

Protan SE, EX and EXG roofing membranes

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

1. Holder of the approval

Protan A/S
P.O.Box 420
NO-3002 Drammen
Tel.: +47 32 22 16 00 Fax.: + 47 32 22 17 00

2. Manufacturer

Protan A/S, Drammen.
Protan Fasteners are manufactured by authorised sub-contractors.

3. Product description

Protan SE, EX and EXG are roofing membranes made of pliable PVC with a core of woven polyester. Stabilisers have been added to make the roofings 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.

Protan washers are delivered as a supplementary product for mechanical fastening of loosely laid Protan SE, EX and EXG. The washers are made of steel plates coated with 20 µm Aluzink AZ 150 on both sides, in accordance with SS 1151-20. The discs are shaped and have punched holes for screws or plugs as shown in fig. 2 and 3.

Table 1

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

	Protan SE		Protan EXG		Protan EX	
Thickness (mm)	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
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 & 2 m ± 2 %	1 m & 2 m ± 2 %	1 m & 2 m ± 2 %	1 m & 2 m ± 2 %	1 m & 2 m ± 2 %	1 m & 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			50 g/m ²	50 g/m ²		

Copyright Norwegian Building Research Institute

Reference: Contr. O 8279

Subject: Roofing membranes

Head office: Norwegian Building Research Institute
P.O.Box 123 Blindern, N-0314 Oslo
Tel: +47 22 96 55 55 Fax: +47 22 69 94 38

Local Department: Norwegian Building Research Institute
Høgskoleringen 7, N-7491 Trondheim
Tel: +47 73 59 33 90 Fax: +47 73 59 33 80

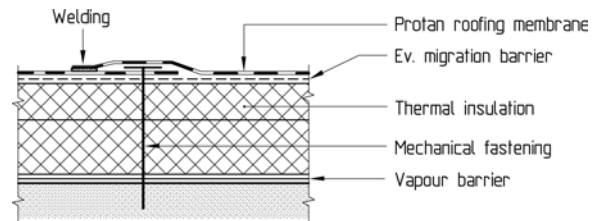


Fig. 1
Protan SE roofing, mechanically fastened at the edge.

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 underlays, but needs a separate migration barrier/levelling layer on polystyrene underlays and for re-roofing applications.

Protan EX has a laminated felt, and can be laid directly on old roofing underlays. The membrane may also be used as under turf roofing as shown in Fig. 4. An additional loose felt must be used on liquid applied asphalt roofings.

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. Protan SE, EX and EXG fulfil all requirements for roofing membranes class T5 specified in NS 3531.

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

Properties	Test method	Protan SE		Protan EXG		Protan EX		Unit
		1,2 mm	1,6 mm	1,2 mm	1,6 mm	1,2 mm	1,6 mm	
Water tightness (10 kPa)	NS 3531	tight		tight		tight		-
Dimensional stability:								
- heat	NS 3531/3503	± 0,5		± 0,5		± 0,5		%
- water	NS 3531/3502	± 1,0		± 1,0		± 1,0		%
- artificial ageing	NS 3531/3502	± 1,0		± 1,0		± 1,5		%
Tensile strength	NS 3531/3507	≥ 1050	≥ 1100	≥ 1100		≥ 1200		N/50 mm
Elongation at break	NS 3531/3507	≥ 15		≥ 15		≥ 15		%
Cold crack by folding	NS 3531/3542	≤ - 30		≤ - 30		≤ - 30		°c
Tearing strength (trapezium)	NS 3531/3541	≥ 210		≥ 210		≥ 300		N
Penetration on EPS, 20 kg/m ³ by:								
increasing load, chisel	NT Build 336	≥ 350	≥ 400	≥ 350	≥ 400	≥ 550	≥ 550	N
impact, +23 °C	NT Build 335	≤ 8	≤ 8	≤ 8	≤ 8	≤ 6	≤ 6	mm/diam.
impact, -20 °C	NT Build 335	≤ 10	≤ 10	≤ 10	≤ 10	≤ 8	≤ 8	mm/diam.
Water vapour permeability	NT Build 130	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	NT Build 130	16	22	16	22	16	22	m
Adhesion, felt	ASTM D 1876	-		-		≥ 15		N/50 mm

*The values are acceptance limits for the manufacturers 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	1,6mm	1,2mm	1,6 mm	
Cold crack by folding: Aged in hot water	NS 3531/3542	≤ - 30		≤ - 30		≤ - 30		°C
Artificial ageing	NS 3531/8140	≤ - 25		≤ - 25		≤ - 25		°C

Table 4
Environmental declaration for Protan SE

ISO/EMAS reg.: NS-EN ISO 1400:NO 97-OSL-SYMI-8015, EMAS:NO-99-OSL-AE-9068
Functional unit: per m ² laid roofing and 60 years
The declaration covers: Complete lifetime
Number of replacements: 1 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 material

Total use of energy	27,95 kWh
Electrical energy	11,54 kWh
Fossil/Bio/Other energy ²	16,41 kWh
Non-renewable sources	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

Safety in case of fire

Protan SE fulfils the requirements of class Ta concerning spread of flames in accordance with NS 3919 on non-combustible underlays, on wood-based underlays, and on EPS-insulation with a migration barrier of minimum 50 g/m².

Protan EX satisfies the requirements of class Ta on underlays of old roofing membranes.

Protan EXG satisfies the requirements of class Ta on all underlays.

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

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 and 5B".

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

Fastening with normal steel washers like Protan 40 Washer can be used in longitudinal overlap joints on stiff underlays, i.e. on wood-based roof sheathing or on concrete.

Protan 45 x 65 Washer with recession, or plastic fasteners with integrated washer and sleeve, should be used on underlays of insulation material with good compression strength, such as EPS 20kg/m³ or similar.

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

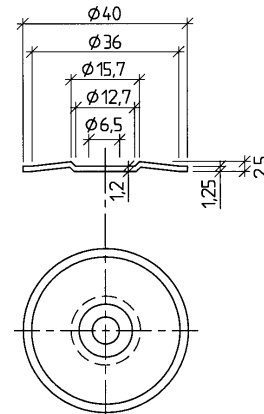


Fig. 2
Protan 40 Washer. Steel thickness 1.25 mm

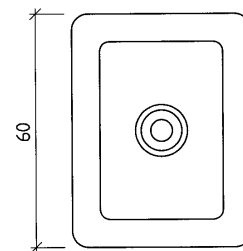
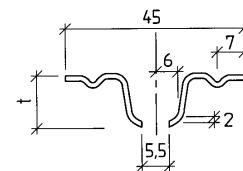


Fig. 3
Protan 45 x 60 Washer with recession.
Steel thickness 1.25 mm.

Suitable fasteners for fixing 2,0 m wide Protan SE, EX and EXG are:

- Teleskop Dracula
- Iso-Tak Twin Peak
- SFS IT-C 40 x 82
- Croco Ø 50 mm with studs

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 shall be used when the membrane is installed on old asphalt roofing without additional insulation.

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

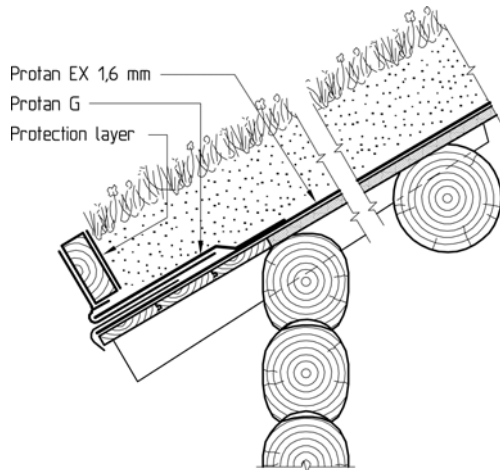


Fig. 4
Example of Protan EX used on a non-insulated roof with turf roofing.

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 underlays 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 and 5B". The capacities apply to Norwegian conditions, with load coefficient 1.6 according to NS 3479.

The capacities shown in Table 5 may also be used for designing fastener spacing in other countries by multiplying the values with the following factors in order to fit the various systems for load calculation:

- Denmark: Factor 0.8 with load calculation based on DS 410 ("rægningsmessige laster")
- Sweden: Factor 0.8 with load calculation based on Konstruktionsregler 94 ("dimensionerande last")
- Finland: Factor 1.0 with load calculation based on Rak MK-B1
- Germany: Factor 0.6 with load calculation based on DIN 1055 Teil 4 ("Rechenwert der windlast")

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.

Table 5
Design capacities at ultimate limit state for mechanical fasteners in Protan SE, EX and EXG 1.2 mm and 1.6mm.

Fastening system/Fastener	Capacity, N per fastener
Placed at lane edge, Protan SE, EXG	
Roofing nail 2,8 - 25 mm	100
Staples (2 x 20 mm)	130
Protan 40 washer	650
ECOTEK 40 washer	650
Teleskop 40 washer	650
Iso-Tak 40 washer	650
Teleskop 42 fastener	700
ECOTEK 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 Twin Peaks fastener	1100
Teleskop Dracula 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 fastener	1100
SFS IT-C 40 x 82 washer	1100
SK Isofest Ø 50 Croco with studs	1100
Placed in roll flip X-335	
Protan 40 washer	1000
Teleskop 42 fastener	1000
Protan 45 x 60 washer with recession	1100
SFS IT-C 40 x 82 washer	1100
Teleskop Dracula fastener	1100
Iso-Tak Twin Peaks 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

7. Factory production control

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

The manufacturer Protan A/S has a quality system which is certified by Det Norske Veritas according to ISO 9001, certificate 95-OSL-AQ-6343.

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 – 2001.

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 – 2000.

The data in Table 4 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.



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 Norwegian Building Research Institute beyond the provisions of Norwegian Standard 3403.

11. Project management

The project manager for this approval is Mr. Knut Noreng, Department of Building Technology, Norwegian Building Research Institute, Trondheim, Norway.

for Norwegian Building Research Institute

Trond Ø. Ramstad
Head of Approvals