Technical Data Sheet

BluSeal PVC Tunnel Liner

PVC FLEXIBLE SHEET MEMBRANE

BluSeal PVC is supplied and installed as a fully sealed and welded, robust membrane system.

BluSeal PVC Tunnel Liner is a synthetic membrane of plasticised PVC sheet which forms a flexible and durable tunnel membrane. BluSeal PVC Tunnel Liner is used for lining bored and driven tunnels, cut and cover tunnels, cross passages, shafts and underground structures. BluSeal PVC Tunnel Liner comes in a range of thicknesses for various performance applications. The membrane is applied to structures to prevent water inflow and provide asset protection.

Application Advantages

- Flexibility to conform to various surface profiles
- High tear strength and elongation
- Exceptional waterproofing performance
- Good weldability

Lifecycle Advantages

- 100 year design life
- International Standards testing
- Fire rated

About the Product

BluSeal PVC is supplied and installed as a fully sealed and welded robust membrane system. The installed system includes proprietary system provisions for service penetrations, through fixings and terminations. The liner is suitable for a range of underground structures providing the most robust and reliable solution available for concrete protection and water infiltration management. Under the supervision of Bluey Engineers and trained installers, BluSeal PVC can be applied to tunnels, basements and other structures as either a tanked or drained lining system. PVC allows easy hand welding in complex areas providing cost savings on installation around structures with complex geometry. BluSeal PVC is designed and installed in accordance with International standards. BluSeal PVC is the most reliable choice for all civil engineering underground structures.

Application Solutions

- Lining bored and driven tunnels
- Cut and cover tunnels
- Green roofs
- Cross passages
- Underground structures
- Flat and insulated roof structures

Project Specification Clause

PVC FLEXIBLE SHEET MEMBRANE - The PVC Sheet membrane used for this project shall be supplied and installed as a fully sealed and welded robust membrane system. It shall be a pre-fabricated product that has independent testing to validate the performance outlined in the technical data table on the following pages. BluSeal PVC Tunnel Liner manufactured by Bluey Technologies or equivalent shall be accepted.

Project Examples

Tunnel waterproofing, basements, green roofs, rail bridges, land bridges.

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Application Specification

PREPARATION

1.1 Substrate surfaces onto which a waterproof membrane is to be applied shall be prepared by the addition of a shotcrete smoothing layer to remove local peaks and infill hollows, or a suitably smooth concrete or rock surface.

1.2 Surfaces on which waterproofing systems shall be installed shall be clean, free from loose aggregate, sharp protrusions, projecting tying wire, release agents and other substances which are likely to damage or affect the waterproofing system.

1.3 Large circumferential irregularities shall not exceed 200mm when measured from a 1.0m curved edge held against the tunnel circumference.

1.4 Any curvature or irregularity shall have a radius greater than 200mm. In areas where curvature is in excess of this value the Waterproofing Supervisor shall be required to inspect and deem if acceptable with the use of double geotextile fleecing, etc.

1.5 The shotcrete (including smoothing layer) shall be cured for at least 24 hours prior to membrane placement.

1.6 Steel elements, such as reinforcement bars, steel girders and the heads of rock bolts (as far as not used to hold inner lining structures) shall be covered with at least 20mm of shotcrete (or other approved method).

1.7 Depth pins shall be cut flush with the surface and patched with mortar.

1.8 Running water ingress shall be plugged prior to the initial lining of the tunnel with geotextile. Where heavy water ingress is encountered it shall be collected into half-pipes (e.g. flexi-drain or strip-drains, etc.), mounted by nailing and led into the permanent drainage system as appropriate.

1.9 If water is later found excessively penetrating through the shotcrete lining, which can adversely affect the installation of membrane, the water shall be collected by means of hoses and temporarily drained to the tunnel invert (i.e. during concrete lining pour, etc.).

1.10 The drainage shall be maintained during the membrane installation process so that no water pressure can develop behind the membrane.

1.11 BluSeal PVC Tunnel Liner is to be installed over non woven geotextile of not less than 500gsm.

APPLICATION

2.1 BluSeal PVC Tunnel Liner must be installed by an approved, specialised applicator. Experienced in installation techniques and testing is essential.

2.2 Following installation of geotextile, the compatible roundels are nailed to the surface using a suitable nail gun. Roundels shall be set in a pattern to adequately support the membrane. This will vary between the tunnel crown, walls and invert.

2.3 BluSeal PVC Tunnel Liner shall be attached to the roundels by hot air 'spot' welding.

2.4 The membrane shall be laid with sufficient slack (quilting) to avoid potential overstressing of the membrane sheet and possible tearing during concreting. However, it should not be installed too loose, that the membrane folds over itself during concrete placement (the membrane should be pressed against the surface during concreting).

2.5 Adjacent sections (rolls) of BluSeal PVC Tunnel Liner shall be overlapped by approximately 100mm and joined by double seam welding.

2.6 Double seam welds are to be tested by applying pressure to the gap between the welds.

2.7 Areas where a double seam weld is not possible, a hand weld is to be employed. These welds are to be tested by nail test, or if profile permits a vacuum test.

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Product Data

Please refer to Important Notice on following page

TESTED CHARACTERISTIC	STANDARD	RESULT	
		BluSeal PVC OBV Tunnel Liner (Austrian Tunnel Specification)	**BluSeal PVC Tunnel Liner** (British Tunnel Specification)
CE Marking	EN 13491	Complies	
General Appearance	EN1850-2	No tears, blisters, bubbles, pores or any other type of visual imperfection	
Straightness and Flatness	EN1848-2	g ≤50mm, p ≤10mm	
Density	EN ISO 1183-1	1.28g/cm^3 ± 0.02	
Nominal Thickness	EN 1849-2	2.1mm	2.0mm
Mean Thickness		≥2.0mm	≥2.0mm
Minimum Value		2.0mm	1.8mm
Maximum Value		2.2mm	2.2mm
Thickness of SL		≤0.2mm	≤0.6mm
DSC Analysis	EN ISO 11357-1	Dependent upon diagram analysis	N/A
IR Spectroscopy	ASTM E 334	Dependent upon diagram analysis	N/A
Tensile Strength	EN ISO 527-1	L ≥16N/mm^2, T ≥16N/mm^2	
Elongation @ Failure		L ≥300% - 10% + 20%, T ≥300% -10% + 20%	
Secant Modulus 1-2%		≤20 N/mm^2	
Resistance Under Water Pressure	EN 1928 (Method B)	5 bars @ 1 hour - No leakage	
Root Resistance	EN 14416	No penetration	
Tear Resistance	EN 12310-2	≥80N/mm	
Appearance of Welded Seam	DVS 2225-5	Free of faults	
Shear Test of the Welded Seam - Failure Behaviour	EN 12317-2	Break outside of the weld seam	
Peel Test of the Welded Seam - Failure Behaviour and Resistance to Peeling	EN 12316-2	>6N/mm	
Static Puncture Resistance (CBR)	EN ISO 12236	>2.5 kN	N/A
Water Absorption	EN ISO 62	≤4%	
Permeability to Liquids	EN 14150	Impermeable	
Fire Resistance and Combustibility	EN ISO 11925	Class E	
Bulge Elongation @ Multiaxial Tensile Test	EN 14151	>50%	
Impact resistance: Height of Fall Without Perforation	EN 12691 (500g, 750mm)	≥750mm	

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Long Term Compressive Strength	OEBV Directive, Appendix 1 (7MPa/48h)	Complies	N/A
Foldability @ Low Temperature	EN 495-5	No cracks or visible defects	
Dimensional Stability After Storage @ High Temperature	EN 1107-2	After 6 hours @ 80°C L ≤2%, T ≤2%	
Condition After Accelerated Ageing	EN1850-2	No visible defects	
Resistance to Artifical Weathering	EN1850-2	No visible defects	
Thermal Ageing	EN1296	After 70 days storage @ 80°C:	
Change in Tensile Strength	EN ISO 527-1	L ≤10%, T ≤10%	
Change in Elongation @ Break	EN ISO 527-1	L ≤10%, T ≤10%	
Foldability @ 20°C	EN 495-5	No cracks or visible defects	N/A
Resistance to Oxidation	EN 14575	After 90 days storage @ 85°C	
Change in Tensile Strength	EN ISO 527-1	L ≤20%, T ≤20%	N/A
Change in Elongation @ Break	EN ISO 527-1	L ≤20%, T ≤20%	N/A
Behaviour after Immersion in Hot Water	EN1296	After 8 months storage @ 50°C:	
Change in Tensile Strength	EN ISO 527-1	L ≤20%, T ≤20%	N/A
Change in Elongation @ Break	EN ISO 527-1	L ≤20%, T ≤20%	N/A
Foldability @ 20°C	EN 495-5	No cracks	N/A
Change in Mass		≤4%	N/A
Behaviour after Immersion in Aqueous Solution H_2O	EN 14575	After 90 days storage @ 23°C:	
Change in Tensile Strength	EN ISO 527-1	L ≤25%, T ≤25%	N/A
Change in Elongation @ Break	EN ISO 527-1	L ≤25%, T ≤25%	N/A
Behaviour after Immersion in Aqueous Solution Ca(OH)2	EN 14575	After 90 days storage @ 23°C:	
Change in Tensile Strength	EN ISO 527-1	L ≤25%, T ≤25%	N/A
Change in Elongation @ Break	EN ISO 527-1	L ≤25%, T ≤25%	N/A
Behaviour after Immersion in Aqueous Solution H_2SO_3	EN 14575	After 90 days storage @ 23°C:	
Change in Tensile Strength	EN ISO 527-1	L ≤20%, T ≤20%	N/A
Change in Elongation @ Break	EN ISO 527-1	L ≤20%, T ≤20%	N/A

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IMPORTANT NOTICE

This Technical Data Sheet is provided for general information and instruction only. The properties and characteristics set out herein represent typical testing results under laboratory conditions. Results of actual product characteristics may vary slightly. Site-specific and project-specific conditions may affect product performance, including without limitation: surfaces, environmental conditions, contact conditions, storage conditions, storage timeframes, weather, and climatic or seasonal conditions. Not all product parameters are batch tested as part of the manufacturing quality control process, and performance may vary between batches.

If Bluey gives any express written product warranty in relation to the product, that warranty is subject to the foregoing qualifications, despite anything to the contrary in any other document. All other representations, advice, suggestions or promises regarding the product's performance or its implementation, whether verbal or in writing, and whenever given, including in the course of any field services, are expressly disclaimed. Without limiting the foregoing, Bluey will have no liability for loss or damage of any kind if any application specifications are not followed.

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