

Protan SE, EX and EXG roofing membranes

are approved by Norwegian Building Research Institute with properties, field of application and conditions as stated in this document.

1. Holder of the approval

Protan AS
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2. Manufacturer

Protan AS, Drammen.

3. Product description

Protan SE, EX and EXG are roofing membranes made of pliable PVC with a core of woven polyester. Stabilizers have been added to make the roofing resistant to high and low temperatures, ultra violet radiation, and to limit spread of flames. Installation is carried out by using hot air welding.

Protan SE, EX and EXG are available in two thicknesses, and with specifications as shown in Table 1. Protan EX has a layer of polyester felt, and Protan EXG a layer of glass felt, fixed to the underside.

Standard widths are 1 m and 2 m. Standard length is 20 m per roll. Other dimensions are available on special order.

The membranes are manufactured with several standard surface colours. The underside is dark grey.

4. Field of application

Protan SE, EX and EXG are used as exposed, mechanically fastened roofing membranes on flat and sloping roofs, see Fig. 1.

Protan SE can be used as roofing on all types of underlay, but needs a separate migration barrier/levelling layer on polystyrene underlay and for re-roofing applications.

Protan EX has a laminated felt, and can be laid directly on old roofing underlay. The membrane may also be used as under turf roofing as shown in Fig. 2. An additional loose felt must be used on liquid applied asphalt roofing.

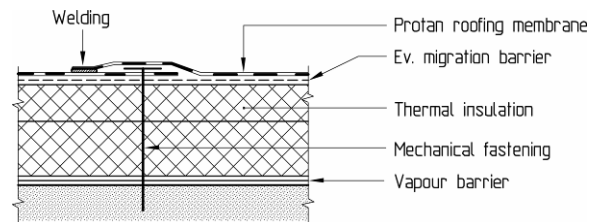


Fig. 1
Protan SE, EX and EXG roofing, mechanically fastened at the edge

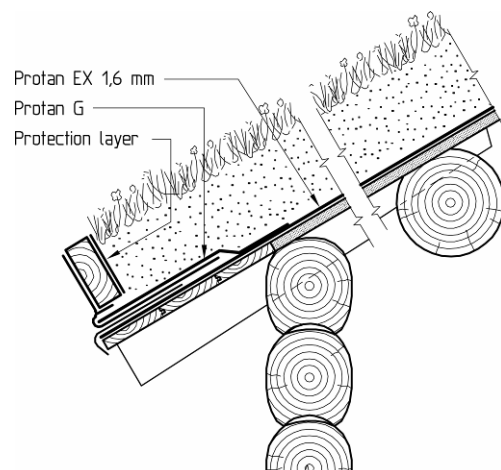


Fig. 2
Example of Protan EX used on a non-insulated roof with turf roofing

Protan EXG is laminated with glass felt and can be laid directly on polystyrene.

Roofs must have adequate slope to drain water from rain and melting snow. NBI recommends that all roofs have an inclination of minimum 1:40.

5. Properties

Product properties for fresh material are shown in Table 2. Some properties measured after accelerated ageing are shown in Table 3.

Table 1
Measures and tolerances for Protan SE, EX and EXG roofing membranes

	Protan SE		Protan EXG		Protan EX	
	1.2 +0.2/-0.1	1.6 +0.2/-0.15	1.2 + 0.2/-0.10	1.6 +0.2/-0.15	1.2 +0.2/-0.1	1.6 +0.2/-0.15
Thickness (mm)						
Weight (kg/m ²)	1.4 +0.2/-0.1	1.75 +0.2/-0.1	1.4 + 0.2/-0.1	1.75 +0.2/-0.1	1.4 +0.2/-0.1	1.75 +0.2/-0.1
Width	1 m og 2 m ± 2 %	1 m og 2 m ± 2 %	1 m og 2 m ± 2 %	1 m og 2 m ± 2 %	1 m og 2 m ± 2 %	1 m og 2 m ± 2 %
Roll length	20 m + 2 %/-0 %	20 m +2 %/-0 %	20 m +2 %/-0 %	20 m +2 %/-0 %	20 m +2 %/-0 %	20 m +2 %/-0 %
Weight. Polyester core (impr.)	80 g/m ²	80 g/m ²	80 g/m ²	80 g/m ²	80 g/m ²	80 g/m ²
Weight. Polyester felt					180 g/m ²	180 g/m ²
Weight. Glass felt			55 g/m ²	55 g/m ²		

Table 2
Product properties for fresh material of Protan SE, EX and EXG roofing membranes*)

Property	Test method	Control limit/product						Unit
		Protan SE		Protan EXG		Protan EX		
		1.2 mm	1.6 mm	1.2 mm	1.6 mm	1.2 mm with felt	1.6 mm with felt	
Water tightness (10 kPa)	NS-EN 1928	Tight	Tight	Tight	Tight	Tight	Tight	-
Joint peel resistance - side lap joint (T-peel)	NS-EN 12316-2	≥ 150	≥ 260	≥ 150	≥ 260	≥ 150	≥ 260	N/50 mm
Joint shear resistance - side lap joint	NS-EN 12317-2	≥ 1000	≥ 1000	≥ 1000	≥ 1000	≥ 1000	≥ 1000	N/50 mm
Tensile strength	NS-EN 12311-2	≥ 1050	≥ 1050	≥ 1050	≥ 1050	≥ 1100	≥ 1100	N/50 mm
Elongation	NS-EN 12311-2	≥ 15	≥ 15	≥ 15	≥ 15	≥ 15	≥ 15	%
Tear resistance	NS-EN 12310-2	≥ 210	≥ 210	≥ 210	≥ 210	≥ 300	≥ 300	N
Resistance								
By static load	NS-EN 12370	≥ 200	≥ 200	≥ 200	≥ 200	≥ 200	≥ 200	N
By impact at +23 °C	NS-EN 12691	≤ 8	≤ 8	≤ 8	≤ 8	≤ 6	≤ 6	mm diam.
By impact at -10 °C	NS-EN 12691	≤ 8	≤ 8	≤ 10	≤ 10	≤ 8	≤ 8	mm diam.
Dimensional stability	NS-EN 1107-2	± 0.5	± 0.5	± 0.5	± 0.5	± 0.5	± 0.5	%
Flexibility at low temperature	NS-EN 495-5	≤ -30	≤ -30	≤ -30	≤ -30	≤ -30	≤ -30	°C
Water vapour permeability	NS-EN ISO 12572	12 · 10 ⁻¹²	9 · 10 ⁻¹²	12 · 10 ⁻¹²	9 · 10 ⁻¹²	12 · 10 ⁻¹²	9 · 10 ⁻¹²	kg/m ² s Pa
Water vapour resistance as equivalent air layer thickness	NS-EN ISO 12572	16	22	16	22	16	22	m

*) The values have acceptance limits for the manufacturer's internal control and for audit testing

Table 3
Product properties for aged material of Protan SE, EX and EXG roofing membranes

Property	Test method	Value						Unit
		Protan SE		Protan EX		Protan EXG		
		1.2 mm	1.6 mm	1.2 mm	1.6 mm	1.2 mm	1.6 mm	
Cold crack by folding Aged in hot water ¹⁾	NS-EN 495-5	≤ -30		≤ -30		≤ -30		°C
Artificial ageing ²⁾	NS-EN 495-5	≤ -25		≤ -25		≤ -25		°C

1) Aged according to method NS-EN 1847 (NS 3531) for 8 weeks at 60 °C

2) Aged according to method NS-EN 1297 with specimen exposed to UV light, heat radiation, water and laboratory climate

Safety in case of fire

Protan SE fulfils the requirements of class B_{ROOF} (t2) according to prEN 13501-5 for all underlay except EPS/WPS-insulation. When using a migration barrier of at least 50 g/m² glass felt, Protan SE fulfils class B_{ROOF} (t2) also on EPS/XPS-insulation.

Protan EX satisfies the requirements of class B_{ROOF} (t2) on underlay of old roofing membranes.

Protan EXG fulfils class B_{ROOF} (t2) according to prEN 13501-5 for all underlay.

The testing is performed according to ENV 1187.

Calculation of fasteners

Load capacities for fastening the roofing membrane with various types of fasteners are shown in Table 5. The capacities relate to the fastening of the membrane itself. The strength of the hold to weak underlay may limit the overall capacity of the fixing points.

Calculation of fastener spacing is carried out according to NBI Building Research Design Sheet 544.206 and "TPF Informs No. 5". The capacities apply to Norwegian conditions, with load coefficient 0.9 · 1.5 according to NS 3490. Factor 0.9 is reduction factor k_L regarding reliability class 1 and factor 1.5 is load factor.

Environmental declaration

Environmental declaration for Protan SE is given in Table 4. The products do not contain any of the substances listed as injurious to health and environment by the authorities for protection of the environment.

Waste treatment/recycling

The materials in Protan SE, EX and EXG can be recycled, and a system for recycling has been established. Energy can be retrieved by delivering the membranes to a waste combustion plant.

6. Special conditions for use and installation

Storage

Protan roofing membranes should be stored in a dry place, with the rolls placed on pallets at the building site and protected by a covering.

Table 4
Environmental declaration for Protan SE¹⁾

NS-EN ISO 14 000: NO 97-OSL-SYMI-8015	
EMAS reg: NO-99-OSL-AE-9068	
Functional unit:	per m ² laid roofing and 60 years
The declaration covers:	complete lifetime
Number of replacements:	one time

Quality of the data

Evaluated data quality	94 %
Extent of data for raw material (in factory)	95 %
Percentage of materials included	100 %
Percentage of materials with environmental data	98 %
Pct. of materials with spec. environmental data	39 %

Resources and raw materials

Total use of energy	27.95 kWh
Electrical energy	11.54 kWh
Fossil/bio/other energy ²⁾	16.41 kWh
Non-renewable materials	100 %; 70 %/30 % ³⁾
Renewable materials	0 %
Recycled materials	0 %

Environmental effect

Greenhouse effect	3.598 kg CO ₂ -eqv.
Detrimental effect on the ozone layer	0.000 kg ODP
Embittering	0.021 kg SO ₂ -eqv.
Forming of photo-oxidants	0.003 kg POCP
Excessive fertilising	0.002 kg PO ₄ -eqv.

Waste treatment

Waste sent to depot	0.24 kg
Waste for recycling/re-use	1.59 kg
Waste for burning	2.52 kWh
Special waste	0.19 kg

1) Environmental declaration of building components, Økobygg 1999

2) Including raw material energy

3) Scarce/Plentiful

Installation

The joints of Protan SE, EX and EXG are welded by the use of hot air, and the membranes shall be installed in accordance with the manufacturer's instructions. The products shall otherwise be used in accordance with the principles shown in NBI Building Research Design Sheet 544.202, 544.204 and 544.206, as well as in "TPF Informs No. 5".

Widths over 1 m should only be used at the mid-section of the roof, and where the dimensioning peak velocity pressure is ≤ 40 m/s. Maximum spacing between fasteners shall be 1 m.

Fasteners

Fastening with normal steel washers can be used in longitudinal overlap joints on stiff underlay, i.e. on wood-based roof sheathing or on concrete.

On underlay of insulation material with good compression strength, such as EPS 20 kg/m³ or similar, plastic fasteners with integrated sleeve are preferably used.

When roofing membranes are installed on insulation material with lower compression strength, the tightening of the fasteners must be controlled, or fasteners with good telescopic action must be used.

Fasteners with studs must always be used on the roll width of 2 m for Protan SE and EXG. Some suitable fasteners are:

- a) Teleskop Dracula TPD 50
- b) Iso-Tak Twin Peak (Plus)
- c) Iso-Tak Pluss 48-3N
- d) Croco Ø 50 mm with studs

Underlay

When a fire classification is required the underlay must be in accordance with the provisions stated in section 5 "Safety in case of fire".

To avoid migration, Protan EXG or a separate migration barrier must be used when the roofing is installed directly on old, aged PVC, or on EPS or XPS insulation.

Protan EX or Protan SE shall be used with a separate barrier when the membrane is installed on old asphalt roofing without additional insulation.

Protan EX is recommended for installation on wood-based roof sheathing.

Inspections and maintenance

The roofing membranes must be cleaned locally before starting any welding of joints as a part of repair work.

Roof traffic

When it should be expected that roof traffic may exceed what is required for normal inspection visits and maintenance, special measures should be taken to protect the roofing membrane.

7. Factory production control

Protan SE, EX and EXG are subject to supervisory factory production control and product control according to contract between Norwegian Building Research Institute and Protan AS concerning NBI Technical Approval and the related production control description.

The manufacturer Protan AS has a quality system which is certified by Det Norske Veritas according to ISO 9001, certificate no. 95-OSL-AQ-6343.

Table 5

Design capacities at ultimate limit state for mechanical fasteners in Protan SE, EX and EXG 1.2 mm and 1.6 mm

Fastening system/Fastener	Capacity, N per fastener
Placed at lane edge, Protan SE, EXG	
Roofing nail 2,8–25	100
Staples (2 x 20 mm)	130
ECOfek 40 washer	650
Teleskop 40 washer	650
Iso-Tak 40 washer	650
Teleskop 42 fastener	700
ECOfek 45 fastener	700
Iso-Tak 45 fastener	700
SK Isofest Y40 fastener	700
SK Isofest Ø 50 Croco without studs	750
SFS IT-C 40 x 82 washer	1000
Iso-Tak 48-3N	1000
Iso-Tak Twin Peaks Pluss fastener	1100
Teleskop Dracula TPD 50 fastener	1100
SK Isofest Ø 50 Croco with studs	1100
Placed at the edge, Protan EX	
Teleskop 42 fastener	850
Teleskop 40 washer	900
Iso-Tak 40 washer	900
Teleskop Dracula TPD 50 fastener	1100
SFS IT-C 40 x 82 washer	1100
SK Isofest Ø 50 Croco with studs	1100
Placed in roll flip X-335	
Teleskop 42 fastener	1000
SFS IT-C 40 x 82 washer	1100
Teleskop Dracula TPD 50 fastener	1100
Iso-Tak Twin Peaks Pluss fastener	1100
SK Isofest Ø 50 Croco with studs	1100
Pull through resistance	
Teleskop 40 washer	1100
Iso-Tak 40 washer	1100
Iso-Tak 45 washer	1000
Teleskop 42 fastener	1000
SFS IT-C 40 x 82 washer	1200

8. Basis for the approval

Material- and design data have been verified by type testing and audit testing performed by NBI during the years 1975–2004.

Resistance against spread of flames have been verified by type testing and audit testing performed by the Norwegian Fire Research Laboratory during the years 1975–2004.

The data in Table 5 is based on system tests in accordance with the test methods NT Build 307 and NBI 162/90, supplemented by comparable results from simplified tests in accordance with NBI 163/91.

The durability of Protan PVC roofing membranes against humus attacks from roots in the turf roofing has been verified according to DIN 16734 par. 5.16, see report 31224/96 and 33354/97 from Süddeutsches Kunststoff-Zentrum, and in accordance with FLL-Verfahren (1999), see report dated 12.10.1999 from Institut für Bodenkunde und Pflanzenernährung.

9. Marking

All rolls/packages shall be marked with the manufacturer's product code, product name and date of production. The approval mark for NBI Technical Approval No. 2010 may also be used.



Approval mark

10. Liability

The holder/manufacturer has sole product responsibility according to existing law. Claims resulting from the use of the product cannot be brought against the NBI beyond the provisions of Norwegian Standard NS 8402.

11. Technical management

Project manager for this approval is Mr. Knut Noreng, Norwegian Building Research Institute, Department of Materials and Structures - Trondheim.

Norwegian Building Research Institute

Grete Kjeldsen
Assistant Head of Approvals