SINTEF

SINTEF Certification

No. 2010

Technical Approval

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Valid until: 01.09.2024

Provided listed on www.sintefcertification.no

SINTEF confirms that

Protan SE, T, SE-L, SE Titanium+, EX roofing membranes

has been found to be fit for use in Norway and to meet the provisions regarding product documentation given in the regulation relating to the marketing of products for construction works (DOK) and regulations on technical requirements for building works (TEK), with the properties, fields of application and conditions for use as stated in this document

1. Holder of the approval

Protan AS
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2. Product description

Protan SE, T, SE-L, SE Titanium+ and EX 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, ultraviolet radiation and atmospheric contaminations, and to limit spread of flames. Welding is carried out by using hot air.

Protan SE, T, SE-L, SE Titanium+ and EX and are available in several thicknesses, and with specifications as shown in table 1. Other widths and lengths can be ordered.

Protan SE-L has a lacquered surface.

Protan SE Titanium+ has a lacquered surface and chemicals added to reduce possible influence of microbes.

Protan EX has a warm-concealed layer of polyester felt fixed to the bottom side.

The membranes are manufactured with several surface colours The membranes in white surface color is marketed as Protan Cool Roof. The bottom side is dark grey.

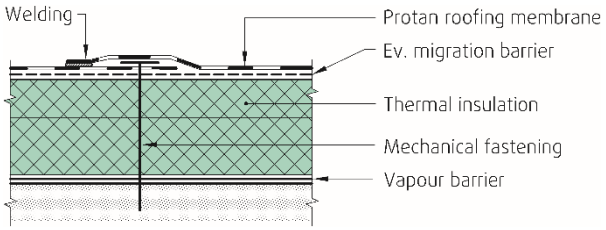
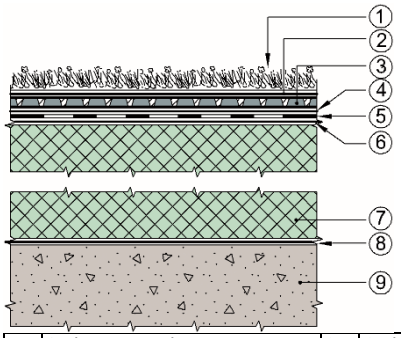


Fig.1
Protan SE roofing membranes, mechanically fastened at the edge



1	Sedum vegetation	6	Optional migration layer if insulation of EPS/XPS
2	Optional filtering layer of geotextile	7	Insulation
3	Drainage layer	8	Vapour barrier
4	Optional protection layer of fibre	9	Structural deck
5	Protan SE Titanium +		

Fig. 2
Protan SE Titanium+ composed for extensive green roofs

Table1
Measures and tolerances for Protan SE, T, SE-L, SE Titanium+ and EX roofing membranes, measured according EN 1848-2 and EN 1849-2.

Property	Protan SE / Protan SE-L					Protan T	Protan SE Titanium+	Protan EX				Unit	Tolerances according EN 13956
Thickness	1,2	1,6	1,8	2,0	2,4	2,0	1,6	1,2[1)]	1,6[1)]	1,8[1)]	2,0[1)]	mm	+10 % / -5 %
Weight	1,4	1,8	2,1	2,4	2,9	2,4	1,8	1,4[1)]	1,8[1)]	2,1[1)]	2,4[1)]	kg/m²	+10 % / -5 %
Width	1,0 2,0	1,0 2,0	1,0 2,0	1,0 2,0	1,0 2,0	1,0 2,0	1,0 2,0	1,0 2,0	1,0 2,0	1,0 2,0	1,0 2,0	m	+1 % / -0,5 %
Roll length	20	20	15	15	10	15	20	20	20	15	15	m	+5 % / -0 %
Weight polyester-core (impr.)	80	80	80	80	80	80	80	80	80	80	80	g/m²	-
Weight polyester felt	-	-	-	-	-	-	-	180	180	180	180	g/m²	-

[1)] Measured without polyester felt

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Table 2
Product characteristics for fresh material of Protan SE, T, SE-L, SE Titanium+ and EX roofing membranes

Property	Protan	SE 1.2 SE-L 1,2		SE 1.6 SE-L 1.6		SE Titanium + 1.6		SE 1.8 SE-L 1.8		SE 2.0 SE-L 2.0		SE 2.4		SINTEF's recom. minimum values[4]	Unit
	Test method EN	DoP[1]	Control-limit[2]	DoP[1]	Control-limit[2]	DoP[1]	Control-limit[2]	DoP[1]	Control-limit[2]	DoP[1]	Control-limit[2]	DoP[1]	Control-limit[2]		
Foldability at low temperature	495-5	≤ -30	≤ -30	≤ -30	≤ -30	≤ -25	≤ -25	≤ -25	≤ -25	≤ -25	≤ -25	≤ -25	≤ -25	≤ -30 [3] ≤ -25 [3]	°C
Dimensional stability	1107-2	-	± 0.5	-	± 0.5	-	± 0.5	-	± 0.5	-	± 0.5	-	± 0.5	± 0.5	%
Water tightness (10 kPa)	1928 (A)	Tight	Tight	Tight	Tight	Tight	Tight	Tight	Tight	Tight	Tight	Tight	Tight	Tight	-
Tear resistance L T	12310-2	≥ 210 ≥ 210	≥ 210 ≥ 210	≥ 210 ≥ 210	≥ 210 ≥ 210	≥ 210 ≥ 210	≥ 210 ≥ 210	≥ 210 ≥ 210	≥ 210 ≥ 210	≥ 210 ≥ 210	≥ 210 ≥ 210	≥ 210 ≥ 210	≥ 210 ≥ 210	≥ 180	N
Tensile strength L T	12311-2 (A)	≥ 1100 ≥ 1050	≥ 1100 ≥ 1050	≥ 1100 ≥ 1100	≥ 1100 ≥ 1100	≥ 1100 ≥ 1100	≥ 1100 ≥ 1100	≥ 1100 ≥ 1100	≥ 1100 ≥ 1100	≥ 1100 ≥ 1100	≥ 1100 ≥ 1100	≥ 1100 ≥ 1100	≥ 1100 ≥ 1100	≥ 600	N/50mm
Elongation L T	12311-2 (A)	≥ 15 ≥ 15	≥ 15 ≥ 15	≥ 15 ≥ 15	≥ 15 ≥ 15	≥ 15 ≥ 15	≥ 15 ≥ 15	≥ 15 ≥ 15	≥ 15 ≥ 15	≥ 15 ≥ 15	≥ 15 ≥ 15	≥ 15 ≥ 15	≥ 15 ≥ 15	≥ 10	%
Peel resistance Average Maximum	12316-2	- ≥ 200	- [5] ≥ 200 [6]	- ≥ 200	- [5] ≥ 200 [6]	- ≥ 200	- [5] ≥ 200 [6]	- ≥ 200	- [5] ≥ 200 [6]	- ≥ 200	- [5] ≥ 200 [6]	- ≥ 200	- [5] ≥ 200 [6]	≥ 150 ≥ 200	N/50mm
Shear resistance joints	12317-2	≥ 1000	≥ 1000	≥ 1000	≥ 1000	≥ 1000	≥ 1000	≥ 1000	≥ 1000	≥ 1000	≥ 1000	≥ 1000	≥ 1000	≥ 600	N/50mm
Punctering - Impact v/+23°C - Impact v/ -10°C - Static load - Static load	12691 (A) 12691 12730 (A) 12730 (C)	≥ 400 - - ≥ 20	≥ 400 ≤ 10 ≥ 20 -	≥ 500 - - ≥ 20	≥ 500 ≤ 10 ≥ 20 -	≥ 500 - - ≥ 20	≥ 500 ≤ 10 ≥ 20 -	≥ 700 - - ≥ 20	≥ 700 ≤ 10 ≥ 20 -	≥ 800 - - ≥ 20	≥ 800 ≤ 10 ≥ 20 -	≥ 900 - - ≥ 20	≥ 900 ≤ 10 ≥ 20 -	≥ 400 ≤ 15 ≥ 20 -	mm mmdia kg kg
Water vapour resistance / equiv. air layer thickness	ISO 12572	-	16	-	22	-	22	-	24.5	-	27	-	32	-	m

Property	Protan	T		EX 1,2		EX 1,6		EX 1,8		EX 2,0		SINTEF's recom. minimum values[4]	Unit
	Test method EN	DoP[1]	Control-limit[2]	DoP[1]	Control-limit[2]	DoP[1]	Control-limit[2]	DoP[1]	Control-limit[2]	DoP[1]	Control-limit[2]		
Foldability at low temperature [3]	495-5	≤ -25	≤ -25	≤ -30	≤ -30	≤ -30	≤ -30	≤ -25	≤ -25	≤ -25	≤ -25	≤ -30 [3] ≤ -25 [3]	°C
Dimensional stability	1107-2	-	± 0.5	-	± 0.5	-	± 0.5	-	± 0.5	-	± 0.5	± 0.5	%
Water tightness (10 kPa)	1928 (A)	Pass	Tight	Pass	Tight	Pass	Tight	Pass	Tight	Pass	Tight	Tight	-
Tear resistance L T	12310-2	≥ 210 ≥ 210	≥ 210 ≥ 210	≥ 300 ≥ 300	≥ 300 ≥ 300	≥ 300 ≥ 300	≥ 300 ≥ 300	≥ 300 ≥ 300	≥ 300 ≥ 300	≥ 300 ≥ 300	≥ 300 ≥ 300	≥ 180	N
Tensile strength L T	12311-2 (A)	≥ 1100 ≥ 1100	≥ 1100 ≥ 1100	≥ 1100 ≥ 1100	≥ 1100 ≥ 1100	≥ 1100 ≥ 1100	≥ 1100 ≥ 1100	≥ 1100 ≥ 1100	≥ 1100 ≥ 1100	≥ 1100 ≥ 1100	≥ 1100 ≥ 1100	≥ 600	N/50mm
Elongation L T	12311-2 (A)	≥ 15 ≥ 15	≥ 15 ≥ 15	≥ 15 ≥ 15	≥ 15 ≥ 15	≥ 15 ≥ 15	≥ 15 ≥ 15	≥ 15 ≥ 15	≥ 15 ≥ 15	≥ 15 ≥ 15	≥ 15 ≥ 15	≥ 10	%
Peel resistance Average Maximum	12316-2	- ≥ 200	- [5] ≥ 200 [6]	- ≥ 200	- [5] ≥ 200 [6]	- ≥ 200	- [5] ≥ 200 [6]	- ≥ 200	- [5] ≥ 200 [6]	- ≥ 200	- [5] ≥ 200 [6]	≥ 150 ≥ 200	N/50mm
Shear resistance joints	12317-2	≥ 1000	≥ 1000	≥ 1000	≥ 1000	≥ 1000	≥ 1000	≥ 1000	≥ 1000	≥ 1000	≥ 1000	≥ 600	N/50mm
Punctering - Impact v/+23°C - Impact v/ -10°C - Static load - Static load	12691 (A) 12691:2001 12730 (A) 12730 (C)	≥ 800 - - ≥ 20	≥ 800 ≤ 10 ≥ 20 -	≥ 400 - - ≥ 20	≥ 400 ≤ 10 ≥ 20 -	≥ 600 - - ≥ 20	≥ 600 ≤ 10 ≥ 20 -	≥ 700 - - ≥ 20	≥ 700 ≤ 10 ≥ 20 -	≥ 800 - - ≥ 20	≥ 800 ≤ 10 ≥ 20 -	≥ 400 ≤ 15 ≥ 20 -	mm mmdia kg kg
Water vapour resistance / equiv. air layer thickness	ISO 12572	-	27	-	16	-	22	-	24.5	-	27	-	m

1) The manufacturers Declaration of performance, DoP
2) Control limit shows values, product has to satisfy during internal factory production control and audit testing.
3) SINTEF's recommended minimum values are -30 °C for membranes of 1,2 mm thickness and -25 °C for membranes of 1,5 mm thickness and more
4) SINTEF's recommended minimum values for SINTEF Technical Approval for mechanically fastened membranes
5) For failure mode A the average peel resistance has to be assessed towards SINTEF's recommended minimum value for average peel resistance
6) The control limit applies for failure mode B and C

3. Fields of application

Protan SE and *Protan SE-L* are primary 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 substrate but needs a separate migration barrier/levelling layer on polystyrene substrate and for re-roofing applications. Protan SE-L has a lacquered surface which gives an extra benefit on visible surfaces where the aesthetical appearance is important.

Protan T can be used as exposed mechanically fastened membranes for terraces.

Protan SE Titanium+ can be used under same conditions as Protan SE, but the main purpose is to be a roofing membrane in an extensive green roof application, fig. 2.

Protan EX has a warm concealed felt and can be laid directly on old roofing underlay of bitumen. The membrane can also be used under turf roofing. An additional loose felt must be used on liquid applied bituminous roofing.

Roofs must have adequate slope to drain water from rain and melting snow. SINTEF Building and Infrastructure recommends in general a minimum slope of 1:40 for all roofs.

4. Properties

Material properties

Product characteristics for fresh material are shown in table 2.

Safety in case of fire

Protan SE, T, SE-L and SE Titanium+ are satisfying the requirements of class B_{ROOF} (t2) according to EN 13501-5 for substrates shown in table 3.

Protan EX is satisfying the requirements of class B_{ROOF} (t2) in accordance with EN 13501-5 on substrate shown in table 4. of old roofing membranes.

The testing is carried out in accordance with CEN/TS 1187, test 2.

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 substrate may limit the overall capacity of the fixing points. The lowest value for membrane/foundation must always be used.

Calculation of fastener spacing is carried out according to SINTEF Building Research Design Guide 544.206 *Mekanisk feste av asfalttakbelegg og takfolie på flate tak* and "TPF Informs No. 5" published by Takprodusentenes Forskningsgruppe.

Table 3
Protan SE, T, SE-L og SE Titanium+ are classified for B_{ROOF} (t2) on following substrates

Type of substrate	Protan SE/ SE-L/T/ SE Titanium+
EPS *	No
EPS + ≥120 g/m^2 glass felt *	Yes
PIR * / **	Yes
Stone wool	Yes
Wooden roof boards	Yes
Concrete / silicate board	Yes
Old roofing membrane on EPS *	No
Old roofing membrane on EPS + ≥120 g/m^2 glass felt *	Yes
Old roofing membrane on PIR * / **	Yes
Old roofing membrane on stone wool	Yes
Old roofing membrane on wooden roof boards	Yes
Old roofing membrane on concrete / silicate board	Yes

* In case of roofing on lightweight combustible insulation (eg EPS or PIR): See clause 6 *Special conditions for use and installation*, section *Substrate*, regarding requirements for replacement of combustible insulation to non-combustible around passages and against adjacent structures.

** Fire technical classification on PIR applies only to the tested PIR product " PIR Kingspan Therma TR26 LPC/FM ".

Table 4
Protan EX is classified for B_{ROOF} (t2) on following substrates

Type of substrate	Protan EX
EPS *	No
Stone wool	Yes
Wooden roof boards	Yes
Concrete / Silicate board	Yes
Old roofing membrane on EPS * / **	Yes
Old roofing membrane on stone wool	Yes
Old roofing membrane on wooden roof boards	Yes
Old roofing membrane on concrete / silicate board	Yes

* In case of roofing on lightweight combustible insulation (eg EPS or PIR): See clause 6 *Special conditions for use and installation*, section *Substrate*, regarding requirements for replacement of combustible insulation to non-combustible around passages and against adjacent structures.

** See clause 6 *Special conditions for use and installation*, section *Substrate*, regarding requirements for the old roofing membrane.

Table 5
Design capacities at ultimate limit state for mechanical fasteners in Protan SE, T, SE-L, SE Titanium+ and EX

Fastening system/fastener [2]	Capacity [1] N/piece
Protan SE, SE-L, T, SE Titanium+ (overlapp)	
Roofing nail 2,8–25	100
Staples (2 x 20 mm)	130
Eurofast TLK Ø45 fastener	620
SFS intec MW-40-F washer	650
SFS intec MW-40-R washer	650
Guardian SP 40-F washer	650
SFS IR-82x40 washer	650
Guardian SPA 8240-D washer	700
SFS Iso-Tak R45/RP45 fastener	700
Guardian R(P) 45 fastener	700
SFS Iso-Tak LB45 light weight concrete plug	700
Koelner GOK-Plus fastener with studs	720
Ecotek50 IH-P fastener with studs	750
Guardian CBF/CP concrete plug	800
Guardian RB(P) 48 fastener with studs	900
Guardian SPBA 8240 washer	1000
SFS Iso-Tak R(P) 48–3N fastener with studs	1000
Protan EX (overlapp)	
SFS Iso-Tak R45/RP45 fastener	725
SFS intec MW-40-F/ MW-40-R washer	900
Pull through membrane (outside overlapp)	
SFS Iso-Tak R45/RP45 fastener	1000
SFS intec MW-40-F/ MW-40-R washer	1100

[1] The values given in table 5 are design capacities at ultimate limit state for use in Norway with safety factor γ_m=1,3. Also other fasteners than those given in table 5 can be used if they are documented with ETA or SINTEF Technical Approval.

Durability
The products have shown satisfying properties are related to type-testing and annual control testing performed by SINTEF Building and Infrastructure.

Products are evaluated to have satisfying properties to be used in turfed roofs.

5. Environmental aspects

Substances hazardous to health and environment
Protan SE, T, SE-L, SE Titanium+ and EX contains no hazardous substances with priority in quantities that pose any increased risk for human health and environment. Chemicals with priority include CMR, PBT or vPvB substances.

Effect on soil, surface water and ground water
The leaching properties of Protan SE, T, SE-L, SE Titanium+ and EX are evaluated to have no negative effects on soil or water.

Waste treatment/recycling
The product shall be sorted residual waste. The product shall be delivered to an authorized waste treatment plant for energy recovery.

The product can by ended service life be delivered to material recycling in recycling system.

Environmental declaration
An environmental declaration (EPD) has been worked out according to EN 15804 for Protan SE. For complete documentation see EPD no. NEPD-32-203-NO and NEPD-323-203-NO, https://www.epd-norge.no/.

No environmental declaration (EPD) has been worked out for the remaining products.

6. Special conditions for use and installation

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 like EPS with compression strength of ≥ 80 kPa (class CS (10) 80 according to EN 13162/13163), 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 and fasteners with good telescopic action must be used.

Widths over 1 m should only be used at the field zone of the roof where the design peak velocity pressure is less than 3.75 kN/m² with exception of vacuum roofing where rolls of 2 m widths should be placed on the whole roof surface. When rolls with widths of above 1 m are used an accurate design consideration for distances and numbers of fasteners need to be done.

Installation
The joints 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 "TPF Informs No. 5" and in the following SINTEF Building Research Design Guides:
- *544.202 Takfolie. Egenskaper og tekking*
- *544.204 Tekking med asfalttakbelegg eller takfolie. Detaljløsninger*
- *544.206 Mekanisk feste av asfalttakbelegg og takfolie på flate tak,*

Substrate
When a fire classification is required the underlay must be in accordance with the provisions stated in section 4 *Safety in case of fire*.

Substrates of combustible insulation as EPS or PIR must be covered or divided, and also replaced with non-combustible insulation around bushings and adjacent constructions according to regulations in "Veiledning om tekniske krav til byggverk" § 11-9 and further descriptions in SINTEF Building Research Design Guides no. 525.207 *Kompakte tak* og 520.339 *Bruk av brennbar isolasjon i bygninger, and* "TPF informerer nr. 6 Branntekniske kostruksjoner for tak" published by Takprodusentenes Forskningsgruppe.

In connection with re-roofing, on old bituminous roofing membrane laid on insulation of EPS, the membrane in the old roofing must fulfil the requirements of class B_{ROOF} (t2) according to EN 13501-5 on EPS. When the membrane is installed on old asphalt roofing without additional insulation, Protan SE with a separate barrier or Protan EX shall be used.

A separate migration barrier of either a glass felt with in minimum 100 g/m^2 or a polyester felt of in minimum 180 g/m^2 must be used when the roofing is installed directly on old, aged PVC, or on EPS 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 is 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.

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.

7. Factory production control

The product is produced by Protan AS, P.O. Box 420, 3002 Drammen, Norway.

The holder of the approval is responsible for the factory production control in order to ensure that the product is produced in accordance with the preconditions applying to this approval.

The manufacturing of the product is subject to continuous surveillance of the factory production control in accordance with the contract regarding SINTEF Technical Approval.

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.

8. Basis for the approval

Material- and design data have been verified by type testing and audit testing performed by SINTEF Building and Infrastructure during the years 1975–2022.

Resistance against spread of flames have been verified by type testing and audit testing performed during the years 1975–2022.

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, plus on tests according to ETAG 006 and EN 16002.

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, report 31224/96 and 33354/97 from Süddeutsches Kunststoff-Zentrum, and in accordance with FLL-Verfahren (1999), report dated 12.10.1999 from Institut für Bodenkunde und Pflanzenernährung.

9. Marking

All rolls/packages shall be marked with the manufacturer's name, product name and date of production. Each roll need to be marked med manufacturers production code.

Protan SE, T, SE-L, SE Titanium+ and EX are CE marked in accordance with EN 13956.

The approval mark for SINTEF 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 SINTEF beyond the provisions of Norwegian Standard NS 8402

for SINTEF

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