Water proof membrane

Material

- The material types of waterproof membrane include Ethylene-Copolymer-Bitumen (ECB), Poly-Vinyl-Chloride (PVC), or other material, such as EVA and LDPE. The physical and chemical properties can fully meet all the standards requirements in Table I or Table II.
- There should be layers revealing cracks on one side and the color should contrast sharply with the waterproof membrane for easy identification of cracks by naked eyes.

Size

- The length of waterproof membrane should be cut based on the tunnel perimeter. There should be no vertical joint except the intersection or special design.

Material requirements and testing standard: As Table I and II.

- **ECB Waterproof Membrane Material Requirement and Testing Standard**

Testing Item	Testing Standard	Testing Regulation
Thickness	2.0mm	DIN 53370
Tensile Strength	8 N/square millimeter (min.)	DIN 53455
Elongation at Break	500% (min.)	DIN 53455
Compressive Strength (20% Strain)	2.5 N/square millimeter (min.) (Length of the cubic sample is 10mm.)	DIN 53454
Anti Fracture Strength	150 N/mm (min.)	DIN 53363
Waterproof	Excellent (10 bar/10 hours)	DIN 16726
Tensile Strength of Seam	7.2 N/square millimeter (min.)	DIN 16726
Heat Resistance	±2% (max.)	DIN 16726
Water Absorption	1% (max.)	DIN 53495
Acid and Alkali Resistance (28 Days)	Loss in Tensile Strength ±20% (max.)	DIN 16726
	Elongation at Break: ±20% (max.)	
Flammability	Nonflammable	DIN 4102/1

＊The length of the cubic sample is 10mm.

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▪ PVC Waterproof Membrane Material Requirement and Testing Standard

Testing Item	Testing Standard	Testing Regulation
Thickness	2.0 mm	DIN 53370
Tensile Strength	15 N/square millimeter (min.)	DIN 53455
Elongation at Break	250 % (min.)	DIN 53455
Compressive Strength (20% Strain)	2.5 N/square millimeter (min.) (Length of the cubic sample is 10mm.)	DIN 53454
Anti Fracture Strength	100 N/mm (min.)	DIN 53363
Waterproof	Excellent (10 bar/10 hours)	DIN 16726
Tensile Strength of Seam	13.5 N/square millimeter (min.)	DIN 16726
Heat Resistance	±2% (max.)	DIN 16726
Water Absorption	1% (max.)	DIN 53495
Acid and Alkali Resistance (28 Days)	Loss in Tensile Strength: ±20% (max.)	DIN 16726
	Elongation at Break: ±20% (max.)	
Flammability	Nonflammable	DIN 4102/1

＊The length of the cubic sample is better to be 10 mm.

▪ Physical Property of ECB Waterproof Membrane

Item	Measurement	Unit	Standard
Thickness	ASTM D1593	mm	2
Tensile strength	ASTM D638	N/mm2	Above 14
Extension Ratio	ASTM D638	N	Above 225
Strength of Seam	ASTM D638	N/mm2	Above 12.6
Tearing Strength (20%)	ASTM D1004	N/mm2	Above 100
Compressive Strength	ASTM D695	N/mm2	Above 2.5
Puncture Strength	ASTM E154	N	Smaller than 3500: No puncture
Water Resistance	ASTM D751 Method A	10bar/100hrs	No leakage
Folding Strength under Low Temperature	ASTM D146, F137	…	No cracks
Aging	Oven: 80℃/24 hrs		
Appearance	Visual Inspection	…	No bubble

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Size Variation	Micro Ruler Measurement	%	Below 1
Rate of Change under Tensile Strength	ASTM D638	%	Below 5
Rate of Change of Elongation	ASTM F137	%	Below 10
Folding Strength under Low Temperature	ASTM D146	…	No cracks 180° Folding Angle under -20℃
Water Resistance at 23±2℃ (14 Days) Rate of Change of Tensile Strength Rate of Change of Elongation	ASTM D638 ASTM D618	% %	10 以下 10 以下

▪ Physical Property of PVC Waterproof Membrane

Item	Measurement	Standard
Thickness	DIN 53370	2 mm
Tensile strength	DIN 53455	Above 15 N/mm^2
Elongation	DIN 53455	Above 250%
Compressive Strength (20%)	DIN 53454	Above 2.5 N/mm^2
Tearing Strength	DIN 53363	Above 100N/mm
Water Resistance	DIN 16726	No leakage
Strength of Seam	DIN 16726	Above 13.5 N/mm2
Stability of Size	DIN 16726	±2% (max)
Water Absorption	DIN 53495	1% (max)
Chemical Resistance	DIN 16726	±2% (max)
Flame Resistance	DIN 4102/1	Nonflammable

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