

BluSeal VLDPE Tunnel Liner

VLDPE Flexible Sheet Membrane

Material Description

BluSeal VLDPE Tunnel Liner is a synthetic membrane of VLDPE sheet which forms a flexible and durable tunnel membrane. **BluSeal VLDPE Tunnel Liner** is used for lining bored and driven tunnels, cut and cover tunnels, cross passages, shafts and underground structures.

BluSeal VLDPE 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.

BluSeal VLDPE Tunnel Liner 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 VLDPE Tunnel Liner** can be applied to tunnels, basements and other structures as either a tanked or drained lining system.

BluSeal VLDPE Tunnel Liner allows easy hand welding in complex areas providing cost savings on installation around structures with complex geometry. **BluSeal VLDPE Tunnel Liner** is designed and installed in accordance with international standards.

Characteristics and Benefits

- Flexibility to conform to various surface profiles
- High tear strength and elongation
- Exceptional waterproofing performance
- Good weldability
- 120-year design life
- International Standards testing
- Fire rated
- Able to be extrusion welded

Areas of Application

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

Application Specification

Preparation

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.
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.
3. Large circumferential irregularities shall not exceed 200mm when measured from a 1.0m curved edge held against the tunnel circumference.
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.
5. The shotcrete (including smoothing layer) shall be cured for at least 24 hours prior to membrane placement.
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).
7. Depth pins shall be cut flush with the surface and patched with mortar.

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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.
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.).
10. The drainage shall be maintained during the membrane installation process so that no water pressure can develop behind the membrane.
11. **BluSeal VLDPE Tunnel Liner** is to be installed over non-woven geotextile of not less than 500gsm.

Application

1. **BluSeal VLDPE Tunnel Liner** must be installed by an approved, specialised applicator. Experienced in installation techniques and testing is essential.
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.
3. **BluSeal VLDPE Tunnel Liner** shall be attached to the roundels by hot air 'spot' welding.
4. The membrane shall be laid with sufficient slack (quilting) to avoid potential overstretching 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).
5. Adjacent sections (rolls) of **BluSeal VLDPE Tunnel Liner** shall be overlapped by approximately 100mm and joined by double seam welding.

6. Double seam welds are to be tested by applying pressure to the gap between the welds.
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.
8. Hand welds can then be extrusion welded to give hand welds a double weld.

Project Specification Clause

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

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Performance Data

Description	Standard	Requirement VLDPE	Result
Appearance	BS EN 1850-2	Full surface bond of the signal layer with the base material, free from bubbles, cracks, and entrapped air	Complies
Straightness and Flatness	BS EN 1848-	$g \leq 50\text{mm}$ $p \leq 10\text{mm}$	$g \leq 50\text{mm}$ $p \leq 10\text{mm}$
Minimum Thickness	BS EN 1849-2	$\geq 2\text{mm}$	$\geq 2\text{mm}$
Nominal Thickness		$\geq 2.1\text{mm}$	$\geq 2.1\text{mm}$
Thickness of Signal Layer		$\leq 0.6\text{mm}$	Complies
Density (Tolerance)	BS EN 1183-1	$< \pm 0.005\text{g/cm}^3$	$< \pm 0.005\text{g/cm}^3$
DSC-Analysis and IR Spectroscopy	BS EN ISO 11357-1 BS EN ISO 11357-3 ASTM E334	Individual evaluation of diagram	Complies
MFR (Melt Mass-Flow Rate)	BS EN ISO 1133- (Method A)	Nominal value $\pm 15\%$	Complies
Tensile Strength	BS EN ISO 527-1 BS EN ISO 527-3 BS EN ISO 527-5	$\geq 15\text{N/mm}^2$	$> 23\text{N/mm}^2$
Elongation @ Failure	BS EN ISO 527-1 BS EN ISO 527-3 BS EN ISO 527-5	$\geq 500\%$	$\geq 500\%$
Elastic Modulus EI-2	BS EN ISO 527-1 BS EN ISO 527-3 BS EN ISO 527-5	$\leq 100\text{N/mm}^2$ (Figure 4.3)	$\leq 100\text{N/mm}^2$ (Figure 4.3)
Puncture Resistance	BS EN ISO 12236	$> 2.8\text{kN}$	3.5kN
Burst Strength	BS EN 14151	$\geq 50\%$	168%
Multi-Axial-Elongation			
Impact Resistance (500g)/Dynamic Perforation	BS EN 12691	Watertight @ 750mm	Watertight @ 970mm
Behaviour Under Hydrostatic Pressure (10bar/24 hours)	BS EN 1928	No leakage	Complies
Heat Distortion/Dimension Stability	BS EN 1107-2 BS EN 1850-2	$\leq 2.0\%$ (6 hours/80°C)	1.66%
Behaviour After Heat Exposure		Free from bubbles	Complies
Dimensional Stability	ÖNORM EN 1107-2	$\leq 2\%$ (1h/100°C)	Complies
Long Term Compressive Strength		Watertight at 7N/mm ² , 48h test	Complies
Reaction to Fire	ÖNORM EN ISO 11925-20	Class E	Complies
Environmental Stress Cracking	BS EN 14576	≥ 200 hr	Complies

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Performance Data (cont'd)

Description	Standard	Requirement VLDPE	Result
Oxidation Resistance 90 days/85°C	BS EN 14575		
Change of Tensile Strength		≤20%	7%
Change of Elongation		≤20%	6%
Behaviour After Storage in Aqueous Solutions: 90 days/23°C Ca(OH) ₂	BS EN 14415		
Change of Tensile Strength		≤25%	LD: 4%, TD: 8%
Change of Elongation		≤25%	LD: 11%, TD: 13%
Low Temperature Behaviour	BS EN 14415	No cracks at -20°C	Complies
Behaviour After Storage in Aqueous Solutions: 90 days H ₂ SO ₃ (5 - 6%)	BS EN 14415		
Change of Tensile Strength		≤20%	LD: 3%, TD: 14%
Change of Elongation		≤20%	LD: 5%, TD: 10%
Low Temperature Behaviour		No cracks at -20°C	Complies
Behaviour After Storage in Warm Water Solutions: 70 days/70°C	EN 1296		
Change of Tensile Strength		≤20%	8%
Change of Elongation		≤20%	5%
No cracks @ -20°C		Fulfil	Complies
Water Absorption	EN ISO 62	≤20%	0.05%
Tear Resistance	EN 12310	80N/mm	194.5N/mm
Root Penetration	EN 14416	No penetration	Complies
Reaction to Fire	BS EN ISO 11925-2 BS EN 13501-1	Minimum Class E	Complies
Weld Execution	BS EN 12316-2 BS EN 12317-2	Free from defects	Complies
Behaviour of the Welding Seam @ Shearing		Break outside seam	Complies
Short-Time-Jointing-Factor fz		0.6	Complies
Behaviour of the Welding Seam @ Peeling		Peeling is allowable, if resistance to peeling is reached	No peeling of weld
Resistance to Peeling		6N/mm	8.5N/mm
Dielectric Constant	ASTM G62	N/A	12.3kV/mm
Breakdown Voltage		N/A	26.1kV
Micro-organism Change of Tensile Strength and Elongation	BS EN 12225	≤10%	<5%

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Disclaimer

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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.

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