TEST REPORT

Accredited for compliance with ISO/IEC 17025 – Testing
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TEST SUMMARY

Objective

Assessment of supplied sample to AS4654.1-2012

Project

Evaluation of Actflex 3000 to AS 4654.1-2012

Report Number

372-1 AS4654.1-2012

Customer

NAME	Forspec Protective Coatings
ADDRESS	22/872 Canterbury Road Roselands 2196 NSW
CONTACT PERSON	James Gilto
EMAIL	info@forspec.com.au
TELEPHONE	02 8021 3517

Name of test material

Actflex 3000

Description of test material

PRE-Applied HDPE membrane

Date of receipt of test material

17/09/2024

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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

Michael Bakanyozo

Head Laboratory Technician

Reviewer

Eric Scardigno

Laboratory Manager

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SUMMARY OF TESTS

AS4654.1 Requirements:

PROPERTY	METHOD	RESULT	ASSESSMENT CRITERIA	ASSESSMENT
Abrasion Resistance: non-trafficable	AS 1580.403.2	***0.047mm***	AS 4654.1 Paragraph 2.3	**Meets requirement for non-trafficable membrane**
Abrasion Resistance: trafficable	AS 1580.403.2	***0.071 mm***	AS 4654.1 Paragraph 2.3	**Meets requirement for areas subjected to pedestrian traffic and occasional service vehicle traffic**
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*	***1273 %***	*AS 4654.1 Appendix A, Table A1*	**CLASS III**
Durability: Control Tensile Strength		***12.83 MPa***	*State result*	
Durability: Water Immersion Elongation at Break	*AS 4654.1 Appendix A*	***1249 %***	*AS 4654.1 Appendix A, Table A4*	**PASS**
Durability: Water Immersion Tensile Strength		***11.40 MPa***	*State result*	
Durability: Detergent Immersion Elongation at Break		***1275 %***	*AS 4654.1 Appendix A, Table A4*	**PASS**
Durability: Detergent Immersion Tensile Strength		***12.61 MPa***	*State result*	
Durability: Heat Aging Elongation at Break		***1165 %***	*AS 4654.1 Appendix A, Table A4*	**PASS**
Durability: Heat Aging Tensile Strength		***12.23 MPa***	*State result*	

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Field Seam Strength	*AMTM005*	***288.73N/25mm***	*State result*	[redacted]
Temperature Resistance: Water Vapour Transmission	*AMTM004*	***0.10 g/m²/24 hours***	*State result*	
Water Vapour Transmission	*ASTM E96*	***0.10 g/m²/24 hours***	*State result*	
Puncture Resistance	BS EN 12691	***500mm***	*State result*	
Water impermeability	AS ISO 13007.5 A.7	**No Visual Penetration. Weight gain: 0.04g**	No Visual Penetration below membrane and ≤3g weight gain	**PASS**

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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: 19/12/2024

PARAMETER	VALUE
Abrasion assessment method	Depth of abrasion
Abrasive wheels: Model	CS-10
Panel 1 Abrasive wheels: Serial Number & Expiry Date	LX20C1 – JULY 2027
Panel 2 Abrasive wheels: Serial Number & Expiry Date	LX20C1 – JULY 2027
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	1.587	1.562	0.025
	2	1.580	1.515	0.065
	3	1.618	1.562	0.056
2	1	1.626	1.574	0.052
	2	1.590	1.574	0.016
	3	1.631	1.563	0.068
Mean		1.605	1.558	0.047
Standard Deviation		0.020	0.027	0.022

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: 0.047mm. This sample is suitable for areas subjected only to maintenance access.

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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: 19/12/2024

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	1.561	1.483	0.078
	2	1.622	1.538	0.084
	3	1.617	1.550	0.067
2	1	1.612	1.539	0.073
	2	1.594	1.537	0.057
	3	1.643	1.575	0.068
Mean		1.608	1.537	0.071
Standard Deviation		0.034	0.036	0.009

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."**

Result: 0.071mm. Meets requirement for areas subjected to pedestrian traffic and occasional service vehicle traffic.

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CYCLIC MOVEMENT

Date of test: 28/10-1/11/2024

Testing:

Testing carried out in accordance with AS 4858.1 Appendix B "Assessment of resistance of waterproofing membranes to cyclic movement"

Additions, deviations and/or exclusions from AS 4858.1 Appendix B:

Nil

Test Parameters:

PARAMETER	VALUE
Membrane class	III
Number of cycles	50
Cycle time	2 Hours
Cycle expansion	4 mm
Sample Size	65 mm x 25 mm
Sample span	2 mm between plates
Sample thickness	1.731 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	28/10/2024	0	☐Yes	☒No	
2	29/10/2024	11	☐Yes	☒No	
3	30/10/2024	23	☐Yes	☒No	
4	31/10/2024	36	☐Yes	☒No	
5	1/11/2024	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 types of any surface defects that have been induced and the number of cycles at which onset of the defect occurred"*

Result: Meets the requirement for CSIRO moving joint test as per AS 4858.1 Appendix B.

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DIMENSIONAL STABILITY

Date of test: 9/12/-12/12/2-24

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 Reading at 95% RH & 20°C*	*Date*	*Pointer Reading at 15% RH & 32°C*	*Date*	*sign*
Width wise	700mm	9/12	700mm	10/12	700mm	11/12	700mm	11/12	700mm	12/12	MB
Length wise	700mm	9/12	700mm	10/12	700mm	11/12	700mm	11/12	700mm	12/12	MB

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DURABILITY OF MEMBRANE

CONTROL SET

Date of test: 18/10/2024

Testing: Test carried out in accordance with AS1145.3.

Additions, deviations and/or exclusions from AS1145.3: Nil

Test Parameters:

PARAMETER	VALUE
Ambient temperature (conditioning)	22.6-24.8°C
Ambient humidity (conditioning)	27.0-43.8%RH
Ambient temperature (testing)	24.8°C
Ambient humidity (testing)	29.8% RH
Accuracy grading of test machine	A
Specimen type	Type 2
Elongation measurement type:	Electronic internal measurement
Method of preparation of specimens	Dry Film Provided
Orientation of specimens to direction of cast	Parallel to direction of casting blade
Clamping device:	Pneumatic jaws
Testing speed:	50mm/min

Test Results:

Replicate	Sample thickness (mm)	Maximum Extension (mm)	Tensile Strength (MPa)	Elongation at Break (%)
1	1.78	613.3	11.90	1227
2	1.71	642.3	14.32	1285
3	1.74	642.5	13.24	1285
4	1.75	641.4	11.28	1283
5	1.74	642.8	13.40	1286
Mean	1.74	636.5	12.83	1273
Std Deviation	0.02	12.9	1.22	26

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 III

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DURABILITY OF MEMBRANE

WATER IMMERSION

Date of test: 24/10-12/12/2024

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)	22.6-24.8°C
Ambient humidity (conditioning)	27.0-43.8%RH
Ambient temperature (testing)	23.1-24.9°C
Ambient humidity (testing)	37.9-65.8% RH
Minimum accuracy grading of test machine	A
Specimen type	Type 2
Elongation measurement type:	Electronic internal measurement
Method of preparation of specimens	Dry Film Supplied
Orientation of specimens to direction of cast	Parallel to direction of casting blade
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	1.75	636.8	12.25	1273
2	1.74	624.4	12.07	1249
3	1.78	642.5	11.33	1285
7 Day Means	1.76	634.5	11.88	1269
7 Day Std Devs	0.02	9.3	0.49	19
4	1.77	553.2	11.41	1106
5	1.75	642.8	13.03	1286
6	1.72	554.4	7.39	1111
28 Day Means	1.75	583.5	10.61	1168
28 Day Std Devs	0.03	51.4	2.91	102
7	1.80	622.2	12.20	1244

8	1.79	642.3	12.60	1285
9	1.77	609.4	9.41	1219
56 Day Means	1.78	624.6	11.40	1249
56 Day Std Devs	0.02	16.6	1.74	33

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 319% or greater is required.

Result: 1249% PASS

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DURABILITY OF MEMBRANE

DETERGENT IMMERSION

Date of test: 24/10-12/12/2024

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)	22.6-24.8°C
Ambient humidity (conditioning)	27.0-43.8%RH
Ambient temperature (testing)	23.1-24.9°C
Ambient humidity (testing)	37.9-65.8% RH
Minimum accuracy grading of test machine	A
Specimen type	Type 2
Elongation measurement type:	Electronic internal measurement
Method of preparation of specimens	Dry Film Supplied
Orientation of specimens to direction of cast	Parallel to direction of casting blade
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	1.74	642.4	11.87	1285
2	1.75	642.8	12.31	1286
3	1.74	643.0	12.47	1286
7 Day Means	1.75	642.7	12.22	1285
7 Day Std Devs	0.01	0.3	0.31	1
4	1.69	642.5	13.92	1285
5	1.69	639.6	7.45	1279
6	1.72	418.0	10.13	836
28 Day Means	1.70	566.7	10.50	1133
28 Day Std Devs	0.02	128.8	3.25	258
7	1.81	642.1	12.83	1284

8	1.75	642.3	12.21	1285
9	1.75	628.1	12.80	1256
56 Day Means	1.77	637.5	12.61	1275
56 Day Std Devs	0.04	8.2	0.35	16

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 319% or greater is required.

Result: 1275% PASS

NATA WORLD RECOGNISED ACCREDITATION

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DURABILITY OF MEMBRANE

HEAT AGING

Date of test: 7/11/2024

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)	22.6-24.8°C
Ambient humidity (conditioning)	27.0-43.8%RH
Ambient temperature (testing)	23.9°C
Ambient humidity (testing)	45.3% RH
Accuracy grading of test machine	A
Specimen type	Type 2
Elongation measurement type:	Electronic internal measurement
Method of preparation of specimens	Dry Film Supplied
Orientation of specimens to direction of cast	Parallel to direction of casting blade
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	1.87	582.7	12.95	1165
2	1.89	606.6	13.37	1213
3	1.83	558.2	10.38	1116
Mean	1.87	582.5	12.23	1165
Std Deviation	0.03	24.2	1.62	48

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 393% or greater is required.

Result: 1165% PASS

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FIELD SEAM STRENGTH

Date of test: 19/12/2024

Testing:

Test carried out in accordance with AMTM005.

Additions, deviations and/or exclusions from AMTM005:

Nil

Test Parameters:

PARAMETER	VALUE
Ambient temperature (conditioning)	22.6-24.8°C
Ambient humidity (conditioning)	27.0-43.8%RH
Ambient temperature (testing)	23.9°C
Ambient humidity (testing)	45.1% RH
Accuracy grading of test machine	A
Elongation measurement type:	Electronic internal measurement
Orientation of specimens to direction of cast	Parallel to direction of casting blade
Clamping device:	Pneumatic jaws
Testing speed:	100mm/min

Test Results:

Replicate	Peak Force (N/25mm)	Mode of Failure	
		Lap joint	Sheet
1	295.86	☒	☐
2	268.73	☒	☐
3	322.43	☒	☐
4	272.76	☒	☐
5	283.86	☒	☐
Mean	288.73		
Std Deviation	21.59		
Number of Failures		5	0
% Failure		100	0

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TEMPERATURE RESISTANCE

Date of test: 11/11-25/11/2024

Testing:

Test carried out in accordance with AMTM004.

Additions, deviations and/or exclusions from AMTM004:

Nil

Test Parameters:

PARAMETER	VALUE
Cold exposure: Immersion date	4/11/2024
Cold exposure: Removal date	6/11/2024
Cold exposure: Temperature range	-21.5/-22.5
Heat exposure: Immersion date	6/11/2024
Heat exposure: Removal date	8/11/2024
Heat exposure: temperature range	85°C
WVT: Date of test	11/11-25/11/2024
WVT: Test temperature	23.6-24.9°C
WVT: Test humidity	37.9-56.9% 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 TRANSMISSON RATE ($g/m^2/24$ hours)
			EQUATION	r^2 VALUE	
1	1.71	Side A, top of cast film	$Mass_{(g)}=0.000002(Time_{hr})+165.53$	0.1161	0.01
2	1.70	Side A, top of cast film	$Mass_{(g)}=0.000002(Time_{hr})+162.68$	0.3513	0.04
3	1.73	Side B, bottom of cast film	$Mass_{(g)}=0.000002(Time_{hr})+165.85$	0.701	0.14

4	1.72	Side B, bottom of cast film	$Mass_{(g)}=0.000003(Time_{hr})+165.47$	0.8574	0.22
Mean	1.71				0.10
Std Deviation	0.01				0.09

Result: 0.10 g/m^2/24 hours. PASS

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WATER VAPOUR TRANSMISSION RATE

Date of test: 21/10-4/11/2024

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:	23.1-25.0°C
Test humidity:	39.2-44.8% 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 TRANSMISSION RATE (g/m^2/24 hours)
			EQUATION	r^2 VALUE	
1	1.70	Side A, top of cast film	$Mass_{(g)}=0.000003(Time_{hr})+173.90$	0.1053	0.02
2	1.70	Side A, top of cast film	$Mass_{(g)}=0.000002(Time_{hr})+174.60$	0.0633	0.01
3	1.71	Side B, bottom of cast film	$Mass_{(g)}=0.00005(Time_{hr})+172.40$	0.9729	0.36
4	1.73	Side B, bottom of cast film	$Mass_{(g)}=0.000003(Time_{hr})+174.79$	0.1300	0.02
Mean	1.71				0.10
Std Deviation	0.01				0.17

Result: 0.10 g/m^2/24 hours. PASS

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PUNCTURE RESISTANCE

Date of test: 12/12/2024

Testing:

Test carried out in accordance with BS EN 12691.

Additions, deviations and/or exclusions from BS EN 12691:

Nil

Test Parameters:

PARAMETER	VALUE
Ambient temperature (conditioning)	22.6-24.8°C
Ambient humidity (conditioning)	27.0-43.8%RH
Ambient temperature (testing)	24.0°C
Ambient humidity (testing)	51.4% RH
Method of preparation of specimens	Dry Film supplied

Test Results:

RESULT	OUTCOME
Test Method (A or B per BS EN 12691)	Method A
Lowest height of dart released causing greater than 1 of 5 specimens to be punctured	800mm
Highest height resulting in less than 2 specimens punctured	500mm

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Water Impermeability

Testing:

Test carried out in accordance with AS ISO 13007.5 A.7.

Additions, deviations and/or exclusions from AS ISO 13007.5 A.7:

Nil

Sample Preparation:

PARAMETER	VALUE
Ambient Temperature (conditioning)	23.5-25.4 °C
Ambient humidity (conditioning)	52.3-55.4%RH
Ambient temperature (testing)	23.6-24.2 °C
Ambient humidity (testing)	49.6-55.5%RH

Test Results:

Test Date: 10-17/02/2025

SAMPLE	Water pressure	Water Impermeability			
		MASS (m1) (g)	MASS (m2) (g)	Weight gain (g)	Visual Penetration
Control Block	1.5bar	393.09	4232.30	302.21	Yes
1	1.5bar	4016.81	4016.81	0.00	No
2	1.5bar	3992.19	3392.20	0.01	No
3	1.5bar	4002.00	4002.11	0.11	No
Mean		4003.67	3803.7	0.04	No
Std Deviation		12.39	356.5	0.06	No

Weight Gain: 0.04g

Pass

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END OF REPORT