



# TEST REPORT

## DC16981-01-1

### REPORT ON TESTING OF BUTYNOL 1.0MM BLACK MEMBRANE TO THE REQUIREMENTS OF AS 4654.1-2012

#### CLIENT

Ardex Australia Pty Ltd  
PO Box 796  
Seven Hills NSW 1730  
Australia

# TEST SUMMARY

## Objective

Testing was completed of the Butynol 1.0mm Black membrane to the requirements of AS 4654.1-2012 *Waterproofing membranes for external above-ground use Part 1: Materials*.

## Summary

Passing results were obtained for the 1.13 mm thick Butynol 1.0mm Black membrane where requirements are stated in the AS 4654.1-2012 Standard. The Butynol 1.0mm Black membrane samples supplied met the requirements to be classified as Class III (High Extensibility).

## Test sponsor

Ardex Australia Pty Ltd  
PO Box 796  
Seven Hills NSW 1730  
Australia

## Description of test specimen

The client supplied Butynol 1.0mm Black membrane samples to be tested. The sheet samples were received on 8 January 2023 and assigned the BRANZ sample reference 23/018. The Butynol 1.0mm Black membrane was supplied in sheet roll and was tested in both principal directions, the Machine Direction (MD) and the Cross Direction (CD), which were labelled on the samples by the client.



REPORT NUMBER:

**DC16981-01-1**

ISSUE DATE:

**10 July 2023**

PAGE:

**2 of 13**

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## LIMITATION

The results reported here relate only to the items tested.

## TERMS AND CONDITIONS

This report is issued in accordance with the Terms and Conditions as detailed and agreed in the BRANZ Services Agreement for this work.



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REPORT NUMBER:

**DC16981-01-1**

ISSUE DATE:

**10 July 2023**

PAGE:

**3 of 13**

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REPORT NUMBER:

**DC16981-01-1**

ISSUE DATE:

**10 July 2023**

PAGE:

**4 of 13**

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# 1. SCOPE

The client requested testing of the Butynol 1.0mm Black membrane to the performance specifications of AS 4654.1-2012, Waterproofing membranes for external and above-ground use, Part 1: Materials. Testing was completed to AS 4654.1-2012 Table 2.1 – fully bonded membranes. An Instron 5569 Universal testing machine and a 10 kN load cell was used to provide a constant rate of elongation.

# 2. SUMMARY

**Table 1: AS 4654.1-2012 Table 2.1 Requirements – Fully Bonded Membranes and Mechanically Fastened membranes – Butynol 1.0mm Black membrane.**

PROPERTY REQUIRED	METHOD	RESULTS		
		MD	CD	Pass/Fail
Abrasion resistance	AS 1580.403.2	0.04 mm		Regular vehicle traffic
Bond strength	ASTM C794	Plywood 32.8 N	Concrete 27.6 N	N/A
Cyclic movement	Moving Joint Test	Tested as Class III		Pass
Dimensional stability	ASTM D6207	+1 mm		N/A
Elongation at break	AS 4654.1-2012 Appendix A	485.8 %	531.1 %	N/A
Field seam strength	EN 12316.2, EN 12317.2	Shear: 188N (end lap) 168N (side lap) Peel: 46N (end lap) 47N (side lap)		N/A
Heat ageing	AS 4654.1-2012	499.0 %	531.1 %	Pass
Temperature resistance	AS 4654.1-2012 Clause 2.6	543.0 %	542.3 %	Pass
Ultraviolet resistance	AS 4654.1-2012 Table A4	520.2 %	572.7 %	Pass
Tensile strength	AS 4654.1-2012 Table A4	10.72 MPa	10.22 MPa	N/A
Thickness	Various methods	1.13 mm	1.16 mm	N/A
Durability <sup>1</sup>	AS 4654.1-2012 Table A4	N/A	N/A	Pass
Water vapour transmission rate	ASTM E96	0.69 g/m <sup>2</sup> /24 hours		N/A

**Notes:**

1. Durability of membranes is a combined group of assessments as detailed in AS 4654.1-2012 Appendix A, Table A4.



### 3. ABRASION RESISTANCE

#### 3.1 Testing

Test carried out in accordance with AS 1580.403.2.

Number of samples: 2  
Number of test points: 6  
Abrader wheels: H-22  
Number of revolutions: 1000

Table 2: Abrasion results for Butynol 1.0mm Black.

Thickness Points	Sample 1			Sample 2		
	Initial	Final	Loss	Initial	Final	Loss
1	1.14	1.11	0.03	1.14	1.11	0.03
2	1.14	1.09	0.05	1.14	1.10	0.04
3	1.16	1.11	0.05	1.15	1.11	0.04
4	1.14	1.09	0.05	1.16	1.11	0.05
5	1.15	1.11	0.04	1.13	1.09	0.04
6	1.13	1.09	0.04	1.14	1.08	0.06
Average	1.14	1.10	0.04	1.14	1.10	0.04

Mean loss: 0.04 mm

**Requirement:** For areas subjected to regular vehicle traffic the depth of abrasion shall be less than 0.05 mm.

**Result:** Pass

### 4. BOND STRENGTH

#### 4.1 Testing

Testing was carried out on Butynol 1.0mm Black in accordance with ASTM C794, with variations to the specimen preparation process. As the product is a sheet membrane, it was fully bonded to the substrate using adhesive (supplied by the client) in 25 mm wide strips and then peeled off using the membrane instead of mesh.



## 4.2 Results

Results are an average of 4 samples.

**Table 3: Bond strength results**

Substrate	Mean Force, N
Plywood	32.8
Concrete Masonry	27.6

## 5. CYCLIC MOVEMENT

### 5.1 Testing

Testing carried out in accordance with AS 4654.1-2012 Appendix B Assessment of resistance of waterproofing membranes to cyclic movement. Note: this material was tested as a Class III.

<b>Sample</b>	Butynol 1.0mm Black
<b>Sample code</b>	23/018
<b>Material class</b>	Class III
<b>Test time</b>	2 hours
<b>Cyclic extension</b>	4 mm
<b>Rate of extension</b>	3.34 mm/min

### 5.2 Results

The test sample achieved a control elongation at break of 485.8 % MD and 544.3% CD as per AS 4654-2012 Appendix A.

<b>Number of cycles completed:</b>	50
<b>Surface crazing:</b>	Nil
<b>Surface tears:</b>	Nil
<b>Membrane Rupture:</b>	Nil
<b>Results</b>	Pass

For Class III high extensibility membranes, the minimum bond breaker/tape width to bridge joints opening up by 5 mm is 12 mm as per AS 4654.1-2012 Table A2.



REPORT NUMBER:

**DC16981-01-1**

ISSUE DATE:

**10 July 2023**

PAGE:

**7 of 13**

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## 6. CONTROL

### 6.1 Testing

Test carried out in accordance with AS 4654.1-2012 Appendix A in both principal directions.

### 6.2 Results

Results are an average of 6 samples.

**Table 4: Control results for Butynol 1.0mm Black in Machine Direction (MD).**

Thickness (mm)	Max Load (N)	Max Stress (MPa)	Elongation at break (%)
1.13	301.7	10.72	485.8

**Table 5: Control results for Butynol 1.0mm Black in Cross Direction (CD).**

Thickness (mm)	Max Load (N)	Max Stress (Mpa)	Elongation at break (%)
1.12	285.9	10.22	544.3

**Requirement for Class III** The specimens have an elongation at break of >300%.

**Classification:** Class III (High extensibility)

Note: Both MD and CD samples exceeded the Introns frame elongation capacity. The control specimens did not break during testing.

## 7. HEAT AGEING

### 7.1 Testing

Testing carried out in accordance with AS 4654.1-2012 Appendix A.

### 7.2 Results

Results are an average of 6 samples.

**Table 6: Heat ageing results Butynol 1.0mm Black MD**

Thickness (mm)	Max Load (N)	Max Stress (Mpa)	Elongation at break (%)
1.15	303.6	10.60	499.0





**Table 7: Heat ageing results Butynol 1.0mm Black CD**

Thickness (mm)	Max Load (N)	Max Stress (Mpa)	Elongation at break (%)
1.15	284.5	9.86	531.1

**Requirement:** The specimens require an elongation at break greater than 50% of the control sample, 485.80 % MD and 531.1% CD. An elongation of less than 242.9 % MD or 265.6 % CD is a fail.

**Result:** Pass

## **8. TEMPERATURE RESISTANCE**

### **8.1 Testing**

Testing carried out in accordance with AS 4654.1-2012 Clause 2.6. Samples were exposed for 2 days at -15°C and then exposed for 2 days at 85°C.

### **8.2 Results**

Results are an average of 5 samples.

**Table 8: Temperature resistance results Butynol 1.0mm Black MD**

Thickness (mm)	Max Load (N)	Max Stress (Mpa)	Elongation at break (%)
1.15	293.4	10.24	543.0

Results are an average of 6 samples.

**Table 9: Temperature resistance results Butynol 1.0mm Black CD**

Thickness (mm)	Max Load (N)	Max Stress (Mpa)	Elongation at break (%)
1.15	287.0	10.00	542.3

**Requirement:** The membrane shall remain waterproof when subjected to temperatures likely to be encountered in use: for Australia these would be within the range -15°C to 85°C.

Samples shall exhibit no cracking, fractures, or surface defects after exposure.

**Result:** Pass



## 9. ULTRAVIOLET RESISTANCE

### 9.1 Testing

Testing carried out in accordance with AS 4654.1-2012 Appendix A.

### 9.2 Results

Results are an average of 6 samples.

**Table 10: Ultraviolet resistance results Butynol 1.0mm Black MD.**

Thickness (mm)	Max Load (N)	Max Stress (MPa)	Elongation at break (%)
1.16	318.6	10.97	520.2

**Table 11: Ultraviolet resistance results Butynol 1.0mm Black CD.**

Thickness (mm)	Max Load (N)	Max Stress (MPa)	Elongation at break (%)
1.14	252.6	8.87	572.7

**Requirement:** The specimens require an elongation at break greater than 40% of the control sample, 485.80 % MD and 531.1 % CD. An elongation of less than 194.32% MD, 212.44 % CD is a fail.

**Result:** Pass

## 10. DURABILITY

### 10.1 Testing

Testing carried out in accordance with AS 4654.1-2012 Appendix A

### 10.2 Results

**Table 12: Durability results Butynol 1.0mm Black MD**

Ageing	Aged period	Thickness (mm)	Max Load (N)	Max Stress (Mpa)	Elongation at break (%)
De-ionised water	7 days	1.16	308.1	10.61	543.1
	28 days	1.17	316.0	10.84	496.1
	56 days	1.17	267.5	9.16	426.3
Detergent	7 days	1.16	279.4	9.63	534.7
	28 days	1.16	259.8	8.95	389.0



	56 days	1.16	266.8	9.23	409.7
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Elongation at break (Controls) = 485.80 %, Result = Pass

**Table 13: Durability Results Butynol 1.0mm Black CD**

Ageing	Aged period	Thickness (mm)	Max Load (N)	Max Stress (MPa)	Elongation at break (% of control)
De-ionised water	7 days	1.16	313.8	10.81	550.8
	28 days	1.16	260.2	9.00	500.8
	56 days	1.16	229.5	7.89	413.4
Detergent	7 days	1.15	230.8	8.04	545.6
	28 days	1.15	231.3	8.02	402.8
	56 days	1.15	234.4	8.17	411.9

Elongation at break (Controls) = 531.1 %, Result = Pass

## 11. DIMENSIONAL STABILITY

### 11.1 Testing

Testing carried out to ASTM D6207-03, Dimensional Stability of Fabrics to Changes in Humidity and Temperature with a variation in specimen lengths and measurement gauge length. Due to environmental chamber availability the specimen length was decreased to 850 mm and gauge marks were located at 750 mm from top of specimen. A 1m ruler was used instead of a specimen frame, measurement locations were clearly marked for measurement repeatability. A specimen was taken from both machine and cross direction.

### 11.2 Results

**Table 14: Dimensional Stability results Butynol 1.0mm Black.**

Pointer Settings, mm	MD	CD
Initial Reading	749	750
After first humid cycle at 95% RH and 20°C	749	751
After first dry cycle at 15% RH and 32°C	750	751
After second humid cycle at 95% RH and 20°C	748	750
After second dry cycle at 15% RH and 32°C	750	751

No discolouration, bubbling or curling was observed during or after testing.



## 12. FIELD SEAM STRENGTH

### 12.1 Testing to EN 12316-2 Peel Resistance

Testing was carried out to EN 12316-2: Determination of peel resistance of joints – Part 2. Testing was completed on 23 May 2023.

### 12.2 Sampling

The client provided two jointed samples of Butynol 1.0mm Black labelled with machine and cross direction. Machine direction samples were assumed to be end laps and cross direction samples were assumed to be side laps.

### 12.3 Results

Table 15: Field Seam Strength Peel Resistance results for Butynol 1.0mm Black.

Lap Type	Sample	Mean of 10 points (N)	Failure Mode	Mean peel force (N)
Side Lap	1	45.7	A	46
	2	47.3	A	
	3	45.3	A	
	4	44.3	A	
	5	46.7	A	
End Lap	6	41.5	A	47
	7	38.3	A	
	8	40.5	A	
	9	58.5	A	
	10	55.4	A	

Failure Modes are described as follows:

A = Peeling of the joint, B = Break outside of the joint, C = Delamination of sheet. In this case the area of delamination must be more than 5% of the joint area.

### 12.4 Testing to EN 12317-2 Shear Resistance

Testing was carried out to EN 12317-2: Determination of shear resistance of joints- Part 2. Testing was completed on 23 May 2023.

### 12.5 Sampling

The client provided two jointed samples of Butynol 1.0mm Black labelled with machine and cross direction. Machine direction samples were assumed to be end laps and cross direction samples were assumed to be side laps.



## 12.6 Results

Table 16: Field Seam Strength Shear Resistance results Butynol 1.0mm Black.

Lap Type	Sample	Max Load (N)	Failure Mode	Mean Max Load (N)
Side Lap	1	166.4	Separate/split	168
	2	161.6	Separate/split	
	3	160.5	Separate/split	
	4	169.2	Separate/split	
	5	183.5	Separate/split	
End Lap	6	188.8	Separate/split	188
	7	185.1	Separate/split	
	8	181.7	Separate/split	
	9	201.3	Separate/split	
	10	184.7	Separate/split	

## 13. WATER VAPOUR TRANSMISSION RATE

### 13.1 Testing

Testing carried out in accordance with ASTM E96 desiccant method.

### 13.2 Results

Table 17: Water vapour transmission rate results Butynol 1.0mm Black.

Thickness (mm)	WVTR (g/m <sup>2</sup> /24 hours)	Minimum result (g/m <sup>2</sup> /24 hours)	Maximum result (g/m <sup>2</sup> /24 hours)
1.13	0.69	0.04	2.00



REPORT NUMBER:

DC16981-01-1

ISSUE DATE:

10 July 2023

PAGE:

13 of 13

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