swisspor

APPLICATION GUIDE

swisspor TETTO above rafter insulation

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The informations provided in this documents, are textual guidelines, the datas in the form of technical drawnings correspond to the current technical knowledge at the time of publication and based to the experience of CREATON South-East Europe Kft.. This application guide contains only a part of the product informations. The described applications, examples, do not take into account the special features that may arise in individual cases.

All datas and the suitability of the material for the intended use must always be checked on the construction site! CREATON South-East Europe Kft. disclaims all warranties related the provided informations. This includes typographical errors and the subsequent changes to the specifications.

More informations: **swissporTON.hu**

PART I.
General rules and informations

More informations: **swissporTON.hu**

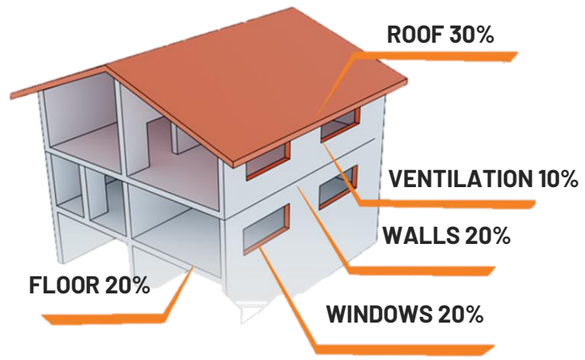
I. Introduction

Almost half of the energy consumption is spent on heating our buildings, which is higher than the share of transport or industry. As a result of the burning of fossil energy carriers (petroleum, coal, natural gas) for heating and energy supply, CO_2 (carbon dioxide) and other harmful substances are released into the air, which greatly contribute to the phenomenon of the greenhouse effect, global warming and climate change. Households' high consumption of energy leads to high costs in addition to harmful emissions.

It is therefore in our common interest to reduce our energy consumption and harmful emissions by insulating our buildings to a sufficient degree, thus contributing to the protection of our environment.

Heat loss and thermal insulation

The rate of heat loss is different for each structure of the building. In an average building, the largest amount of heat typically escapes through the roof and roof slab, which is why heat protection is most justified here.



In the case of roof structures, insulating materials can basically be applied according to three methods: under the rafters, above the rafters and between the rafters, or you can combine the three methods. In the case of insulation between the rafters (depending on the rafter distance), the rafters make up cc. 12% of the roof surface. This high ratio impairs the insulation performance of the entire roof structure. In the case of thermal insulation above the rafters, wood does not play such a big role. Energy loss must be expected at fewer points of the roof structure. With the same insulation material thickness, up to 30-45% higher insulation performance can be achieved, or even 30-45% insulation material can be saved, with the same insulation performance. From a building physics and economic point of view, the combination of thermal insulation above the rafters and thermal insulation above the rafters and between the rafters is the most ideal solution.

Building energy, heat engineering

rding to the European directives, new buildings must meet increasingly strict thermal requirements. According to the most recent amendment of EPBD 2010/31/EU (Energy Performance of Buildings Directive), after December 1, 2020, only buildings with near-zero energy consumption may receive an occupancy permit in the European Union. This is ensured by stricter and multi-level building energy regulation in several steps. The required values of the heat transmission factors of the boundary and door and window structures will become more stringent. The required value of the heat transmission coefficient of the structures delimiting the heated attic has to be uniformly 0.17 W/m^{2}K for all new buildings.

The new requirement value could be ensured with at least 25-35 cm fiber thermal insulation layers built between and under the rafters for structures delimiting the roof space made with traditional technology. The reason for this is the less favorable thermal insulation capacity of fibrous thermal insulation materials, as well as the thermal bridge appearing in the line of the rafters, which must be taken into account when determining the layered thermal transmittance factor.

The most important property of heat-insulating materials is their ability to insulate. The material with favorable thermal insulation properties also meets the requirements in a thinner size, and it is also easier to transport, handle and install.

II. Standards and regulations

General planning and execution rules and regulations for the **swisspor TETTO** thermal insulation system. Compliance with the regulations and rules is important, because warranty claims can only be asserted if the regulations are followed and the original additional elements are used.

- DIN EN 13165 Thermal insulation products for buildings - Factory made rigid polyurethane foam (PUR) products
- DIN EN 1991 Eurocode 1: Actions on structures
- DIN 4102 Fire behaviour of building materials and elements
- DIN 4108 Thermal insulation and energy economy in buildings
- DIN 4109 Sound insulation in buildings
- DIN 68800 Wood preservation
- VOB/C DIN 18338 General technical specifications in construction contracts (ATV) - Roofing work

EN 1304 Clay roofing tiles and fittings. Product definitions and specifications

ZVDH Central Association of the Roofing Trade.

The energy saving regulation (EnEV)

The heating energy saving rules were created in the 70s of the last century as a response to the oil crisis. In Germany, the first heating energy saving regulations applicable from 1977 (WSchVO 1977). And a year later, the heating technology regulation for increasing the technological efficiency was accepted (HeizAnlV 1978). In the period that followed, due to climate change, climate protection came to the fore more and more. The climate can only be effectively protected if measures are implemented on a global scale. Thus, in 2002, the European Union issued its directive on the increased energy efficiency of buildings, which aimed to reduce the energy consumption of buildings in all member countries within a relatively short period of time. Another goal of the regulation is to make the energy demand of new buildings close to zero.

This directive was replaced in Germany in 2002 by the Energy Saving Ordinance (EnEV). EnEv was the first piece of legislation that allows you to determine the environmental balance of a building by measuring not only the useful energy supplied to the building (secondary energy), but also the primary energy used for it, which includes production, distribution, storage, etc. energy losses. In addition, the EnEV also contains regulations on the quality of renovation steps, energy audits and the replacement of old heating systems. The energy conservation decree determines the values of the thermal insulation factors to be observed in the case of new constructions and renovations. The most important of these are heat transfer factors (U values). The heat transfer coefficient is a reference value, it shows how

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much heat passes through a structure with a unit surface as a result of a unit temperature difference. Its unit is W/m²K.

The minimum energy saving requirements for buildings have also been formulated in the EU. The EPBD 2010/31/EU contains the minimum requirements, which is tightened every year. From January 1, 2018, much stricter regulations apply to the thermal insulation of residential buildings than before. The reason for this is that the permissible heat transmission factor of some structural elements of buildings changes. The stricter regulation is intended to reduce heat loss by approximately 40% compared to previous regulations.

The required value of the heat transmission factor

Building boundary structure	U(1) [W/m²K]	U(2) [W/m²K]
External wall	0,45	0,24
Flat roof	0,25	0,17
Attic slab	0,30	0,17
Heated attic bordering structures	0,25	0,17
Lower closing slab above arcade	0,25	0,25
Lower closing slab above unheated spaces	0,50	0,26
Façade glazed window and door (with wooden or PVC frame structure)	1,60	1,15
Façade glazed window and door (with metal frame structure)	2,00	1,40
Facade glass wall	1,50	1,40
Roof light	2,50	1,70
Skylight window	1,70	1,25
Facade or door between heated and unheated spaces	1,80	1,45
Wall between heated and unheated spaces	0,50	0,26
Wall between neighboring heated buildings	1,50	1,50
Wall in contact with the ground between 0 and 1 m	0,45	0,30
Ground floor in a 1.5 m wide strip along the perimeter (can be replaced with thermal insulation of the same resistance placed on the plinth)	0,50	0,30

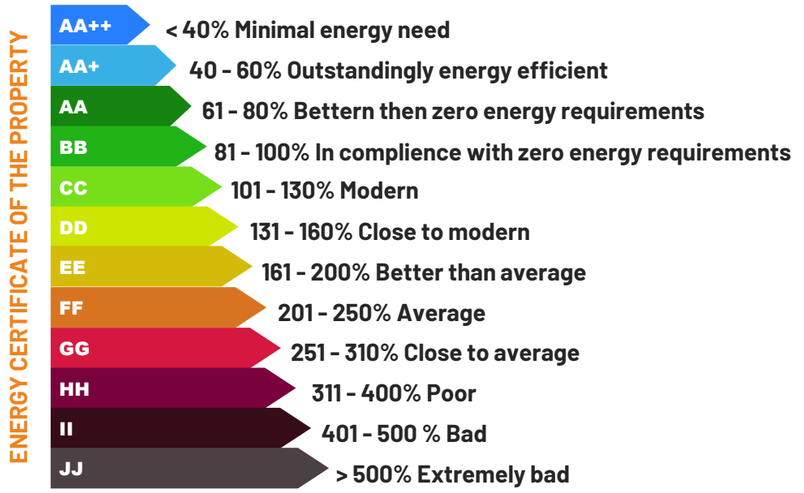
(1) For residential buildings occupied until 31st of December 2017

(2) For residential buildings occupied until 1st of January 2018

Energy certificate

The European Union focuses on the energy efficiency of homes and public institutions, which is why it has made the introduction of the energy certificate mandatory for all member states. The energy certificate (e-green card) is a document that contains the energy performance of the building or individual purpose unit determined by the calculation method according to the legislation issued on the basis of the authorization of this law.

The energy certificate provides information on the energy properties of the building, as well as suggestions for energy saving options, renovations, and modernizations.



Requirements system:

The bases of the qualification system are described in the annexes of the relevant government decree in accordance with the European Union rules. The detailed system of specialized requirements related to this is currently defined in a local level in accordance with the EPBD 2010/31/EU directive.

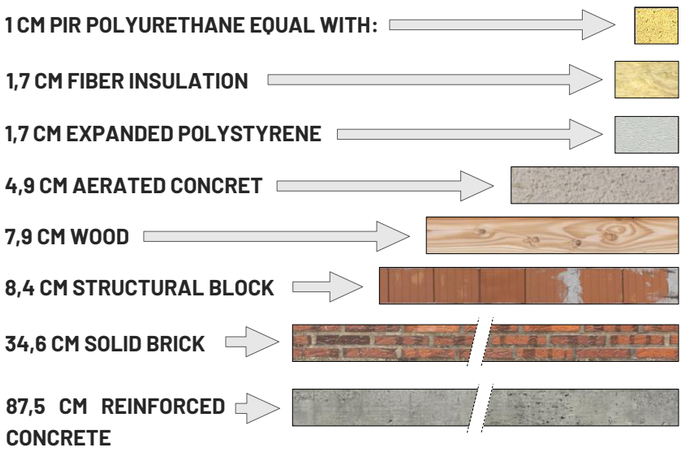
Based on the requirements of the energy quality certificate for buildings, compliance must be substantiated by calculating three indicators:

- the adequacy of the heat transmission factors of the individual boundary structures
- adequacy of the specific heat loss of the building
- adequacy of aggregated energy characteristic

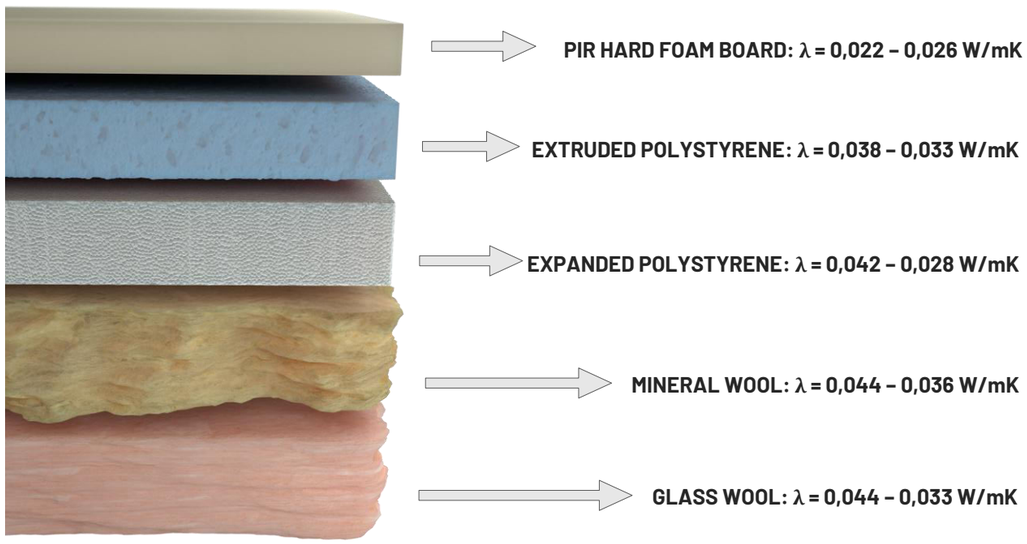
III. The swisspor TETTO thermal insulation

The PIR hard foam

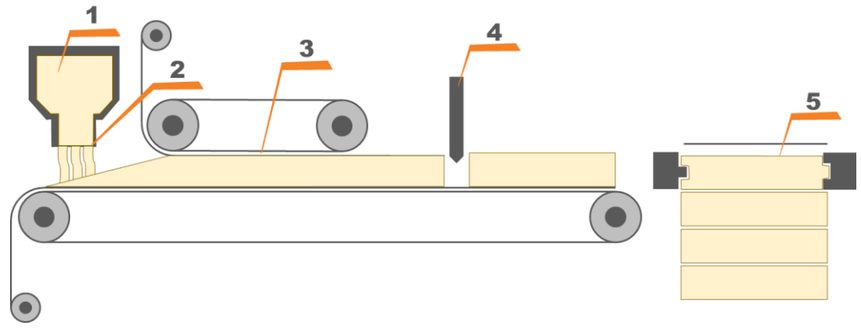
The most important property of heat-insulating materials is their ability to insulate. The material with favorable thermal insulation properties also meets the requirements in a thinner size, and its transport, material handling and installation are also simpler. The **swisspor TETTO** roof thermal insulation system consists of large, polyisocyanurate (PIR) hard foam boards, which have the best thermal insulation parameters among the insulation materials currently available on the market.



The raw material of **swisspor TETTO** thermal insulation boards is polyisocyanurate (PIR) hard foam, which is an improved version of polyurethane (PUR). PIR hard foam is a closed-cell foam with excellent thermal insulation parameters (thermal conductivity, λ=0.022 W/mK). It owes its favorable thermal insulation properties to the pentane (λ=0.013 W/mK) gas enclosed inside the cells, which is twice as good a thermal insulator as air.



Polyisocyanurate foam is created from two liquid raw materials, polyol (A-component) and isocyanate (B-component) through a polyaddition reaction, at low temperature, without catalyst and by-products, under the influence of pentane gas used for foaming. More than 90% of polyisocyanurate has a closed-cell structure, inside which pentane is found. The mixture of the two raw materials swells approximately 50 times and then solidifies.



Production of PIR hard foam boards

1. Foaming agents are mixed as additives to the liquid raw materials. The generated heat of reaction evaporates the added foaming agent.

2. The reaction mixture is applied through a mixing head to the cover layer running on the lower track of the two-track equipment, which can be, for example, an aluminum layer.

3. The applied polyisocyanurate foams within the pressure zone and sticks together with the top layer introduced from above.

4. After the polyisocyanurate foam has hardened, the strip-like sheets are cut to the desired dimensions.

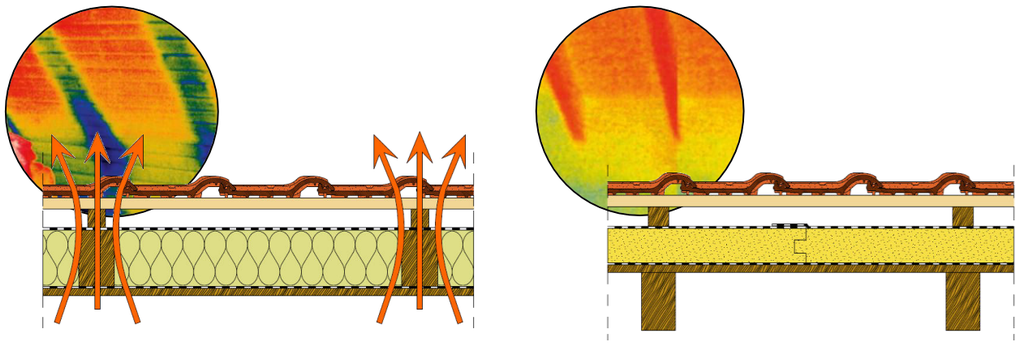
5. After cutting, the grooves (locks) are milled out, and then the additional top layers are applied.

The most important features of the swisspor TETTO thermal insulation board:

- Large-sized **swisspor TETTO** thermal insulation panels are extremely light, making their installation simple, fast and particularly cost-effective.
- Easy assembly and a thermal bridge-free connection are ensured by the all-round knotted edge design.
- It can be cut easily and accurately.
- The outstanding mechanical strength of the boards (compressive strength = 100 kPa) allows them to be laid without support directly on the rafters (no slatting or planking of the surface is necessary). In the case of renovations, it is important that the work phases do not involve breaking up the interior, so the attic can be used continuously during the entire construction.
- The upper side of the boards is provided with a non-slip, weatherproof, watertight, vapor permeable cover film. The edges of the cover films are protected against wetting with a self-adhesive adhesive strip and a 10 cm overlap.

- Moisture resistant. The moisture absorption of the panels after 28 days of continuous water immersion is only 1.3 percent by volume. This water absorption also occurs at the cut edges, as PIR is more than 90% closed-cell.
- The **swisspor TETTO** thermal insulation board does not contain fungicides, but nevertheless protects against fungus and mold growth. Since it does not absorb moisture, it does not provide a breeding ground for microorganisms. With professional installation, it is resistant to mold, fungus, rodents, weak acids or for alkalis.
- It behaves biologically and physiologically completely neutral. It is not carcinogenic, does not cause allergic symptoms, and does not cause irritation on the skin and mucous membranes during installation. It does not contain ozone-depleting gases. Nothing proves its biological neutrality better than the polyurethane thermal insulation of our refrigerators.
- PIR products can be used permanently between -30 and +90 °C, and for short periods up to +250 °C.
- Time-resistant and shape-retaining, it retains its shape, size and favorable technical characteristics for decades.

In the case of a suitable product combination, favorable sound insulation values can be achieved with its installation.



Placing and joining the **swisspor TETTO** boards above the rafters creates a continuous, closed thermal insulation layer, thus eliminating the thermal bridging effect in the line of the rafters. The upper side of the **swisspor TETTO** roof thermal insulation boards is covered with a roofing membrane that forms the underlay, with a self-adhesive strip that extends along the edges (can be overlapped). Thus, by using the system, thermal insulation and underlayment can be created at the same time.

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IV. swisspor TETTO Classic

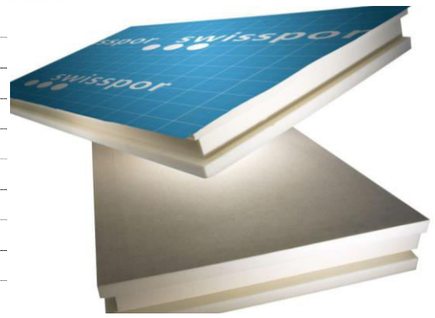
Area of application

The product named **swisspor TETTO Classic** is primarily recommended as an additional thermal insulation layer for the renovation of existing roof structures. Thanks to the special vapor-permeable lamination of the **swisspor TETTO Classic** boards, they enable the moisture in the rafters and in the existing thermal insulation between the rafters to migrate, while the **swisspor TETTO Classic Difuplan** combines the thermal insulation and the watertight, vapor permeable underlayment in one product. The solution is based on laying boards on the outer plane, i.e. all work phases take place from the outer plane, which brings additional benefits in addition to increasing the efficiency of thermal insulation.

Thanks to the outstanding strength parameters of the **swisspor TETTO Classic** boards, they enable the boards to be laid directly on the rafters without support (no slatting or planking of the surface is necessary). The work phases do not involve breaking up the interior, so the attic can be used continuously during the entire construction. In case of renovation, the heating energy demand of the attic can be reduced by up to half by installing a 8 cm PIR board.

swisspor TETTO Classic & TETTO Classic Difuplan

Raw material	PIR hard foam
Size	2362 x 1012 mm (2,39 m^2)
Effective (net) size	2350 x 1000 mm (2,35 m^2)
Compressive strength	100 kPa (10 t / m^2)
Vapor diffusion resistance (μ value):	40-120
Density:	30 kg/m^3
Edge detail:	Interlocking in all side
Lamination	Glass fleece
Fire resistance (EN 13502-1):	„E" class



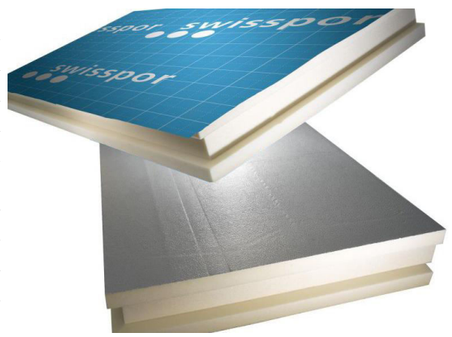
Thickness [mm]	Heat conduction factor λ [W/mK]	Heat transfer factor U [W/(m²K)]	Packaging (board / pack)	Surface (m^2 / pack)	Weight (kg / pack)
80	0,026	0,272	16	37,60	100,8
100	0,026	0,223	12	28,20	92,4
120	0,025	0,183	10	23,50	92,0
140	0,025	0,158	9	21,15	96,3
160	0,025	0,14	8	18,80	98,4
180	0,025	0,125	7	16,45	96,6
200	0,025	0,114	6	14,10	92,4
220	0,025	0,104	5	11,75	85,0
240	0,025	0,095	5	11,75	92,5

V. swisspor TETTO Alu

Area of application

The **swisspor TETTO Alu** offers an ideal solution for all new pitched roofs. On both sides of the boards there is an aluminum coating (lamination), which retains the warm heat rays leaving the interior in winter, and reflects the external solar radiation in summer. In addition to the excellent technical parameters of the polyisocyanurate thermal insulation material, it also offers aesthetic advantages. In the case of thermal insulation other than the rafters, the internal visible wooden structures do not need to be hidden behind thermal insulation, thus these wooden structures can be shown in their beauty and naturalness, thus creating variable, unique roof surfaces. The thermal insulation is placed above the rafters and the entire wooden support structure, thus providing permanent protection to these structural elements, with which the lifespan of our roof structure can be increased several times.

swisspor TETTO Alu és TETTO Alu Difuplan	
Raw material	PIR hard foam
Size	2362 x 1012 mm (2,39 m^2)
Effective (net) size	2350 x 1000 mm (2,35 m^2)
Compressive strength	100 kPa (10 t / m^2)
Vapor diffusion resistance (μ value):	~200
Density:	30 kg/m^3
Edge detail:	Interlocking in all side
Lamination	Aluminium coating
Fire resistance (EN 13502-1):	„E" class



Thickness [mm]	Heat conduction factor λ [W/mK]	Heat transfer factor U [W/(m^2K)]	Packaging (board / pack)	Surface (m^2 / pack)	Weight (kg / pack)
80	0,022	0,243	16	37,60	105,3
100	0,022	0,199	12	28,20	98,4
120	0,022	0,169	10	23,50	95,0
140	0,022	0,146	9	21,15	98,1
160	0,022	0,129	8	18,80	100,0
180	0,022	0,115	7	16,45	98,7
200	0,022	0,105	6	14,10	93,6
220	0,022	0,095	5	11,75	82,7
240	0,022	0,088	5	11,75	90,3

VI. Thermal insulation and underlayment

The **swisspor TETTO** product family not only fulfills the task of thermal insulation, but also the task of the so-called underlayment (secondary covering).

The **Difuplan** versions of the **swisspor TETTO Classic** and **swisspor TETTO Alu** boards are uniquely equipped with a 200 g/m2 roofing foil containing a monolithic functional membrane, which can also be used to create a watertight underlay, so that it can be installed up to a roof pitch of 14° or 12°, depending on the tile model. The monolithic functional membrane provides additional protection during installation and makes the film covering resistant to mechanical effects.

Property	Test method	Datas			
Surface weight	EN 1849-2	200 g/m^2			
Fire resistance	EN 13501-1	E			
Vapor permeability (sd)	EN ISO 12572	0,2 m			
Tensile strength	EN 12311-1	longitudinal	310 N / 50 mm	cross direction:	250 N / 50 mm
Stretchability	EN 12311-1	longitudinal	40%	cross direction:	70%
Tearing resistance	EN 12310-1	longitudinal	200 N	cross direction:	250 N
UV resistance		12 weeks			
Water proofness	EN 1928	W1			
Cold bending	EN 1109	-40 °C			

The **swisspor TETTO Classic** and **swisspor TETTO Alu** boards without roofing membrane can be freely equipped with **swissporTON BASIC**, **swissporTON PRO** and, if required, **swissporTON ULTRA** roofing membranes.

VI. System accessories

System screws

The **swisspor TETTO** thermal insulation elements are fixed using the system screws driven through the counter battens. The system screws are self-drilling steel screws with countersunk heads and top and bottom threads, with the appropriate certifications. The amount of the fastening must be designed resist against the suction effect of the wind and the shear stress resulting from the covering and other meteorological loads. Therefore, the screws are screwed in at an angle of 67° relative to the roof. The screw drive-in guide that is part of the system helps to position it correctly. Thanks to the properly designed fastening, the loads on the roof are lead directly to the rafters. Determining the size and number of screws per square meter requires accurate measurement and design. The min. width of the counter batten is 6 cm!

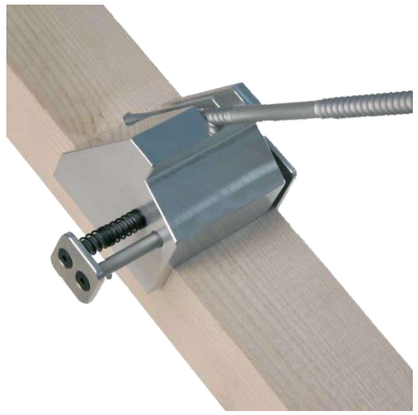
The table below is a guideline for choosing the size of the screws:

Ins. thickness.	Size of the scre					
	without decking			with 19 mm decking		
	Counter batten height [mm]					
	50	75	100	50	75	100
80 mm	8 x 225	8 x 255	8 x 255	8 x 225	8 x 255	8 x 302
100 mm	8 x 225	8 x 255	8 x 275	8 x 255	8 x 255	8 x 302
120 mm	8 x 255	8 x 275	8 x 302	8 x 275	8 x 302	8 x 335
140 mm	8 x 255	8 x 302	8 x 335	8 x 302	8 x 302	8 x 335
160 mm	8 x 275	8 x 302	8 x 335	8 x 302	8 x 335	8 x 365
180 mm	8 x 302	8 x 335	8 x 365	8 x 335	8 x 365	8 x 365
200 mm	8 x 335	8 x 365	8 x 397	8 x 365	8 x 365	8 x 397
220 mm	8 x 365	8 x 365	8 x 397	8 x 397	8 x 397	-
240 mm	8 x 365	8 x 397	-	8 x 397	-	-

Screw drive-in guide

For the professional, perfect fastening of **swisspor TETTO Classic** and **swisspor TETTO Alu** thermal insulation boards, which ensures the screw-in angle of 67°, defines the axis line of the counter batten and guides the screw during insertion.

It can be used for a 60-80 mm wide counter battens.



swissporTON BASIC

- 3-layer vapor-permeable roofing membrane: with a microporous PP membrane between the outer and inner PP protective film.
- Suitable for making stormproof, free-lying and free-overlapped underlayment sheathing.
- The two integrated adhesive strips ensure economical bonding of longitudinal overlaps.
- Can be laid with glued overlaps on a full-surface substrate (e.g. on step-resistant thermal insulation)! It cannot be considered a walkable underlayment!

Application

- The horizontal overlaps should be at least 15 cm!
- The roofing membrane must be guided along the eaves line and glued to the dropping plate!
- Connections and splices must be made in accordance with the local or the ZVDH rules!
- The horizontal overlapst must be glued together with the integrated adhesive strip!
- The overlap of the vertical seams is glued with the **swissporTON NKS** seam adhesive strip or with the **SKL special adhesive**!
- Gently press the areas to be glued together by hand!

Property	Test method	Datas			
Length	**EN 1849-2**	50 m			
Width	**EN 1849-2**	1,5 m			
Weight/roll		11,25 kg			
Roll/pallet		24 pcs			
Mass	**EN 1849-2**	150 g/m^2			
Fire resistance	**EN 13501-1**	E			
Vapor permeability (sd)	**EN ISO 12572**	0,02 m			
Tensile strength	**EN 12311-1**	lengthwise:	310 N / 50 mm	crosswise:	240 N / 50 mm
Expansion	**EN 12311-1**	lengthwise:	70%	crosswise:	80%
Tearing resistance	**EN 12310-1**	lengthwise:	180 N	crosswise:	210 N
UV resistance		12 weeks			
Water tightness	**EN 1928**	W1			
Cold bending	**EN 1109**	-20 °C			

swissporTON PRO

- 4-layer vapor-permeable roofing membrane: with microporous PP membrane and HDPE mesh reinforcement between the outer and inner PP protective film.
- Suitable for the production of watertight, windproof, free-laying and free-lapped underlayment coverings.
- The two integrated adhesive strips ensure economical bonding of longitudinal overlaps..
- Can be laid with glued overlaps on a solid formwork (e.g. decking) with a full surface!

Application

- The overlaps in the direction of the slope should be at least 15 cm.!
- The roofing membrane must be guided along the eaves line and glued to the dropping plate!
- Connections and joints must be made in accordance with the design and construction guidelines of the ÉMSZ or ZVDH!
- The overlap of the longitudinal seams must be glued together with the integrated adhesive strip!
- The overlap of the cross seams is glued with the **swissporTON NKS** seam adhesive strip or with the **SKL** special adhesive!
- A nail seal element from the swissporTON system (**NDS, NDB, NDM**) must be placed under the counter battens.!

Property	Test method	Datas			
Roll length	**EN 1849-2**	50 m			
Roll width	**EN 1849-2**	1,5 m			
Weight/roll		15,75 kg			
Roll/pallet		15 pcs			
Surface weight	**EN 1849-2**	210 g/m^2			
Fire resistance	**EN 13501-1**	class E			
Vapor permeablitiy (sd)	**EN ISO 12572**	0,03 m			
Tensile strength	**EN 12311-1**	lengthwise:	490 N / 50 mm	cross-direction:	460 N / 50 mm
Expansion	**EN 12311-1**	lengthwise:	45%	cross-direction:	70%
Resistance against tearing	**EN 12310-1**	lengthwise:	500 N	cross-direction:	450 N
UV resistance		16 weeks			
Watertightness	**EN 1928**	W1			
Cold bending	**EN 1109**	-40 °C			

siwssporTON ULTRA

- For creating a waterproof underlayment for single and double ventilated roof structures. Can be laid on a solid formwork (e.g. decking) with welded overlaps!
- Multi-layer vapor-permeable roofing membrane: consists of a double-sided TPU copolymer coating and a PES fleece. Thanks to the TPU coating, it is weldable and particularly resistant to chemicals and mechanical influences.
- The adhesive strip on the back makes the work easier and faster.

Application

- When installing as a waterproof underlayment, the foil must be routed over the counter batten, or the **KKS counter batten cap** must be used above the counter battens, which must be welded to the **swissporTON ULTRA** foil with **QSM solvent adhesive** or a **hot air gun**!
- Overlaps of at least 10cm must be welded together with a minimum width of 4cm using **QSM solvent adhesive** or a **heat gun**! The surface at the point of gluing/welding must be dry and dust-free!
- When using **QSM solvent adhesive**, apply the adhesive to both the bottom and top foils in a width of at least 4cm using the bottle with a brush. The adhesive must be allowed to air out for 15 seconds, then the overlap must be pressed together with strong pressure using the pressure roller!
- Welding with a hot air gun takes place at a temperature between 180°C and 240°C. The hot air jet must be quickly and smoothly drawn between the surfaces to be overlapped, which must be pressed together with a pressure roller!
- During soldering, care must be taken to ensure that the foil does not become stretched or creased in the overlapping areas! It is recommended to check the weldings in all cases! Both sides of the **swissporTON ULTRA foil** can be soldered, so even smaller leftovers can be used (e.g. at the corners of chimneys, along standing windows, etc.). Mechanical damage must be professionally repaired by patching or welding!
- Depending on the roof structure, the characteristic vapor permeability of each roof layer must be taken into account!

Property	Test method	Datas			
Length	**EN 1849-2**	25 m			
Width	**EN 1849-2**	1,5 m			
Weight/roll		13,5 kg			
Roll/pallet		20 pcs			
Mass	**EN 1849-2**	360 g/m^2			
Fire resistance	**EN 13501-1**	class E			
Vapor permeability (sd)	**EN ISO 12572**	0,2 m			
Tensile strength	**EN 12311-1**	lengthwise:	420 N / 50 mm	lengthwise:	490 N / 50 mm
Expansion	**EN 12311-1**	lengthwise:	50%	lengthwise:	65%
Tearing resistance	**EN 12310-1**	lengthwise:	310 N	lengthwise:	280 N
UV resistance		16 week			
Water tightness	**EN 1928**	W1			
Cold bending	**EN 1109**	-30 °C			

NDS nail sealing tape

The **swissporTON NDS** nail sealing strip is a double-sided adhesive tape (material: butyl) that is used to seal the perforations that occur on the underlay when attaching the counter batten. The butyl sealing tape provides high surface adhesion. Not resistant to oils and organic solvents (such as gasoline).

- Material: butyl rubber
- Strong adhesion and high surface adhesion.
- Its water resistance and resistance to aging are extremely high.
- Not suitable for gluing surfaces exposed to mechanical stress
- Not resistant to oils and organic solvents (such as gasoline).
- Packaging: 12 rolls/box, 252 rolls/pallet

Application

- The tape must always be glued to the roof foil above the rafters and at the place where the counter batten will be attached.
- After that, the counter battens has to be installed and fixed correctly.
- Before gluing, the surface to be worked on must be dry, clean, dust- and oil-free, and free of surface-active substances.
- The tape must be applied without tension and carefully pressed onto the foil.

Property	Test method	Datas
Carrier		PP fabric
Adhesive component		Butyl rubber
Protective layer		Silicone film
Full thickness		cc. 1.5 mm
Length		10 m
Width		50 mm
Thermal resistance		Between -30 °C and +80 °C, as the temperature rises, the adhesive sealing compound becomes softer and more sticky.
Tensile strength	**EN 14410**	> 70 N / 25 mm
Elongation at break	**EN 14410**	> 15 %
Adhesive layer color		Black
Storage		Store in a dry and UV-protected place between +5 °C and +25 °C
Packaging unit		12 pcs / box

NDB nail sealing tape

The **swissporTON NDB** nail sealing tape is a soft PE foam material for nail sealing with adhesive on both sides. The NDB soft, closed-cell, cross-linked, smooth-surfaced foamed nail sealing tape made of polyethylene can be used to seal the perforations that occur on the underlay when attaching the counter batten.

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Property	Test method	Datas			
Adhesive		rubber-based Hot-Melt (melt adhesive)			
Carrier material		PE foam			
Length		30 m			
Width		60 mm			
Thickness		3 mm			
Tensile strength	**ISO 1926**	Longitudinally	325 kPa	Cross direction:	220 kPa
Elongation at break	**ISO 1926**	Longitudinally	125 %	Cross direction:	115 %
Density	**ISO 845**	cc. 30 kg/cm^3			
Storage		in a dry place, protected from UV radiation from +5°C to +25°C			
Packaging		8 rolls/box and 18 boxes/pallet			
Thermal resistance		from -30°C to +80°C			
Water absorption capacity (7 days):		< 1 vol.- %			

NDM nail sealing mastic

The **NDM nail sealing mastic** is used to seal the perforations that occur in the underlayment when fixing the counter battens. The nail sealing compound can be applied using a dosing bottle to the center line of the counter batten, in an S shape. Lowest operating temperature:

- Gluing surface: at least -5 °C (dry, ice-free gluing surface, if the temperature conditions reach/exceed +7 °C on the given working day)
- Adhesive: at least +7 °C

Before application, the surface to be treated must be dry, clean, dust- and oil-free, and free of surface-active substances.

Property	Datas
Carrier material	1-K moisture-curing polyurethane, solvent-free
Color	Beige
Film layer properties	Elastic, foam
Skin time	cc. 12 minutes
Curing time	approx. 24 hours, until the final hardness is reached, approx. 7 days
Lowest processing temperature	At least + 7 °C
Density	1.13 g/cm^3
Content	1000 ml is enough for approx. 50 meters of counter batten
Packaging unit	10 tubes/box
Storage	Between +15 °C and +25 °C (must be protected from direct sunlight)
Shelf life	12 months in unopened, original packaging

SKL adhesive

Single-component, weather-resistant adhesive and sealant. Suitable for creating horizontal and vertical glued connections for the underlayment.

Also suitable for creating connections between the underlayment and the eave plate, chimneys and/or gable walls.

- It perfectly fixes the underlayment.
- It has an optimal consistency and does not run during application.
- Fast setting time.
- Heat resistance up to +110 °C

Application

- Before using **SKL adhesive**, the surfaces to be connected must be cleaned of dust, oil and other impurities.
- The adhesive can be applied directly to the surface of the underlayment or to the substructure.
- Recommended quantity: 25 g/m^2 (1 tube = approx. 18 linear meters can be glued).
- After applying the adhesive, the surfaces to be joined must be pressed together until adhesion is achieved.
- The color of the adhesive may change due to sunlight, but the strength of the adhesive remains unchanged.
- The product must be stored in a closed and undamaged package in a dry place between 15 °C and 25 °C. Avoid direct sunlight.
- Warranty period: 1 year in original packaging. Viscosity increases during storage

Property	Datas
Raw material	One-component, moisture-curing polyurethane
Color	Black
Surface features	Viscous - elastic
Density	1,52 g/cm^3
Skin time	cc. 7 minutes
Curing time	cc. 24 hours
Application temperature	min. +7 °C
Content	310 ml = 470 g / tube
Packaging	20 tube / box

UAB underlay connection tape

The **swissporTON UAB** is a connecting, self-adhesive butyl tape with a crepped polyethylene coat. Thanks to the special crepped polyethylene, its longitudinal elongation/formability is more than 60%. The underlay connection tape is an ideal solution for sealing connections, e.g. around chimney, but also fits perfectly with irregular structures as well.

Application

- The bonding surfaces must be cleaned of dust, oil and other contaminants.
- Cover porous surfaces with a primer!
- No special tools are required to process the product.
- Unroll it to the required length!
- Remove the silicone protective film from the adhesive side, then place it in the right place! Then press/roll down with a pressure roller!
- Apply a UV protection layer soon after installation!

Storing

- The quality and properties of the material remain unchanged for a very long time. Nevertheless, we use the product within 12 months!
- Store in a dry, covered place at a temperature between +5°C and +40°C.
- After storage at temperatures above +50°C, it may become more difficult to peel off the silicone protective film.
- Storage at temperatures below freezing does not change the product.

Property	Test method	Datas			
Standard thickness		1.2 mm			
Roll length		5 m			
Roll width		25 cm			
Color		Light gray			
Packaging unit		4 pcs / box and 60 box / pallet			
Tensile strength	**EN 12311-1**	Longitudinally	215 N	Crosswise	220 N
Stretchability	**EN 12311-1**	60 %			
Density	**ASTM D 792**	1.4 g/cm3			
Adhesive adhesion strength	**ASTM D 1000**	> – 90 N			
Nail pullout test	**ASTM D 2979**	> – 8 N			
Vertical movement	**ISO 7390**	0 mm			
Usage temperature		Between 0 °C and +40 °C			
Thermal resistance		Between -30 °C and +80 °C (up to +160 °C for up to 24 hours)			
Packaging		4 rolls / box			

Monolithic PUR mounting foam

One-component polyurethane foam, for insulating joints or gaps between the PIR insulation elements, or between adjacent structural elements and the PIR insulation elements.

- Temperature range for the surface, the environment and the box: between +5 °C and +30 °C.
- Dried after about 10 minutes. It can be cut after approx. 15 minutes.
- Yield (volume): approx. 0.019 m^3/tube
- The surface must be stable, clean, free of dust, grease and anti-adhesion agents.
- Packaging: 750 ml/tube, 12 tubes/carton

More informations: **swissporTON.hu**

PART II.
General installation instructions

More informations: **swissporTON.hu**

Installation guide

The purpose of the installation guide is to provide assistance for the trouble-free and safe installation of **swisspor TETTO** insulation elements by presenting examples. In addition to using the guide, the architectural regulations, the guidelines of the roofing profession, and the characteristics of the building must also be taken into account. **swisspor TETTO** thermal insulation system elements offer the perfect solution for thermal insulation above the rafters, so a roof structure without thermal bridges can be created.

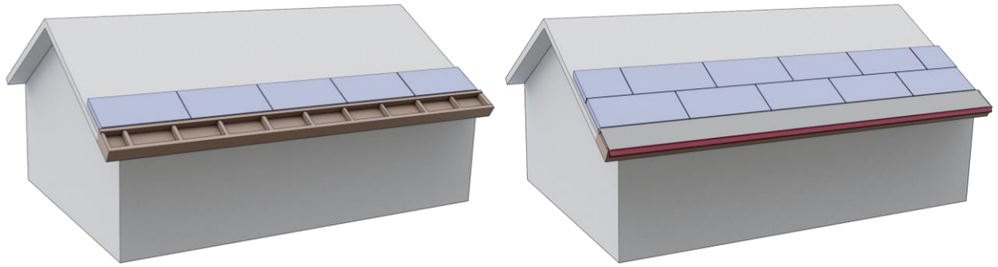
The **swisspor TETTO** insulation boards can be laid directly on rafters or on a flat substrate (e.g. decking, plasterboard, OSB, or other sufficiently rigid boards). The effect of thermal bridges must be taken into account around the eaves, verges and roof openings.

For the subsequent insulation of old buildings, the building's physical characteristics must be taken into account when calculating the thermal and vapor technical characteristics.

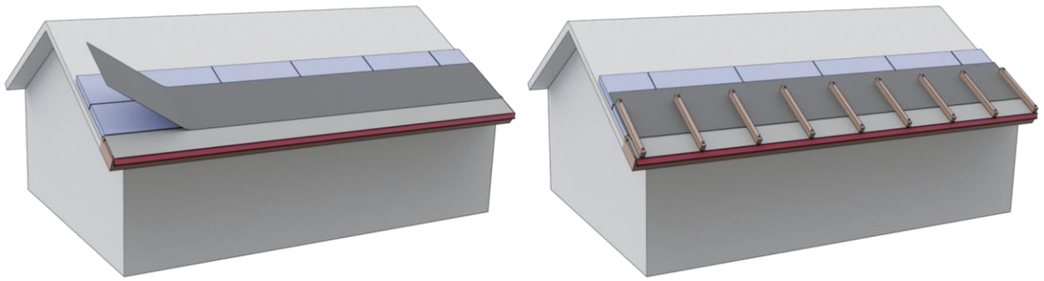
The roofing foil with self-adhesive strips on the upper side of the **Difuplan** insulation boards ensures the drainage of rainwater and powdery snow that may penetrate the roof tiles. To activate the adhesive on the self-adhesive strip, remove the protective film and press the upper layer firmly onto the overlap.

At low temperatures (below -5 degrees), it is recommended to use a heat gun. The selection of **swisspor TETTO** system components depends on the material of the shell, the angle of inclination of the roof, other technical specifications, requirements and individual needs. The thermal insulation boards, after gluing the self-adhesive cover layer on them, are attached to the rafters with the system screws through the counter battens placed on the boards. Depending on the roof covering material, the roof battens can be fixed to the counter battens with the appropriate distances.

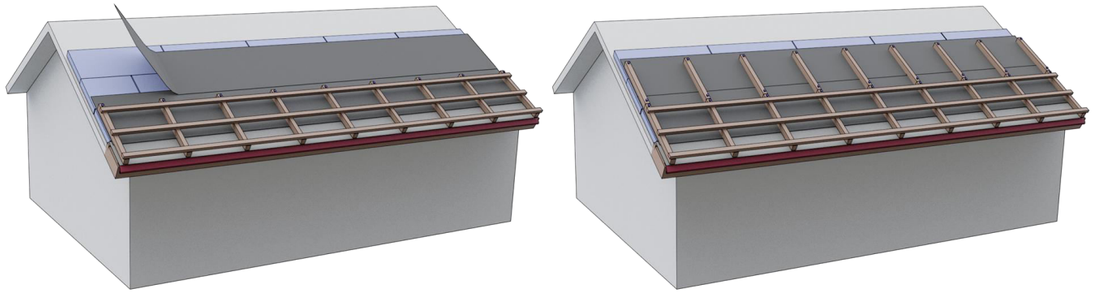
When using natural boards without a roofing membrane, the underlayment must be prepared in a separate work phase. For installing the roof foil, the first two rows of natural insulation boards are fitted in place starting from the eave upwards. In the case of non-insulated eaves, the dripping plate and the first strip of roof foil should be installed afterwards.



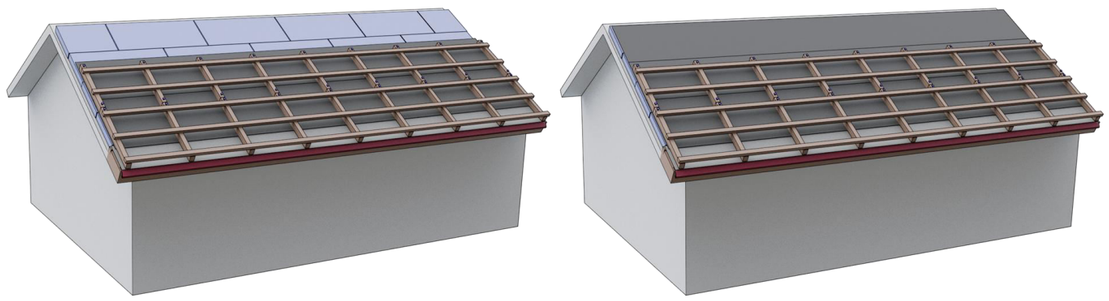
The first foil strip can be applied to the natural boards, and **SKL** or **NKS** adhesive can be used for temporary fixing. The foil laid on the natural sheets should only be stepped on when using **PRO** or **ULTRA** foil with a low roof pitch. The final fixing of the roof foil and the natural thermal insulation board is made by the counter-battens and the system screws that fix them. The length of the counter-batten sections should be chosen so that they do not extend into the overlapping area of the roofing foils.



The roofing battens can be fixed into the counter battens in this way. The next row of natural insulation boards can also be installed by stepping on the counter battens or on the roofing battens. The next roof foil strip can also be placed on the insulation as described previously. As the length of the counter-batten pieces was chosen so that they do not reach the overlap area of the roof foils, the two roof foil strips can be glued together using the integrated glue strips (for **BASIC** and **PRO** foil) or welded together using a heat gun or **QSM** cold-welder solvent.

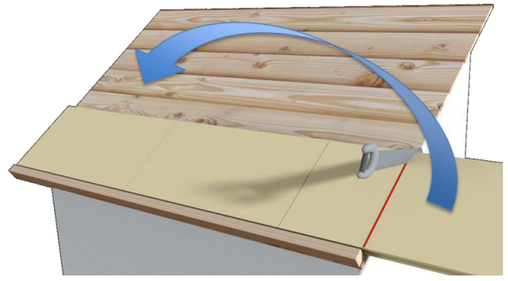


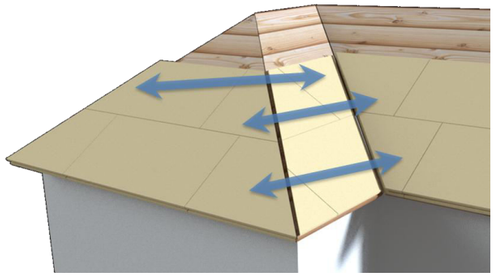
These steps can be repeated until you reach the top of the roof. The fixing requirements for roofs made with this technology may be higher than the static calculations require, so this should be taken into account when ordering the screws! In the case of extremely low pitch angles, the use of these short counter-batten pieces can be avoided.



Laying scheme

The insulation boards are placed on the rafters or wooden formwork from the bottom to the top, i.e. starting from the eave and moving to the direction of the ridge. The tongue (in the interlock) of the elements of the first row should point towards the ridge and the overhanging edge of the roofing foil on the upper side should lie on the eaves. In order to avoid thermal bridges, lay the next row of insulation boards with an offset and press them firmly onto the boards below. During placement, make sure to glue the overlaps of the underlayment properly. In order to avoid cutting waste, the cut elements can be reused at the valleys, roof openings and verges. For cutting, you need a traditional handsaw and a bevel template or a circular saw with an adjustable cutting angle. After cutting with a circular saw, the panel is completely cutted with a manual saw, along the line made by the circular saw.



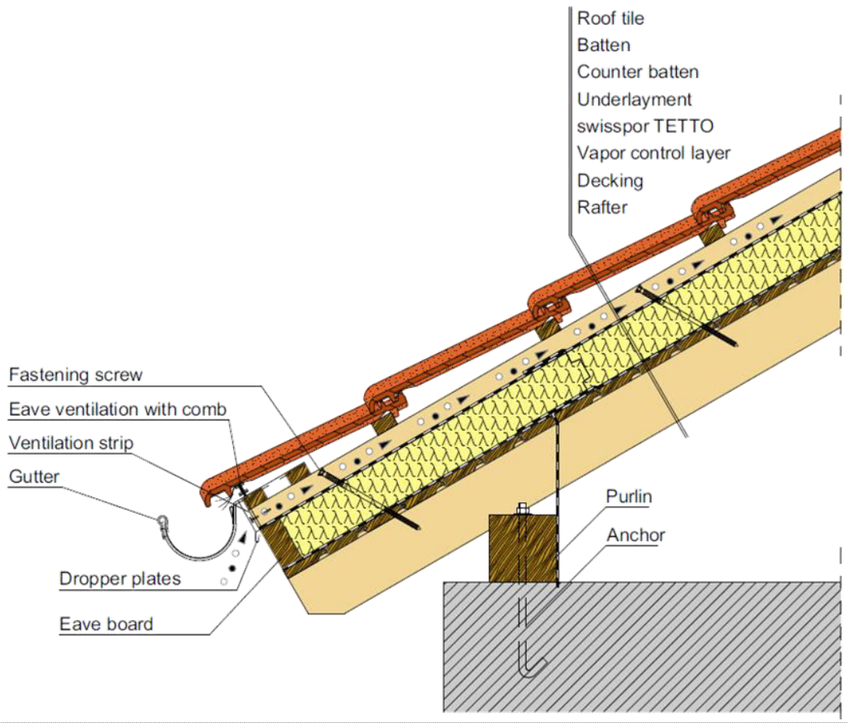


Along the cutted edges, the underlayment must be sealed with the bitumen sealing tape or the **UAB** underlayment connecting tape, and the monolithic PUR foam must be used to fill the gaps between the boards!

More informations: **swissporTON.hu**

Design of the eave with small overhang

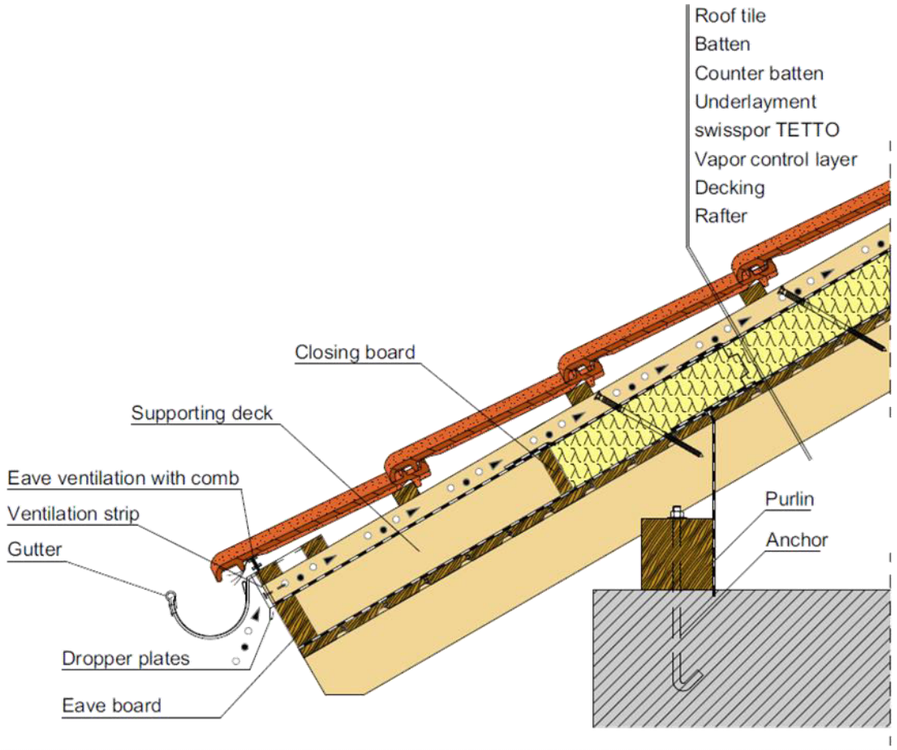
The boards are placed from the eaves in the direction of the ridge. The boards are placed in a binding (the vertical joints are offset). The static loads are handled by the **swisspor TETTO** system screws, so there are no static requirements against the eave board. This board does not play a supporting role after fixing the counter batten. The vapor barrier layer has to connect to the outer walls properly and if it is needed, then the supporting formwork can be cutted to do this. The vapor barrier layer has to sealed airtight at the seams, joints and connections with suitable adhesive tapes. The overhanging edge of the underlayment has to glued into the neighboring boards and into the eave plates along the eave.



Eave detail with small overhang

Design of the eave with large overhang

If the eave has a large overhang, the thermal insulation can be replaced with planks for economic reasons. The planks has the same size as the height of the rafters and fixed to the rafters. Between the plank and the insulation, a contact board is installed as shown in the picture below. An underlayment has to be made above the planks and the overlapping edge of the foil in the top of the insulation board has to be glued into this. The vapor barrier layer has to connect to the outer walls properly and if it is needed, then the supporting formwork can be cutted to do this. The vapor barrier layer has to sealed airtight at the seams, joints and connections with suitable adhesive tapes. In any case, the insulation should extend beyond the outer edge of the walls

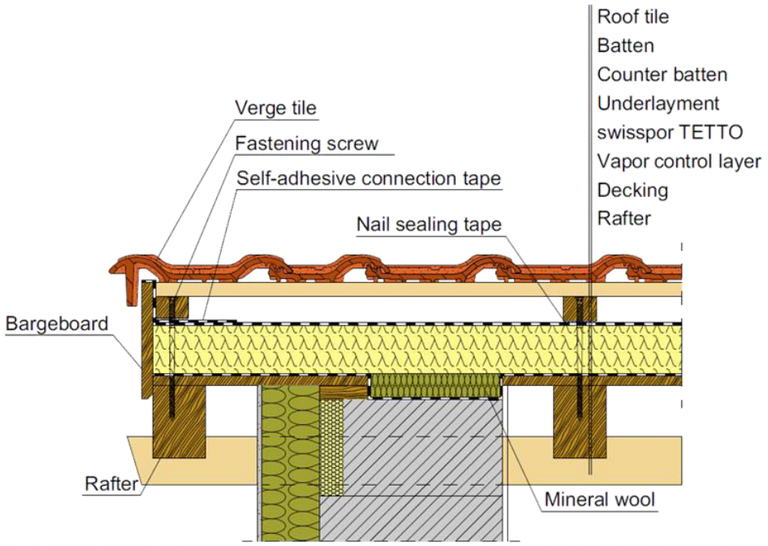


Eave detail with large overhang

More informations: **swissporTON.hu**

Design of the verge with small overhang

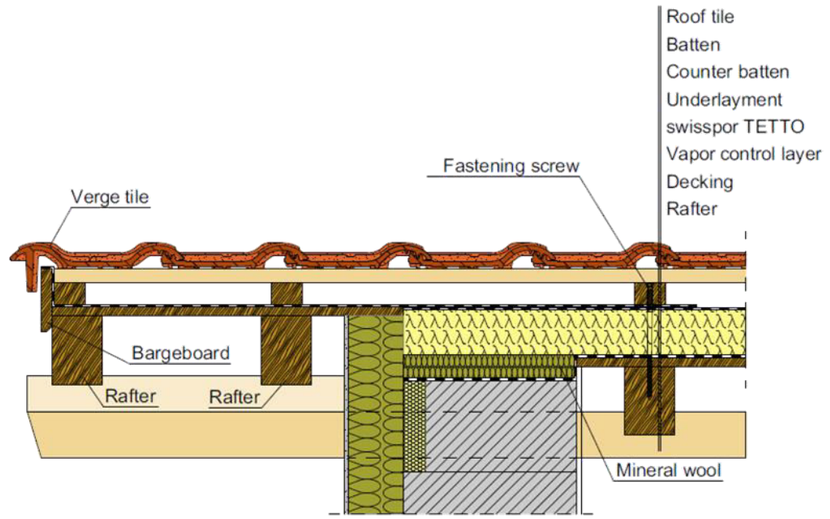
The connection between the vapor barrier and the wall must be airtight, so the formwork must be opened along the verge wall. First, the formwork is installed, then the vapor barrier is led directly to the wall and connected airtight using a joint sealing tape or bituminous insulating sheet. The **swisspor TETTO** insulating elements should reach at least to the outer edge of the wall and always cover the cutting edge with foil. The gaps between the purlins and the wall have to be sealed airtight.



Verge detail with small overhang

Design of the verge with large overhang

For large verge overhang, the thickness of the thermal insulation can be replaced here as well. In order to place the visible formwork on the outside without any interruption, the purlins must be doubled in the outside along the verge. In the inner part, the vapor barrier is led to the verge wall and glued there airtight. The underlayment has to be extended in the outside and the extension has to be glued into the underlayment above the PIR boards. The gaps between the purlins and the wall have to be sealed airtight

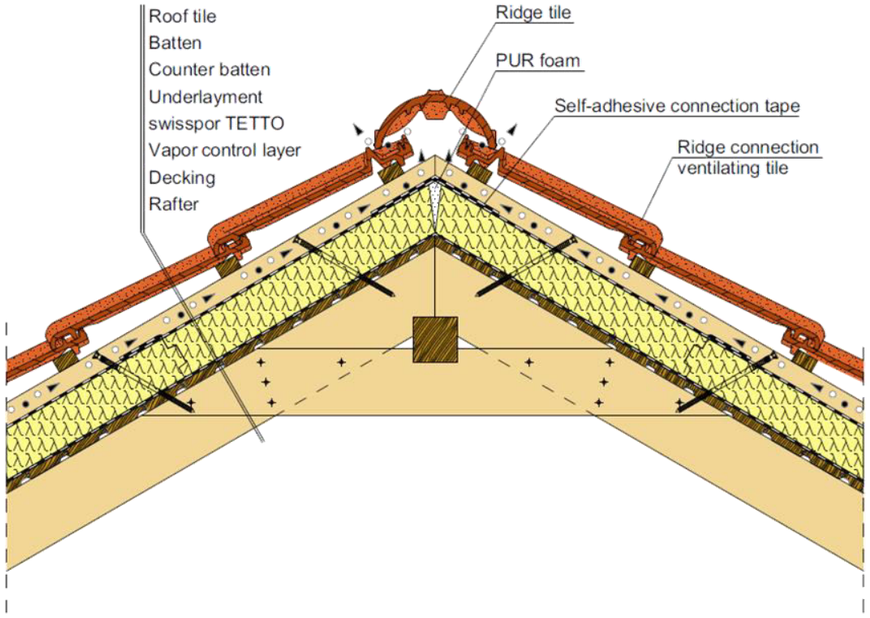


Verge detail with large overhang

More informations: **swissporTON.hu**

Design of the ridges and hips

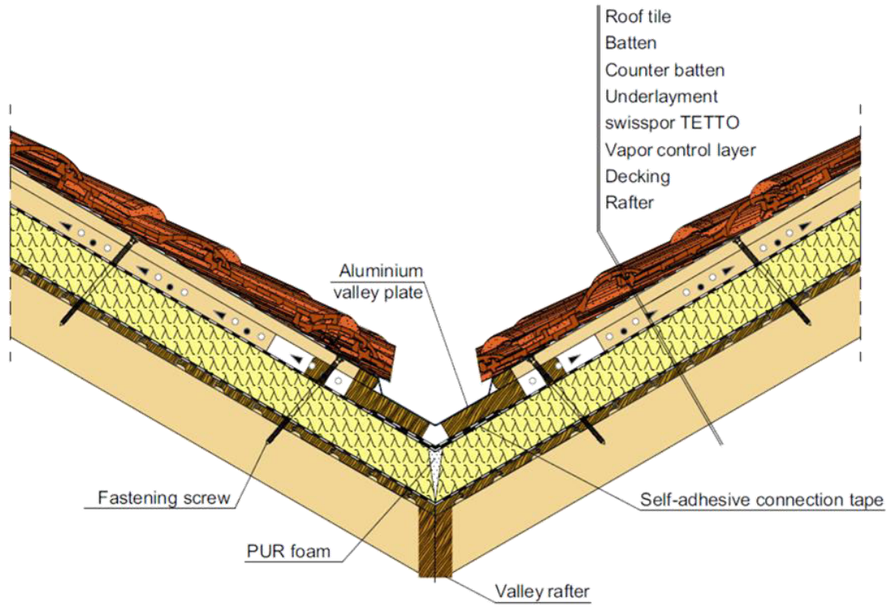
Along the hips and ridges, the PIR boards have to be cutten such a way that a triangular gap created between the two board, so that a perfect sealing is possible with the monolithic PUR foam. The filled gap must be sealed with a sealing tape, which is self-adhesive on its entire surface, thus ensuring the continuity and watertighness of the underlayment. The same should be done for any connection with the building. The air gap above the insulation must be ventilated properly with a ridge connection ventilation tiles or wih the ventilation tiles



Ridge and hip detail

Design of valleys

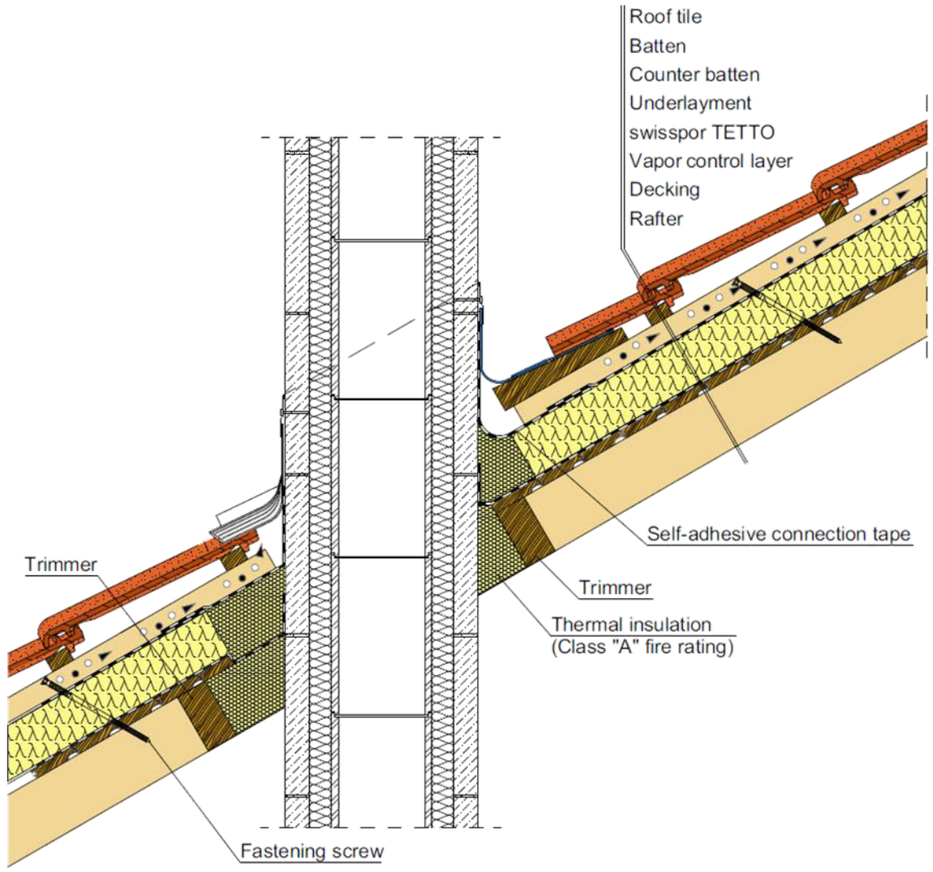
Along the valleys, the PIR boards have to be cutten such a way that a triangular gap created between the two board, so that a perfect sealing is possible with the monolithic PUR foam. The filled gap must be sealed with a sealing tape, which is self-adhesive on its entire surface, thus ensuring the continuity and watertighness of the underlayment. In order to ensure adequate ventilation, a cc. 15 cm of gap should be leaved between the counter battens and valley.



Valley detail

Design ot the chimney edges

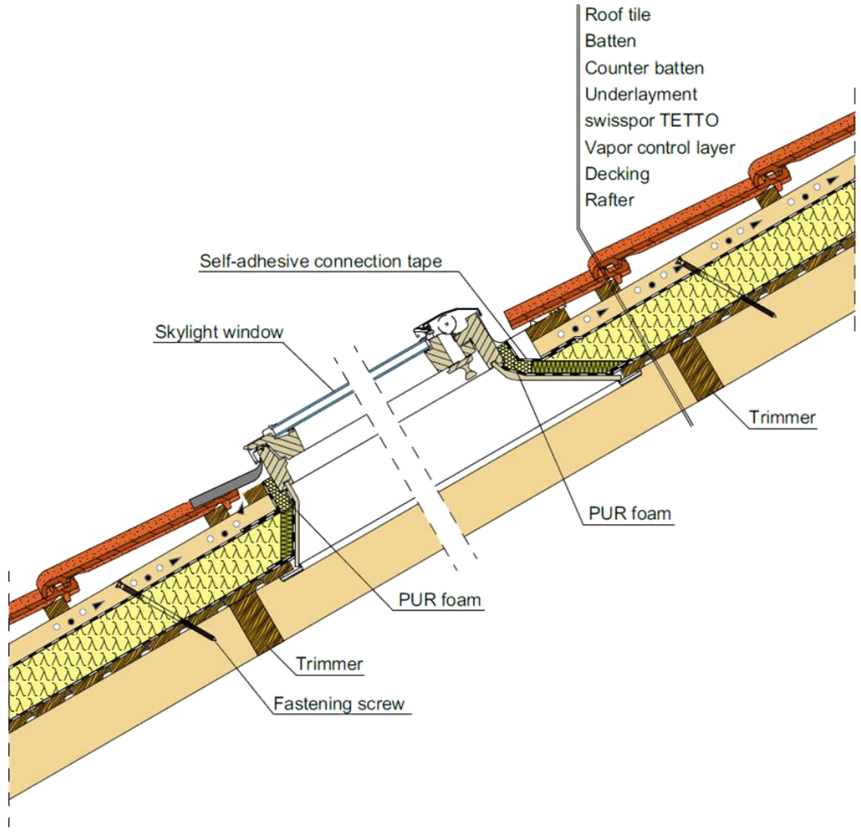
For the chimney connection, make sure that no combustible material is placed next to the chimney wall. Between the chimney and the **swisspor TETTO** insulation boards, a non combustible (class "A" fire resistance) thermal insulation must be installed. The minimum distance between the insulating element and the chimney is determined by the national construction standard. The vapor barrier is connected to the chimney in an airtight manner. The connection between the underlayment and the chimnay can be made with the self-adhesive sealing tape. On the side facing the ridge, the underlayment has to overlap the bitumen sealing tape.



Chimney connection detail

Roof skylight window connection

If necessary an appropriate trimmer has to be installed when making the skylight windows. The location of the window has to be cutted out from the rigid PIR board and the skylight window should be installed according to the guide of the manufacture. The vapor barrier layer or the wind sealing layer is lead up to the cover frame, and fixed with it. In the case of installing a frame roof window with insulation, there is no need to place additional insulation layers. Before installing the cover frame, the connections with the underlayment has to be made with the insulation tape. On the side facing the ridge, the underlayment has to overlap the bitumen sealing tape.



Roof skylight window connection

More informations: **swissporTON.hu**

Notes

More informations: **swissporTON.hu**

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