† XTecGen Laboratory was not NATA accredited for at time of testing.

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Laboratories”*

Report number
414-1 AS 4654.1

Issue Date
09/04/2025

Expiry Date
09/04/2025

TEST REPORT



Accredited for compliance with ISO/IEC 17025 – Testing
20678

DURABILITY OF MEMBRANE

CONTROL SET

Date of test: 7/02/2025

Testing: Test carried out in accordance with AS 1145.3.

Additions, deviations and/or exclusions from AS 1145.3: Nil

Test Parameters:

PARAMETER	VALUE
Ambient temperature (conditioning)	23.6-24.4°C
Ambient humidity (conditioning)	43.8-56.6%RH
Ambient temperature (testing)	23.9°C
Ambient humidity (testing)	52.9% RH
Accuracy grading of test machine	A
Specimen type	Type 2
Elongation measurement type:	Video Extensometer
Method of preparation of specimens	Sheet membrane
Orientation of specimens to direction of cast	-
Clamping device:	Pneumatic jaws
Testing speed:	50mm/min

Test Results:

Replicate	Sample thickness (mm)	Maximum Extension (mm)	Tensile Strength (MPa)	Elongation at Break (%)
1	4.591	5.2	3.68	10
2	4.427	5.1	4.56	10
3	4.721	8.4	3.78	17
4	4.76	4.9	3.82	10
5	4.43	6.3	3.28	12
Mean	4.59	6.0	3.82	12
Std Deviation	0.16	1.4	0.46	3

Requirement for Class III (high extensibility): ≥300% elongation at break

Requirement for Class II (medium extensibility) 60-299% elongation at break

Requirement for Class I (low extensibility) <60% elongation at break.

Classification: Class I

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Report number 414-1 AS 4654.1	Issue Date 09/04/2025	Expiry Date 09/04/2025
---	---------------------------------	----------------------------------

TEST REPORT



WORLD RECOGNISED
ACCREDITATION

Accredited for compliance with ISO/IEC 17025 – Testing
20678

DURABILITY OF MEMBRANE

WATER IMMERSION

Date of test: 10/02-31/03/2025

Testing:

Test carried out in accordance with AS 4654.1 Appendix A.

Additions, deviations and/or exclusions from AS 4654.1 Appendix A:

Nil

Test Parameters:

PARAMETER	VALUE
Ambient temperature (conditioning)	23.6-24.4°C
Ambient humidity (conditioning)	43.8-56.6%RH
Ambient temperature (testing)	23.8-24.2°C
Ambient humidity (testing)	44.8-50.7% RH
Minimum accuracy grading of test machine	A
Specimen type	Type 2
Elongation measurement type:	Video Extensometer
Method of preparation of specimens	Sheet membrane
Orientation of specimens to direction of cast	-
Clamping device:	Pneumatic jaws
Testing speed:	50mm/min

Test Results:

Sample Number	Sample thickness (mm)	Maximum Extension (mm)	Tensile strength (MPa)	Elongation at break (%)
1	4.43	7.6	4.06	15
2	4.39	5.4	3.03	11
3	4.33	7.1	4.32	14
7 Day Means	4.38	6.7	3.81	13
7 Day Std Devs	0.05	1.1	0.68	2
4	4.08	6.6	5.31	13
5	4.40	3.2	3.17	6
6	4.31	6.3	4.26	12
28 Day Means	4.26	5.3	4.25	11
28 Day Std Devs	0.16	1.9	1.07	4
7	4.27	14.0	3.09	28

"This report shall not be reproduced except in full without prior approval of XTec Gen Laboratories"

Report number
414-1 AS 4654.1

Issue Date
09/04/2025

Expiry Date
09/04/2025

TEST REPORT



Accredited for compliance with ISO/IEC 17025 – Testing
20678

8	4.25	18.5	4.01	37
9	4.31	13.8	4.09	28
56 Day Means	4.28	15.4	3.73	31
56 Day Std Devs	0.03	2.7	0.56	5

Passing Requirement: *"Elongation at break shall not be less than 25% retention of elongation at break of the controls"58] Table 6.1. A failure is for less than 25% retention of elongation at break of the controls".*

To pass this condition an elongation at break value of 3% or greater is required.

Result: 31% PASS

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Report number	Issue Date	Expiry Date
414-1 AS 4654.1	09/04/2025	09/04/2025

TEST REPORT



WORLD RECOGNISED
ACCREDITATION

Accredited for compliance with ISO/IEC 17025 – Testing
20678

DURABILITY OF MEMBRANE

DETERGENT IMMERSION

Date of test: 10/02-31/03/2025

Testing:

Test carried out in accordance with AS 4654.1 Appendix A.

Additions, deviations and/or exclusions from AS 4654.1 Appendix A:

Nil

Test Parameters:

PARAMETER	VALUE
Ambient temperature (conditioning)	23.6-24.4°C
Ambient humidity (conditioning)	43.8-56.6%RH
Ambient temperature (testing)	23.8-24.2°C
Ambient humidity (testing)	44.8-50.7% RH
Minimum accuracy grading of test machine	A
Specimen type	Type 2
Elongation measurement type:	Video Extensometer
Method of preparation of specimens	Sheet membrane
Orientation of specimens to direction of cast	-
Clamping device:	Pneumatic jaws
Testing speed:	50mm/min

Test Results: Detergent Immersion

Sample Number	Sample thickness (mm)	Maximum Extension (mm)	Tensile strength (MPa)	Elongation at break (%)
1	4.51	5.9	4.80	12
2	4.13	6.2	4.88	12
3	4.41	3.4	3.04	7
7 Day Means	4.35	5.2	4.24	10
7 Day Std Devs	0.20	1.6	1.04	3
4	4.16	7.1	5.99	14
5	4.38	6.8	4.14	13
6	4.28	11.1	5.02	22
28 Day Means	4.28	8.3	5.05	17
28 Day Std Devs	0.11	2.4	0.93	5
7	4.14	14.5	3.36	29

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Report number
414-1 AS 4654.1

Issue Date
09/04/2025

Expiry Date
09/04/2025

TEST REPORT



WORLD RECOGNISED
ACCREDITATION

Accredited for compliance with ISO/IEC 17025 – Testing
20678

8	4.16	14.0	2.42	28
9	4.07	17.7	2.20	35
56 Day Means	4.12	15.4	2.66	31
56 Day Std Devs	0.05	2.0	0.61	4

Passing Requirement: *“Elongation at break shall not be less than 25% retention of elongation at break of the controls”.*

To pass this condition an elongation at break value of 3% or greater is required.

Result: 31% PASS

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Report number
414-1 AS 4654.1

Issue Date
09/04/2025

Expiry Date
09/04/2025

TEST REPORT



Accredited for compliance with ISO/IEC 17025 – Testing
20678

DURABILITY OF MEMBRANE

HEAT AGING

Date of test: 26/02/2025

Testing:

Test carried out in accordance with AS 4654.1 Appendix A.

Additions, deviations and/or exclusions from AS 4654.1 Appendix A:

Nil

Test Parameters:

PARAMETER	VALUE
Ambient temperature (conditioning)	23.6-24.4°C
Ambient humidity (conditioning)	43.8-56.6%RH
Ambient temperature (testing)	24.0°C
Ambient humidity (testing)	45.4% RH
Accuracy grading of test machine	A
Specimen type	Type 2
Elongation measurement type:	Video Extensometer
Method of preparation of specimens	Sheet membrane
Orientation of specimens to direction of cast	-
Clamping device:	Pneumatic jaws
Testing speed:	50mm/min

Test Results:

Number of replicates	Sample thickness (mm)	Maximum Extension (mm)	Tensile strength (MPa)	Elongation at break (%)
1	4.31	5.1	5.06	8
2	4.09	3.9	3.85	8
3	3.84	4.4	4.44	8
Mean	4.08	4.5	4.45	8
Std Deviation	0.23	0.6	0.60	0

Passing Requirement: "Elongation at break shall be not less than 50% of the result recorded for the controls".

To pass this condition an elongation at break value of 6% or greater is required.

Result: 8% PASS

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Report number	Issue Date	Expiry Date
414-1 AS 4654.1	09/04/2025	09/04/2025

TEST REPORT



WORLD RECOGNISED
ACCREDITATION

Accredited for compliance with ISO/IEC 17025 – Testing
20678

DURABILITY OF MEMBRANE

ULTRAVIOLET EXPOSURE

Date of test: 17/03/2025

Testing:

Test carried out in accordance with AS 4654.1 Appendix A.

Additions, deviations and/or exclusions from AS 4654.1 Appendix A:

Nil

Test Parameters:

PARAMETER	VALUE
Ambient temperature (conditioning)	23.6-24.4°C
Ambient humidity (conditioning)	43.8-56.6%RH
Ambient temperature (testing)	24.2°C
Ambient humidity (testing)	44.0% RH
Accuracy grading of test machine	A
Specimen type	Type 2
Elongation measurement type:	Video Extensometer
Method of preparation of specimens	Sheet membrane
Orientation of specimens to direction of cast	-
Clamping device:	Pneumatic jaws
Testing speed:	50mm/min

Test Results:

Number of replicates	Sample thickness (mm)	Maximum Extension (mm)	Tensile strength (MPa)	Elongation at break (%)
1	3.91	2.0	4.12	4
2	4.49	5.5	7.97	11
3	3.90	6.2	6.58	12
Mean	4.10	4.6	6.22	9
Std Deviation	0.34	2.2	1.95	4

Passing Requirement: "Elongation at break shall be not less than 40% of the result recorded for the controls".

To pass this condition an elongation at break value of 5% or greater is required.

Result: 9% PASS

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Report number	Issue Date	Expiry Date
414-1 AS 4654.1	09/04/2025	09/04/2025

TEST REPORT



Accredited for compliance with ISO/IEC 17025 – Testing
20678

FIELD SEAM STRENGTH

Date of test: 12/02/2025

Testing: Test carried out in accordance with AMTM005.

Additions, deviations and/or exclusions from AMTM005: Nil

Test Parameters:

PARAMETER	VALUE
Ambient temperature (conditioning)	23.6-24.4°C
Ambient humidity (conditioning)	43.8-56.6%RH
Ambient temperature (testing)	23.4°C
Ambient humidity (testing)	48.2% RH
Accuracy grading of test machine	A
Elongation measurement type:	Electronic internal measurement
Orientation of specimens to direction of cast	-
Clamping device:	Pneumatic jaws
Testing speed:	100mm/min

Test Results:

Replicate	Peak Force (N/25mm)	Mode of Failure	
		Lap joint	Sheet
1	607.02	☒	☐
2	523.51	☒	☐
3	494.67	☒	☐
4	364.38	☒	☐
5	517.72	☒	☐
Mean	501.46		
Std Deviation	87.65		
Number of Failures		5	0
% Failure		100	0

Result 501.46 N/25mm

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Report number 414-1 AS 4654.1	Issue Date 09/04/2025	Expiry Date 09/04/2025
---	---------------------------------	----------------------------------

TEST REPORT



WORLD RECOGNISED
ACCREDITATION

Accredited for compliance with ISO/IEC 17025 – Testing
20678

TEMPERATURE RESISTANCE

Date of test: 11-25/03/2025

Testing:

Test carried out in accordance with AMTM004.

Additions, deviations and/or exclusions from AMTM004:

Nil

Test Parameters:

PARAMETER	VALUE
Cold exposure: Immersion date	3/03/2025
Cold exposure: Removal date	5/03/2025
Cold exposure: Temperature range	-16.5 - -17.9°C
Heat exposure: Immersion date	5/03/2025
Heat exposure: Removal date	7/03/2025
Heat exposure: temperature range	85°C
WVT: Date of test	11-25/03/2025
WVT: Test temperature	23.2-24.2°C
WVT: Test humidity	44.1-66.4% RH
WVT: Cup design	Round, anodised aluminium cup
WVT: Cup sealant	Paraffin wax
WVT: Desiccant	Anhydrous Calcium Chloride

Test Results- Temperature Resistance

SAMPLE	THICKNESS (mm)	SIDE OF SPECIMEN HIGHER VAPOUR PRESSURE WAS APPLIED TO	REGRESSION		WATER VAPOUR TRANSMISSION RATE (g/m ² /24 hours)
			EQUATION	r ² VALUE	
1	4.28	Side A, top of cast film	Mass _(g) =0.00002(Time _{hr})+181.93	0.5136	0.14
2	4.33	Side A, top of cast film	Mass _(g) =0.000005(Time _{hr})+180.81	0.0517	0.04
3	4.50	Side B, bottom of cast film	Mass _(g) =0.000006(Time _{hr})+190.64	0.4197	0.04

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TEST REPORT



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4	4.62	Side B, bottom of cast film	$\text{Mass}_{(g)} = 0.000008(\text{Time}_{\text{hr}}) + 189.97$	0.5496	0.06
Mean	4.43				0.07
Std Deviation	0.16				0.05

Result: 0.07 g/m²/24 hours.

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WATER VAPOUR TRANSMISSION RATE

Date of test: 19/03-2/04/2025

Testing:

Test carried out in accordance with ASTM E96 Desiccant Method.

Additions, deviations and/or exclusions from ASTM E96 Desiccant Method:

Nil

Test Parameters:

PARAMETER	VALUE
Test temperature:	23.2-24.2°C
Test humidity:	44.1-55.8% RH
Cup design:	Round, anodised aluminium cup
Sealant:	Paraffin wax
Desiccant:	Anhydrous Calcium Chloride

Test Results

SAMPLE	THICKNESS (mm)	SIDE OF SPECIMEN HIGHER VAPOUR PRESSURE WAS APPLIED TO	REGRESSION		WATER VAPOUR TRANSMISS ON RATE (g/m ² /24 hours)
			EQUATION	r ² VALUE	
1	4.44	Side A, top of cast film	Mass _(g) =0.00002(Time _{hr})+205.91	0.6421	0.14
2	4.11	Side A, top of cast film	Mass _(g) =0.0002(Time _{hr})+206.52	0.9031	1.45
3	4.27	Side B, bottom of cast film	Mass _(g) =0.0001(Time _{hr})+205.26	0.9832	0.72
4	4.42	Side B, bottom of cast film	Mass _(g) =0.00006(Time _{hr})+205.69	0.9429	0.43
Mean	4.31				0.69
Std Deviation	0.15				0.56

Result: 0.69 g/m²/24 hours. PASS

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