

SINTEF confirms that

Protan Vacuum Roofing System

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 Vacuum Roofing System is based on the principle of airtight fastening of the membrane to parapet and penetrations in the roof construction. Essential for the function is an airtight layer in combination with a supporting structure in the inner part of the construction. Wind blowing across the roof surface creates, with help of the roofing membrane's built-in valves, a negative pressure between the airtight layer and the roofing membrane. The negative pressure causes the membrane to be held down against the substrate, and the wind load is transferred to the supporting structures.

Protan Vacuum Roofing System consists of a Protan roofing membrane in combination with Protan Steel Grip Bar, 3209 T-list Black sealing tape and Protan Vacuum Vent.

Protan roofing membrane

Roofing membranes to be used for Protan Vacuum Roofing System are polyester reinforced roofing membranes like Protan SE and EX. The roofing membranes are documented in SINTEF Technical Approval No. 2010.

Protan Steel Grip Bar

Protan Steel Grip Bars are available in two variants. Principle for both is shown in figure 2. The bars are made from galvanized steel.

The standard variant of the bars is shown in figure 2. Protan Grip steel bar has in addition imprints with approximately 40 mm distance to increase the friction between steel bar and membrane/sealing. The primary task of Protan's Steel bars is clamping of the membrane to other building parts to ensure air tightness in the roofing system.

Protan Vacuum Vent

Protan Vacuum Vent is a one-way valve with an external shell of aluminium and an internal ducting system of expanded polystyrene (EPS); see figure 3. The closing mechanism is an EPDM membrane attached on top of the ducting system of EPS.

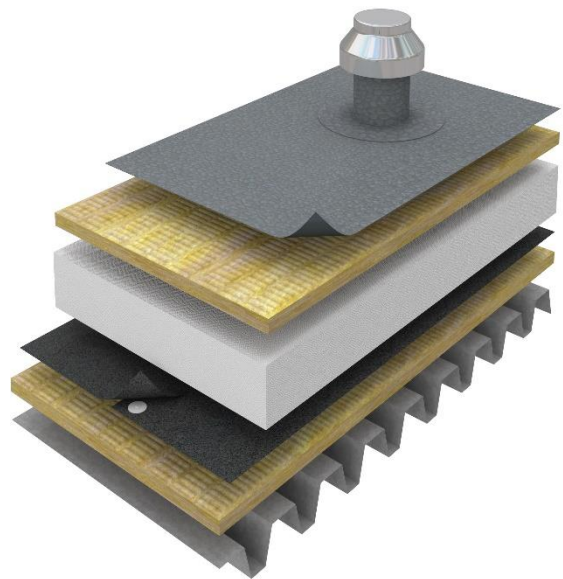


Fig. 1: Protan AS
Principle of Protan Vacuum Roofing System. The membrane is laid with airtight seals along edges and penetrations.

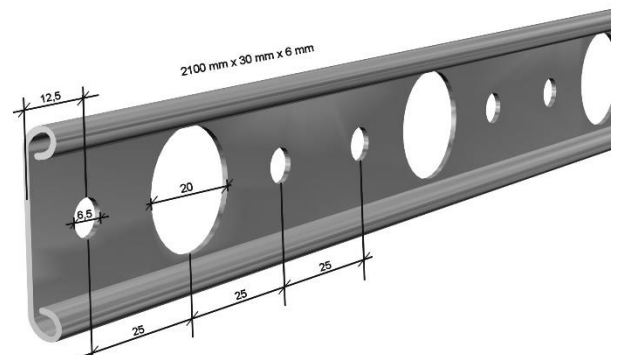


Fig. 2: Protan AS
Protan Steel Grip Bars are supplied in a standard length of 2.1 m.

SINTEF is the Norwegian member of European Organisation for Technical Assessment, EOTA, and European Union of Agrément, UEAtc

3209 T-list Black sealing tape

3209 T-list Black sealing tape is made of PVC with a closed cell structure and is delivered as a supplementary product for the vacuum system.

Supplementary products which are not a part of the system

An airtight layer needs to be part of the construction. Materials and possible supplementary products used for tightening of the airtight layer are not part of this approval. If supplementary products, such as for instance sealing compounds, are in contact with Protan's products, Protan's recommendations regarding chemical compatibility and durability must be followed.

3. Fields of application

Protan Vacuum Roofing System can be used for new roofing and re-roofing on existing plastic-, rubber- and bituminous roofing membranes, with and without additional insulation. It is a presumption that good air tightness can be established to prevent leakage both from outside and inside.

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

4. Properties

Product properties

Product properties for Protan SE and EX are shown in SINTEF Technical Approval No. 2010, table 2.

Properties related to fire

Information regarding fire classification according to EN 13501-5 for Protan SE and Protan EX roofing membranes is given in SINTEF Technical Approval no. 2010, clause 4 *Product properties*, section *Properties related to fire*.

Wind load capacity

The wind load capacity for the roofing system is determined by the airtight layer and the construction it is anchored to. The airtight layer and the underlying construction must be designed for the relevant wind loads.

5. Environmental aspects

Substances hazardous to health and environment

The products contain 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 the products are evaluated to have no negative effects on soil or water.

Waste treatment/recycling

The products shall be sorted as iron or other metals and residual waste. The products shall be delivered to an authorized waste treatment plant for material recycling or be sent to landfill.

Environmental declaration

An environmental declaration (EPD) has been worked out according to EN 15804 for Protan EX, Protan SE and Protan Titanium. For complete documentation see www.epd-norge.no / www.ibu-epd.com, EPD no:

- NEPD-2036-909-NO, Protan SE 1,2
- NEPD-1920-845-NO, Protan SE 1,6
- NEPD-2051-921-NO, Protan EX 1,6

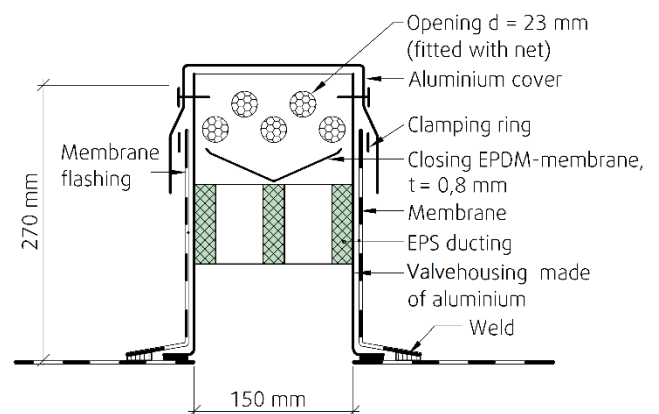


Fig. 3: Protan AS Protan Vacuum-Vent

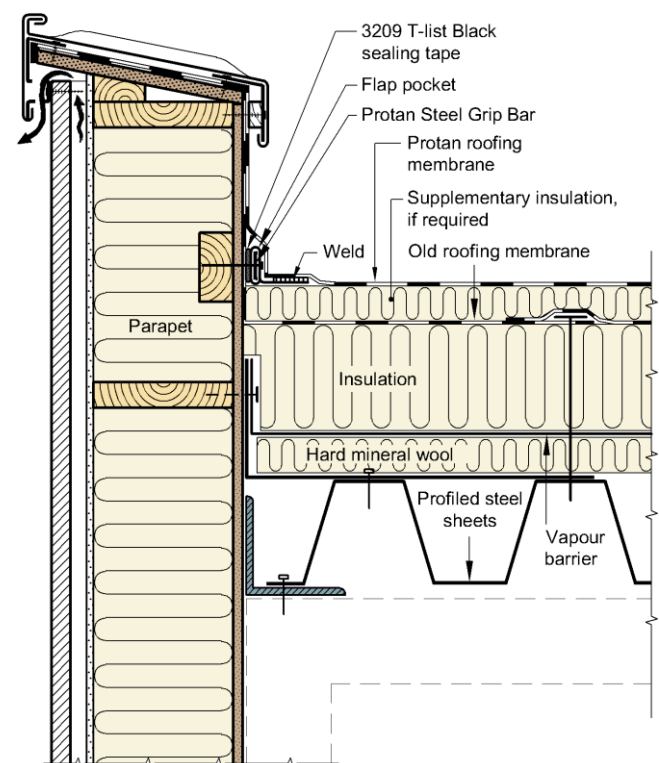


Fig. 4 Sealing principle for edges on a roof with supporting profiled steel plates. Reroofing.

6. Special conditions for use and installation

Design considerations

Evaluation of suitability of Protan Vacuum Roofing System at the actual roof and the dimensioning must be done in cooperation with Protan AS.

The dimensioning mainly involves the number and positioning of valves, and, if required, calculation of the substrate's fastening capacity. The roofing system shall only be installed by roofers who have executed Protan's roofing school and a special training program for the vacuum system. On all roofs with Protan Vacuum Roofing System, the final control shall be reported.

Installation

The joints are welded with hot air. TPF Informerer no. 6 *Branntekniske løsninger for kompakte tak og terrasser* describes which roofing methods can be used on various roof structures. When roofing with hot air or open flame, all combustible insulation must in principle be protected with non-combustible insulation. However, TPF Informerer no. 6 describes exceptions for hot air welding of roofing membranes with fire class B_{ROOF} (t2).

The membrane shall be installed in accordance with Protan's guidelines for design consideration and installation, and in accordance with the principles shown in SINTEF Building Research Design Guide no.:

- 525.207 *Kompakte tak*
- 544.202 *Takfolie. Egenskaper og tekking*
- 544.204 *Tekking med asfalttakbelegg eller takfolie.*

Detaljløsninger

plus information sheets issued by Takproducentenes Forskningsgruppe (TPF), see www.tpf-info.org:

- TPF informerer nr. 6 *Branntekniske løsninger for kompakte tak og terrasser*
- TPF informerer nr. 13 *Tak under oppføring – forholdsregler og tiltak ved bruk*

Substrate and joints

A basic requirement for the vacuum system to work as intended, is that the roofing membrane, the airtight layer and connections of the membrane are airtight.

The substrate for the new membrane may be a lightweight roof structure where the existing roofing (airtight layer) can act as a vapour barrier in the finished roof. The existing roofing membrane must be mechanically fixed, with welded, airtight joints (see figure 1).

The substrate for the new membrane may also be solid concrete roof deck (see figure 5 - 7) or other roofs with an existing roofing membrane that can act as an airtight layer.

Where fire technical class B_{ROOF} (t2) is required for the roofing membrane, the membranes can only be laid on substrates as specified in TG 2010, clause 4 *Properties*, section *Properties related to fire*.

Substrates of combustible insulation, such as EPS, must be covered or divided into areas, and replaced with non-combustible insulation around bushings and adjacent constructions, such as parapets and walls, according to pre-accepted performances given in the guidance to *Forskrift om tekniske krav til byggverk § 11-9* and in TPF informerer nr. 6 *Branntekniske løsninger for kompakte tak og terrasser*.

When 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 bituminous roofing without additional insulation, Protan SE with a separation layer or Protan EX shall be used.

When the membranes are installed on old bituminous roofing membrane, on old and rigid PVC roofing or directly on EPS or XPS insulation, a separate migration barrier/separation layer shall be used in accordance with the manufacturer's installation manual. See SINTEF Building Research Design Guide no. 544.202 *Takfolie. Egenskaper og tekking*. for additional requirements for migration barriers and protective layers.

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

Inspection during reroofing

In connection with reroofing, the existing membrane must be inspected for leakage and if there are any weaknesses in the existing fastening. The membrane/fastening must be repaired if necessary. The membrane is normally inspected visually using non-destructive equipment. In case of doubt, parts of the roof can be opened to investigate the airtightness and the condition of the existing fastening.

Sealing at edges and penetrations

All edges and penetrations in the membrane must be performed with airtight construction details, using Protan Steel Grip Bars, Airtight seal and supplementary products. The steel bar shall be screwed to the substrate.

Figure 4 – 7 show examples of sealing principles at the connections with an external wall or at a top edge/parapet. The distance between fasteners in the steel bars must be verified through wind load calculations/analysis but shall never be greater than 150 mm to ensure an airtight clamp towards the substrate. Figure 8 shows sealing at a roof outlet.

Positioning of valves

Valves are normally placed in corners and the perimeter area along free edges. The following general instructions are applicable when positioning and installing valves, see figure 9:

- two valves in external corners
- two valves in internal corners
- maximum distance between valves along free edges is 15 m
- for pitched roofs with fall > 1:6, valves should be used at the roof ridge, both close to gables and on the centre section.

Traffic on the roof

Special precautionary measures should be taken to protect the roofing membrane if the roof is expected to have more traffic than is necessary for inspection and maintenance purposes only.

Maintenance and inspection

Before starting any welding, as a part of repair work, the roofing membrane must be cleaned locally, in accordance with the vendor's installation manual. An appropriate cleaning agent must be used.

The roof must be checked at regular intervals for the presence of blisters. Durable blisters may indicate a reduced function of the vacuum system, due to of a loss of suction, which in turn may indicate leaks in the airtight layer, the roofing membrane or in the valves.

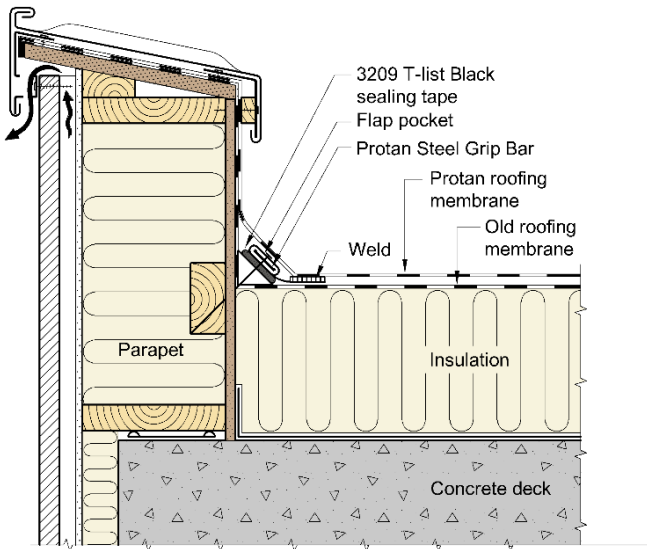


Fig. 5 Sealing principle for edges on roof with use of triangle lath. Reroofing.

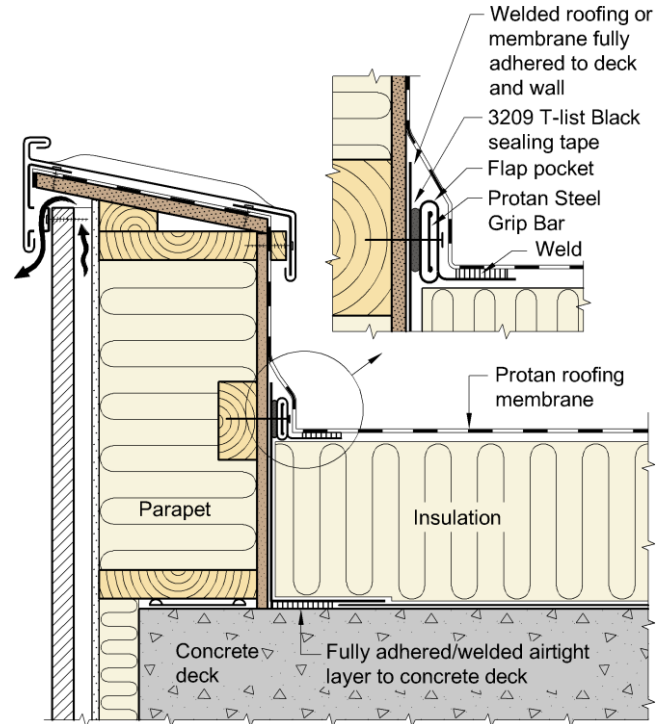


Fig. 7 Sealing principle for edges on a concrete roof deck. New building.

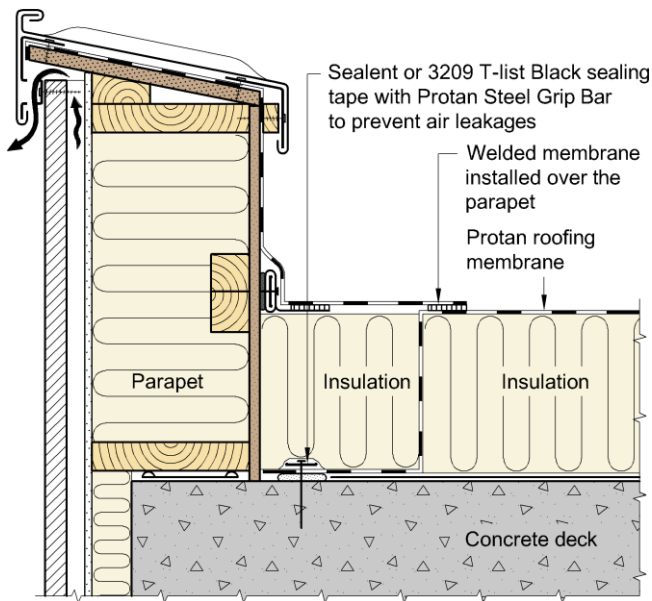


Fig. 6 Sealing principle for edges on a roof with an airtight concrete deck. Suitable if movements are expected between the wall and the deck. New building.

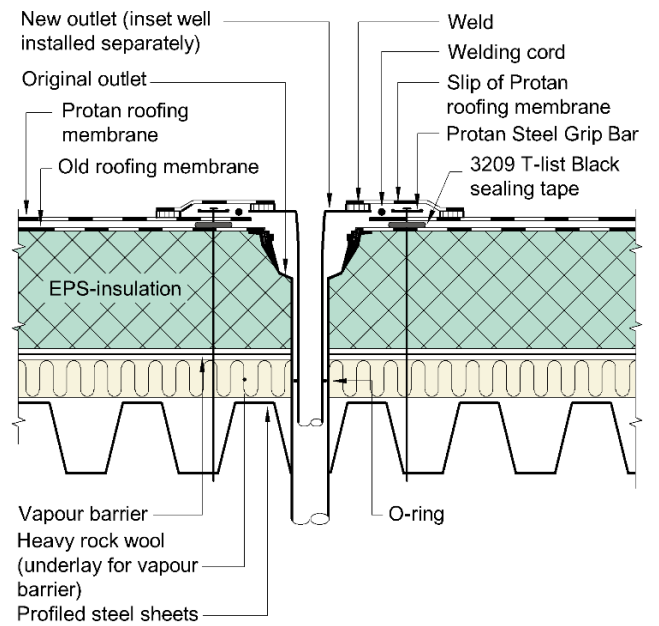


Fig. 8 Principle for sealing at an outlet. Reroofing.

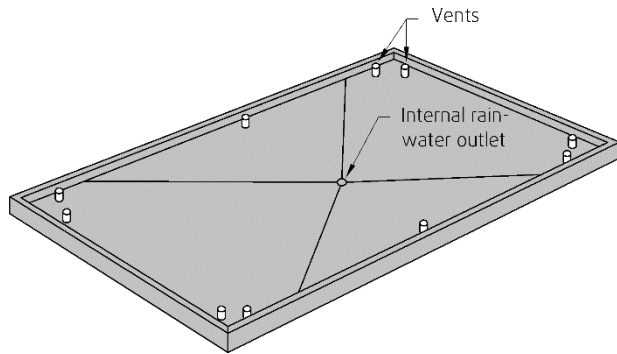


Fig.9
Typical placing of valves. Distances to edges, to corners and between valves must be considered for each project and calculated by Protan AS.

7. Factory production control

The membranes are produced by Protan AS, Baches vei 1, 3413 Lier, Norway.

Protan Steel Grip Bar is produced in Poland for Protan AS.

Protan Vacuum Vent is produced in China for Protan AS.

3209 T-list Black sealing tape is produced in England for Protan AS.

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

The manufacturing of the product(s) and the manufacturer's system for factory production control (FPC) is subject to continuous surveillance in accordance with the contract regarding SINTEF Technical Approval.

Protan AS has a quality management system certified according to EN ISO 9001 and an environmental management system certified according to EN ISO 14001.

8. Basis for the approval

The evaluation of the products is based on reports owned by the holder of the approval.

The evaluation of design and technical solutions are based on recommendations given in SINTEF Building Research Design Guides.

9. Marking

All pallets/packages/of roofing membranes shall be marked with the manufacturers name, product name and production number. All rolls are also marked with week number and year.

Protan Steel Grip Bar is marked with the product name, product code and batch number on the product.

Protan Vacuum Vent is marked with the product name and Protan's article number on the packaging, and with the manufacturer's product number on the foot of the product.

3209 T-list Black sealing tape is marked with vendor and the vendor's article number.

The roofing membranes are CE marked in accordance with EN 13956.

The approval mark for SINTEF Technical Approval TG 2281 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 SINTEF beyond the provisions of Norwegian Standard NS 8402

for SINTEF

Susanne Skjervø

Susanne Skjervø
Approval Manager