

**SINTEF Building and Infrastructure**

Norwegian member of European Organisation for Technical Approvals, EOTA, and European Union of Agrément, UEAtc

## Protan Vacuum Roofing System

is approved by SINTEF Building and Infrastructure with properties, fields of application and conditions as stated in this document

**1. Holder of the approval**

Protan A/S  
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 Norway  
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**2. Manufacturers**

The roofing membrane is produced by Protan A/S, Drammen.  
 Fixing bars and vents are supplied by authorized subcontractors to Protan's specifications.

**3. Product description**
*General*

Protan vacuum roofing system consists of Protan roofing membrane in combination with fixing bars and vacuum vents. The roofing system is based on the principle of anchoring the membrane by creating negative pressure in the layer between the membrane and the substrate when subjected to wind loading. The negative pressure causes the membrane to be held down against the substrate, and load transfer is achieved downwards to the supporting structures. The substrate may for example be an old bitumen membrane. Good airtightness of all connections between the top membrane and the substrate is essential.

The vent system functions as an extra security and consists of one-way vents which let air out to compensate for unintentional air leakages between membrane and substrate. The vents are effective in the area of the roof where the wind suction at any given time is greatest, and they are positioned in corners and along edges; see Fig. 1.

*Membrane*

The membrane can be Protan SE, EX and EXG. Protan SE, EX and EXG is a roofing membrane made of plasticized PVC. All products have a core of woven polyester. The roofing membranes are documented in SINTEF Technical Approval No. 2010.

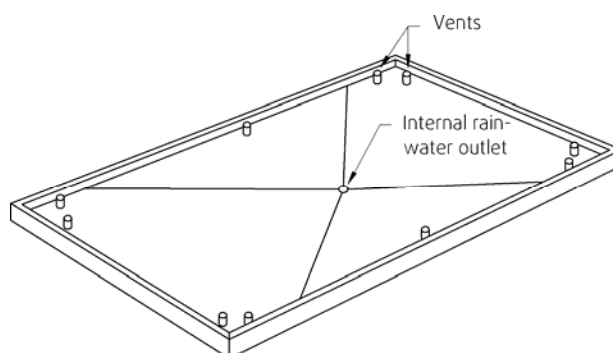


Fig. 1  
 Principle of Protan vacuum roofing system. The membrane is laid with airtight connections along edges and penetrations.

*Fixing bars*

Protan fixing bars are shown in Fig. 2. The bars are made from galvanized steel with a zinc weight of 225 g/m<sup>3</sup>, which is equivalent to a thickness of approx. 20 μm. The primary task of the fixing bars is to ensure airtightness in the roofing system.

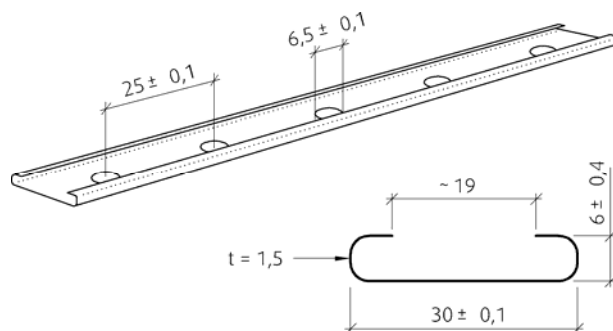


Fig. 2  
 Protan fixing bar. The bars are supplied in standard lengths of 1.95 m.

*Vacuum-vent*

Protan Vacuum-vent is a one-way vent with an external shell of aluminium and an internal ducting system of expanded polystyrene (EPS); see Fig. 3. The closing mechanism is an EPDM membrane attached to one of the partition walls in the EPS cross.

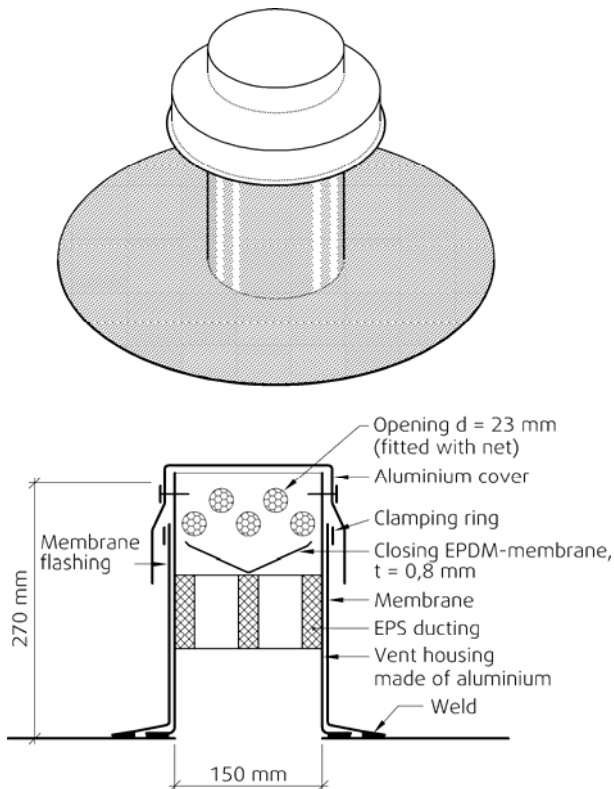


Fig. 3  
Protan Vacuum-vent

#### Supplementary products

Protan airtight seal made of PVC with a closed cell structure, and sealants approved by Protan AS, are delivered as supplementary products for the system.

#### 4. Field of application

Protan vacuum roofing system can be used for new roofing and for reroofing of flat roofs, provided that good air sealing can be established to prevent leaks 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.

#### 5. Properties

The properties of the roofing membranes concerned are set out in SINTEF Technical Approvals No. 2010.

The capacity of the roofing system is determined by the substrate capacity. The substrate must be designed for the relevant wind loads.

#### 6. Special conditions for use and installation

##### Planning and application

Protan vacuum roofing system must always be dimensioned by Protan A/S, who must also carry out an initial survey of the roof in question and assess whether it

is suitable for the system. Dimensioning mainly involves the number of vents, positioning, and, if required, calculation of the substrate capacity.

The roofing system must be installed by installers with special approval by Protan A/S. All approved installers must have completed a compulsory training programme. On all roofs covered with Protan roof covering, vacuum roofing system included, a final control is carried out and reported.

The membrane must also be applied in accordance with Building Research Design Sheets 525.207, 544.202 and 544.204, and with Protan's design and application instructions.

##### Substrate and joints

A basic requirement for the system is that the substrate and connections of the membrane to the substrate have good air tightness. The substrate may be a lightweight roof structure with a vapour barrier having good mechanical strength and welded, airtight joints (see Fig. 4), a solid concrete roof deck or a roof with an existing roofing membrane.

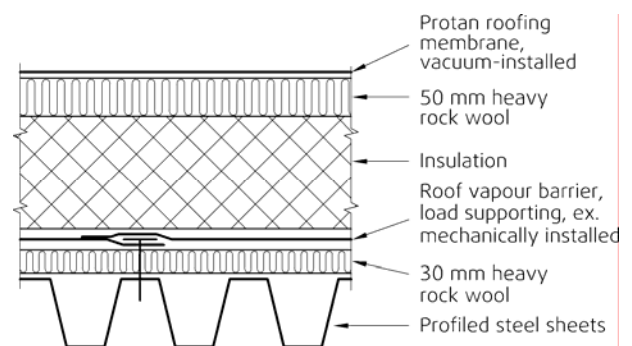


Fig. 4  
Example of a new roof structure with supporting profiled steel sheets.

##### Inspection during reroofing

In conjunction with reroofing, any existing membrane must be inspected for leakage in the membrane and any weaknesses in the existing anchoring, and if necessary these must be repaired. The membrane is normally inspected visually using non-destructive equipment. In case of doubt, parts of the roof can be opened to investigate the air sealing and the condition of the existing anchoring.

##### Sealing at edges and penetrations

All edges and penetrations in the membrane must be performed with airtight construction details, using Protan fixing bars and supplementary products.

Figures 5 to 8 show examples of sealing principles at the connections with an external wall or a top edge/parapet. Figure 9 shows sealing at a roof outlet.

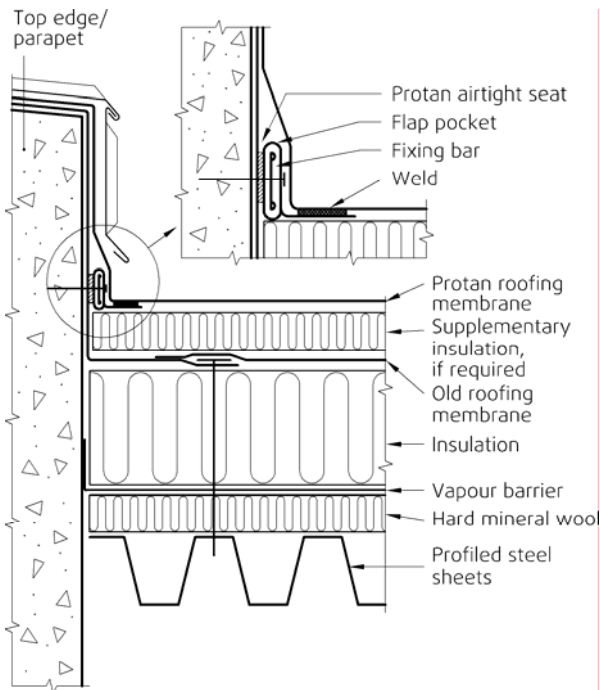


Fig. 5  
Sealing principle for edges on a roof with supporting profiled steel sheets. Reroofing.

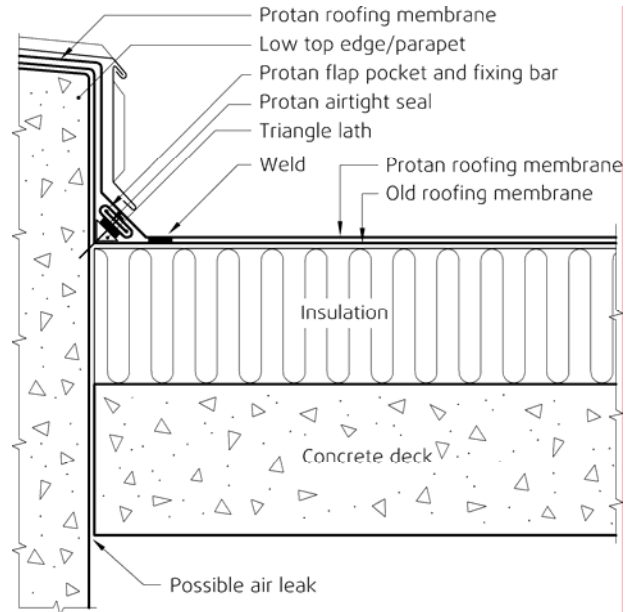


Fig. 7  
Sealing principle for edges on roof with use of triangle lath. Reroofing.

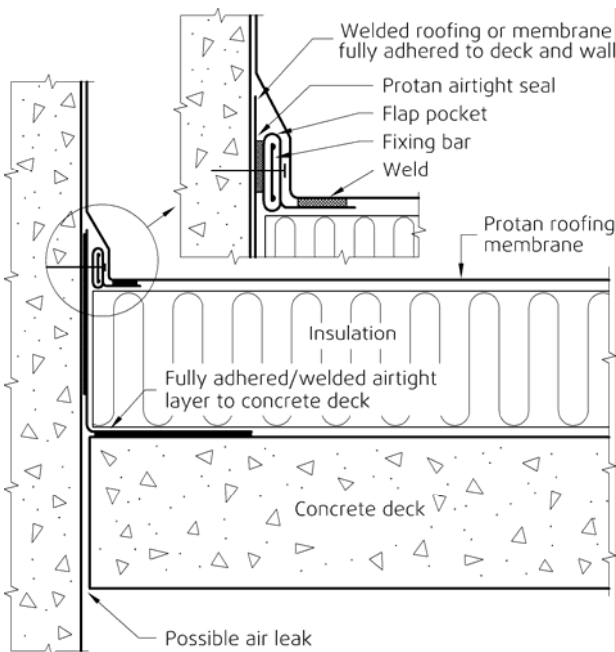


Fig. 6  
Sealing principle for edges on a concrete roof deck. New building or reroofing.

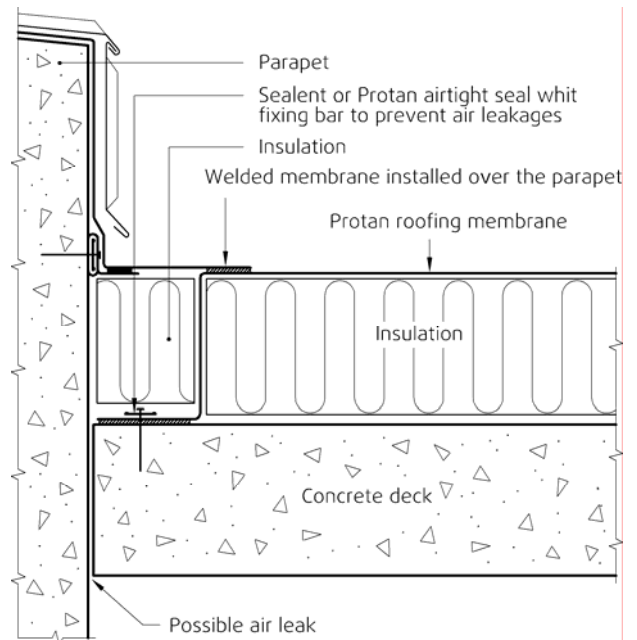


Fig. 8  
Sealing principle for edges on a roof with an airtight concrete deck. New building. Suitable if movements are expected between the wall and the deck.

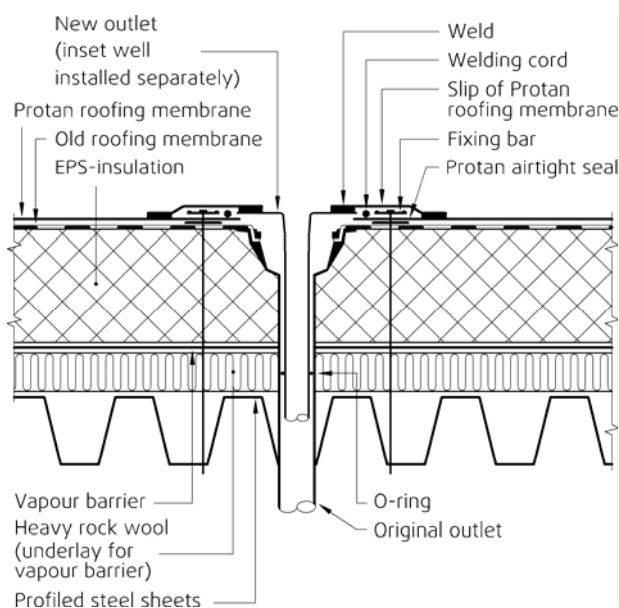


Fig. 9  
Principle for sealing at an outlet.

*Positioning of vents*

Vents are normally only used along free edges. Where the roof abuts against adjacent high walls, the membrane is attached as shown in Figs. 5, 6 or 7. The following general instructions are applicable when positioning and installing vents, see Fig. 10:

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

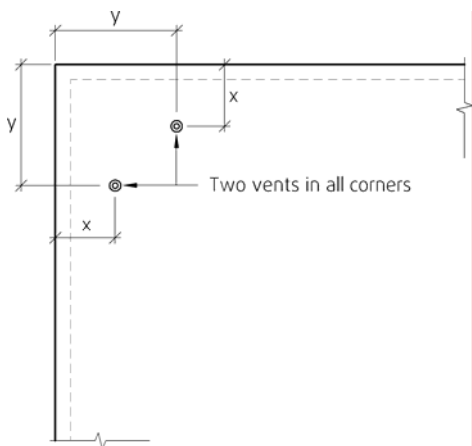


Fig. 10  
Positioning of vents at external corners. Dimensions for x and y must be determined individually for each project and calculated by Protan.

*Roof traffic*

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

*Inspection and maintenance*

When doing repair work, the roofing membrane must be cleaned locally before starting any welding of joints. Appropriate cleaning agent must be used.

**7. Factory production control**

Protan vacuum roofing system is subject to supervisory factory production control according to contract between SINTEF Building and Infrastructure and Protan A/S concerning SINTEF Technical Approval.

Protan A/S has a quality system certified by Det Norske Veritas according to ISO 9001:2000, Certificate No. 95-OSL-AQ-6343.

**8. Basis for the approval**

Material and performance data for the roofing membranes have been determined by type testing and regular audit testing performed by SINTEF Building and Infrastructure and the Norwegian Fire Research Laboratory during the years 1975 – 2006; see SINTEF Technical Approval Nos. 2010 and 2219.

The properties of the roofing system are based on type testing and pilot projects documented in the following reports from the Norwegian Building Research Institute:

- O 8346 dated 22.12.98
- N 8351-P3/P4 dated 14.04.2000
- O 8348 dated 30.06.2000.

**9. Marking**

All pallets/packs of roofing membranes must be marked with the manufacturer’s name, product designation and date of production. All rolls must be marked with the manufacturer’s production code. All pallets/packs of vents and bars must be marked with the manufacturer’s name and product designation. The approval mark for SINTEF Technical Approval No. 2281 may also be used.



Approval mark

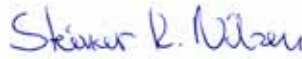
**10. Liability**

The holder/manufacture 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.

**11. Technical management**

Project manager for this approval is Knut Noreng, SINTEF Building and Infrastructure, Trondheim.

for SINTEF Building and Infrastructure



Steinar K. Nilsen  
Approval manager