

European Technical Approval**ETA 10/0019**

Trade Name	UNILIN SW-EPS, SW-XPS, SW-PUR, SW-PUR-ML, SW-WOOL-ML, SW-ALT-ML, SW-FLAX-ML, OPEN PUR, OPEN WOOL, OPEN ALT, OPEN FLAX, SW PLUS PUR
Holder of the approval	UNILIN division insulation bvba Waregemstraat 112 8792 Desselgem Belgium
Website	www.unilin.com
Generic type and use of construction product	Prefabricated wood-based load bearing stressed skin panels
Validity from:	2013-06-27
to	2018-06-26
Manufacturing plant(s):	Waregemstraat 112, 8792 Waregem (BE) 29, Rue de l'usine, 82100 Castelsarrasin (FR)
This European Technical Approval replaces	ETA 10/0019, valid from 30/04/2010 until 29/04/2015
This European Technical Approval contains:	22 pages including 3 annexes which form an integral part of the document



European Organisation for Technical Approvals
Organisation Européenne pour l'Agrément Technique
Europäische Organisation für Technische Zulassungen

I. LEGAL BASES AND GENERAL CONDITIONS

1. This European Technical Approval is issued by UBAtc in accordance with:
 - Council Directive 89/106/EEC of 21 December 1988 on the approximation of laws, regulations and administrative provisions of Member States relating to construction products¹, modified by Council Directive 93/68/EEC² and Regulation (EC) N° 1882/2003 of the European Parliament and of the Council³,
 - Belgian law of 25 March 1996 concerning the adaptation of legislative and administrative provisions of Member States to the Construction Products Directive (89/106/EEC) for construction products⁴ and Belgian Royal Decree of 18 August 1998 concerning construction products⁵
 - Common Procedural Rules for Requesting, Preparing and the Granting of European Technical Approvals set out in the Annex to Commission Decision 94/23/EC⁶
 - Guideline for European Technical Approval for pre-fabricated wood-based loadbearing stressed skin panels, ETA-Guideline Nr 019
2. The UBAtc is authorized to check whether the provisions of this European Technical Approval are met. Checking may take place in the manufacturing plant(s). Nevertheless, the responsibility for the conformity of the products to the European Technical Approval and for their fitness for the intended use remains with the holder of the European Technical Approval.
3. This European Technical Approval is not to be transferred to manufacturers or agents of manufacturers other than those indicated on page 1, or manufacturing plants other than those laid down in the context of this European Technical Approval.
4. This European Technical Approval may be withdrawn by UBAtc, in particular pursuant to information by the Commission according to Article 5(1) of Council Directive 89/106/EEC.
5. Reproduction of this European Technical Approval including transmission by electronic means shall be in full. However, partial reproduction can be made with the written consent of UBAtc. In this case partial reproduction has to be designated as such. Texts and drawings of advertising brochures shall not contradict or misuse the European Technical Approval.
6. Subject to the application introduced, this European Technical Approval is issued by the approval body in its official languages. These versions correspond fully to the version circulated in EOTA. Translations into other languages have to be designated as such.

7. The ETA holder confirms to guarantee that the product(-s) to which this approval relates, is/are produced and marketed in accordance with and comply with all applicable legal and regulatory provisions, including, without limitation, national and European legislation on the safety of products and services. The ETA-holder shall notify the UBAtc immediately in writing of any circumstance affecting the aforementioned guarantee. This approval is issued under the condition that the aforementioned guarantee by the ETA holder is continuously observed.
8. Compared with the previous version, the Sandwich plus element (SW PLUS PUR) and the use of planking have been added and the reaction to fire classes have been specified for the materials referred to.

II. SPECIFIC CONDITIONS OF THE EUROPEAN TECHNICAL APPROVAL

1 Definition of product and intended use

1.1 Definition of the product

Roof elements type SW-EPS, SW-XPS, SW-PUR, SW-PUR-ML, SW-WOOL-ML, SW-ALT-ML, SW-FLAX-ML, SW plus-PUR, OPEN PUR, OPEN WOOL OPEN ALT and OPEN FLAX are prefabricated wood based load bearing stressed skin- panels as defined in the ETAG 019 and are intended to be used as load bearing elements.

The provisions made in this European Technical Approval (ETA) are based on an assumed intended working life for the stressed skin panels of 50 years. The indications given on the working life of the stressed skin panels cannot be interpreted as a guarantee given by the manufacturer or by the Approval Body but are to be regarded only as reasonable working life of the construction works.

The SW-type element is a pure sandwich type element with upper and lower skin. The element has no wooden ribs. The core consists of a rigid insulation material

The SW-ML-type element is a closed box type element with upper and lower skin and with intermediate wooden ribs. The core exists of a rigid or a flexible insulation material.

The OPEN-type element is an open box type element consisting of wooden ribs and a lower skin. The open type element is filled with a rigid or with a flexible insulation material.

The sandwich plus-type element is a combination between a sandwich-type element and an open-type element. The lower skin is glued to the wooden ribs. The upper skin is only glued to the rigid insulation material.

Skins, ribs and core are bonded by means of an adhesive, which can be the foamed PUR itself.

The composition of the different types of elements is given in Annex I.

1.2 Intended use

The main application is load-bearing elements for inclined roofs. However, this is no restriction and the elements can alternatively be used as wall or floor elements.

The elements shall be subjected to static and quasi-static actions only and are intended to be used in classes 1 and 2 according to EN 1995-1-1/A1.

The roof elements are fixed on site on the roof substructure consisting of purlins, ridge purlins and wall plates or directly on trusses. In case of inclined roof elements can be covered with tiles, slates, corrugated plates, ...

¹ Official Journal of the European Communities N° L 40, 11.2.1989, p. 12

² Official Journal of the European Communities N° L 220, 30.8.1993, p. 1

³ Official Journal of the European Union N° L 284, 31.10.2003, p. 1

⁴ Belgian Law Gazette, 21.05.1996

⁵ Belgian Law Gazette, 11.09.1998

⁶ Official Journal of the European Communities N° L 17, 20.1.1994, p. 34

2 Characteristics of product and methods of verification

ER 1 Mechanical resistance and stability

Resistance to static and dynamic loads

The load bearing capacities of all element types can be obtained by calculation.

The sandwich-type elements can be designed according to the EOTA Technical Report No 019 "Calculation models for prefabricated wood-based load bearing stressed skin panels for use in roofs". All types of boards are considered to be load bearing.

The closed-box-type elements (SW-ML) can be designed as a glued thin-flanged I-beam according to EN 1995-1-1. For this type of element, the following skins are considered not to be load bearing:

- particleboard type 3;
- MDF.RWH – panel;
- gypsum plasterboard;
- gypsum fibreboard;
- calcium silicate board;

When one of the skins is not load bearing, the element is designed as a glued thin-flanged U-beam according to EN 1995-1-1. The ribs can be solid wood, glued laminated timber or I-joists

The open-type elements are designed as a glued thin-flanged U-beam according to EN 1995-1-1.

The sandwich plus-type is considered to be a combination of a sandwich-type element and an open-type element. All skins used in this element are considered to be load bearing.

When boards are considered to be load bearing, the following characteristic strength, mean stiffness and modification factors are used:

Board	Strength and stiffness values	k_{mod} , k_{def} , γ_m
Particle board	EN 12369-1	EN 1995-1-1/A1
OSB	EN 12369-1	EN 1995-1-1/A1
Plywood	See following table	EN 1995-1-1/A1
Gypsum fibreboard	According to ETA	According to ETA
Gypsum plaster board	EN 520	
MDF-HLS	EN 12369-1	EN 1995-1-1/A

For plywood, the following minimal strength and stiffness characteristics are used:

Characteristic	Conifer	Combi
$E_{t,c,mean }$ (N/mm ²)	6000	6000
$E_{t,c,mean\perp}$ (N/mm ²)	5000	6000
$f_{m,k, }$ (N/mm ²)	20,0	40,0
$f_{m,k,\perp}$ (N/mm ²)	11,4	22,0
$f_{t,k, }$ (N/mm ²)	10,0	30,0
$f_{t,k,\perp}$ (N/mm ²)	7,0	16,0
$f_{c,k, }$ (N/mm ²)	14,0	21
$f_{c,k,\perp}$ (N/mm ²)	12,6	21
$f_{v,k}$ (N/mm ²)	3,5	7
$f_{r,k}$ (N/mm ²)	0,6	1,7

For gypsum plasterboard (only service class 1), the following strength and stiffness characteristics are used:

$E_{t,c,mean}$ (N/mm ²)	2800
$f_{m,k}$ (N/mm ²)	5,4
$f_{t,k}$ (N/mm ²)	1,4
$f_{c,k}$ (N/mm ²)	3,5
$f_{v,k}$ (N/mm ²)	1,0
$f_{r,k}$ (N/mm ²)	0,9

The following modification and safety factors are used

k_{mod}	1,1	Very short
k_{mod}	0,8	short
k_{mod}	0,6	medium
k_{mod}	0,4	Long
k_{mod}	0,2	Permanent
k_{def}	3	
γ_m	1,3	

The wood based boards and the gypsum fibre board are scarf jointed. At the junction between the gypsum plasterboard in the SW panels, two battens are glued on the board. In order to take the joint into account, the strength values are reduced with 0.5 for plywood and with 0,7 for the other board materials.

For the ribs, the following characteristic strength, mean stiffness and modification factors are used:

Ribs	Strength and stiffness values	k_{mod} , k_{def} , γ_m
Solid wood	EN 338	EN 1995-1-1/A1
Glued laminated timber	EN 14080	EN 1995-1-1/A1
I-joists	According to ETA	According to ETA

The solid wooden ribs can be finger jointed.

For the core, the following characteristic strength, mean stiffness and modification factors are used:

Core	E_{mean} (N/mm ²)	G_{mean} (N/mm ²)	$f_{v,k}$ (N/mm ²)	k_{mod}	k_{def}	γ_m
PUR	4	2,5	0,05	Eota Technical Report TR019		
EPS	4	1,8	0,05			
XPS	4	1,8	0,05			

Dimensional stability

The dimensional stability has been assessed under the conditions of the intended use. In these conditions, no harmful deformations due to moisture are to be expected.

ER 2 Safety in case of fire

Reaction to fire

The classification into Euroclasses according to EN 13501-1+A1 of the components of the elements are given in Annex III.

The materials which are deemed to satisfy all of the requirements for the performance characteristic without the need of testing according to Commission Decision are indicated in Annex III.

Resistance to fire

No performance determined.

External fire performance of roof coverings and claddings

The roof coverings and the claddings are no part of the stressed skin panel.

No performance determined.

ER 3 Hygiene, health and the environment

Vapour permeability and moisture resistance

Vapour permeability, moisture resistance and critical surface humidity of the element can be assessed on basis of calculations according to EN ISO 13788, using thermal conductivities and vapour resistance factors indicated in annex III.

The element shall be separately assessed if it is to be used in a building intended to be refrigerated.

Water tightness

The water tightness of the external envelope has been assessed to fulfil the common requirements against driving rain when the elements are covered with tiles, slates or corrugated plates. Water tightness of the internal surface has not been assessed.

Release of dangerous substances

According to the declaration of the manufacturer the element does not contain harmful or dangerous substances as defined in the EU database with the exception of formaldehyde.

The wood based materials are classified E1 in accordance with EN 13986.

When a glue containing formaldehyde is used, the amount of emission is negligible.

The product used as wood preservative satisfies the requirements of Directive 98/8/Econ biocides.

ER 4 Safety in use

Slipperiness of floors

No performance determined

Impact resistance

No performance determined.

ER 5 Protection against noise

Airborne sound insulation

No performance determined.

Impact sound insulation

No performance determined.

Sound absorption

No performance determined

ER 6 Energy and heat retention

Thermal resistance

The thermal resistance can be determined in accordance with EN ISO 6946, using the thermal conductivities indicated in annex III.

Air permeability

The elements including the joints provide adequate air tightness in relation to the intended use.

Thermal inertia

Density and specific heat capacity of the relevant materials and the thermal conductivity are given in Annex III as a means for the designer to calculate the thermal inertia of the building.

Aspects of durability, serviceability and identification

Durability

The elements can be used in service class 1 or 2 as defined in EN 1995-1-1. During the erection of the building, the elements resist temporary exposure to water without decay, provided that it is allowed to dry afterwards.

Durability may be reduced by attack from insects.

When necessary and required by the local authorities at the building site, elements may be treated against biological attack according to the rules valid on the place. Any adverse effects of the treatment on other properties shall be taken into account. This ETA does not cover these kinds of treatments.

Serviceability

Serviceability of the elements is understood as their ability to resist loads without unacceptable deformation or vibrations. This characteristic is treated under ER 1.

Identification

The elements are delivered in packages for minimal protection during transportation and storage. Proper protection against different weather conditions is to be foreseen. Each delivery package is labelled with an ID number of the element. The product label also bears the CE-marking.

3 Evaluation of conformity and CE marking

3.1 Attestation of conformity

The system of attestation of conformity, specified by the European Commission in decision ... is system 1, according to Council Directive 89/106/EEC Annex III.2(i), and provides for:

Certification of the conformity of the product by a notified certification body on the basis of:

- a. Tasks for the manufacturer:
 - o Factory production control;
 - o Further testing of samples taken at the factory by the manufacturer in accordance with a prescribed test plan;
- a. Tasks for the notified body:
 - o Initial type-testing of the product;
 - o Initial inspection of factory and of factory production control;
 - o Continuous surveillance, assessment and approval of production control.

3.2 Responsibilities

3.2.1 Tasks of the manufacturer

3.2.1.1 Factory production control (FPC)

At the manufacturing plant, the manufacturer has implemented and continuously maintains a factory production control system.

All the elements, requirements and provisions adopted by the manufacturer are documented in a systematic manner in the form of written policies and procedures. The factory production control system ensures that the elements are in conformity with the European Technical Approval.

The personnel involved in the production process have been identified, sufficiently qualified and trained to operate and maintain the production equipment. Machinery equipment is being regularly maintained and this is being documented. All processes and procedures are being recorded at regular intervals.

The factory production control shall address at least:

- Type and quality of all materials and components incorporated in the wood-based load bearing stressed skin panels;
- Positions of structural members;
- Overall dimensions of the roof elements;
- Installation of thermal insulation material;
- Tolerances of geometry, squareness and flatness;
- Markings for correct position and installation in the works, optimal storage conditions on site and special handling;
- Packaging and transport protection;
- Ensure that specified moisture content levels are maintained during manufacture, storage at the factory.

The manufacturer shall only use raw materials supplied with the relevant inspection documents as laid down in the prescribed test plan. The incoming raw materials shall be subject to controls and tests by the manufacturer before acceptance. Check of incoming materials shall include control of inspection documents (comparison with nominal values) presented by the manufacturer of the raw materials by verifying the dimensions and determining the material properties.

The frequencies of controls and tests conducted during manufacturing and on the assembled product are defined by taking account of the manufacturing process of the product and are laid down in the prescribed test plan.

The results of factory production control are recorded and evaluated. The records include at least the following data:

- Designation of the product, basic materials and components;
- Type of control or test;
- Date of manufacture of the product and date of testing of the product or basic materials or components;
- Results of controls and tests and if appropriate, comparison with requirements;
- Name and signature of person responsible for factory production control.

The records shall be kept at least for five years and shall be presented to the approved surveillance.

3.2.1.2 Testing of samples taken at the factory

Testing of samples by the manufacturer according to a prescribed test plan is part of the factory production control.

3.2.1.3 Declaration of conformity

When all the criteria of the Conformity Attestation are satisfied, the manufacturer shall make a Declaration of conformity, stating that the product is in conformity with the provisions of this European Technical Approval

3.2.2 Tasks of approved bodies

3.2.2.1 Initial type testing of the product

Approval tests have been conducted by the approval body or under its responsibility in accordance with section 5 of ETAG 019. The results have been assessed in accordance with section 6 of the ETA Guideline.

3.2.2.2 Initial inspection of factory and of factory production control

An approved body shall conduct initial inspection of each manufacturing line in order to ensure that the premises and technical equipment are acceptable, personnel is qualified and a factory production control system which is in accordance with the provisions in the ETA Guideline and this ETA is followed.

3.2.2.3 Continuous surveillance, assessment and approval of factory production control

The approved body shall visit the factories at least twice a year for surveillance of the manufacturer.

It shall be verified that the factory production control is performed according to this ETA, including tests of samples according to the prescribed test plan.

3.2.2.4 Certification

When all criteria for conformity attestation are fulfilled the approved body shall issue certification of conformity of the product.

In cases where the provisions of the European Technical Approval and the control plans are no longer fulfilled, the certificate of conformity shall be withdrawn.

3.3 CE marking

The letters "CE" shall correspond to the Council Directive 93/68/EC.

The CE marking shall be affixed on the accompanying commercial documents. The symbol "CE" shall be followed by the identification number of the certification body and shall be accompanied by the following additional information:

- Identification number of the notified certification body;
- Name or identification mark and address of manufacturer;
- The last two digits of the year in which the CE marking was affixed;
- Number of the certificate of conformity;
- Number of the European Technical Approval;
- Identification of the product (trade name, intended use);
- Project number and element number for identification of the characteristics;
- Information, regarding the performances of any thermal insulation contained (e.g. reaction to fire class, thermal resistance R, Inverted thermal resistance U).

A simplified CE marking shall be affixed on the product itself. The simplified CE marking affixed on the product shall be accompanied by the following information:

- Identification number of the notified certification body;
- Name and address or identifying mark of the producer;
- Number of the European Technical Approval.

4 Assumptions under which the fitness of the product for the intended use was favourably assessed

4.1 Manufacturing

The elements are manufactured in accordance with the provisions of the European Technical Approval using the manufacturing process as identified in the inspection of the manufacturing plant by approval body.

4.2 Design

The European Technical Approval only applies to the manufacture and use of the elements. Verification of stability of the works including application of loads on the products is not subject to the European Technical Approval.

Fitness for the intended use of the products is given under the following conditions:

- Design of the elements is carried under the responsibility of an engineer experienced in such product;
- Design of the work shall account for the protection of the elements;
- In service, elements are not exposed to detrimental moisture. The definitions of service classes 1 and 2 according to EN 1995-1-1 apply;
- The elements are installed correctly.

Design of the products can be according to EN 1995-1-1 and EOTA technical report 019, taking into account of ER 1 of the European Technical Approval. Standards and regulations in force at the place of use shall be considered.

4.3 Installation

The manufacturer shall prepare installation instructions in which the product-specific characteristics and the most important measures to be taken into consideration for installation are described.

Installation according an installation plan shall be carried out by appropriately qualified personnel under the supervision of the person responsibility for technical matters on site.

Installation shall be done in a reasonable time frame in order to reduce the storage time on site and is followed by cladding. If the latter is not possible to be foreseen within a reasonable time frame, the products shall be protected against weather conditions providing the necessary ventilation. The water tight vapour open barrier is not to be considered as proper protection and shall not be exposed to UV radiation from direct sunlight.

Damaged products or products with swollen boards shall not be installed.

The roof elements are installed perpendicularly on the direction of the support and in case of a purlin roof from the ridge to the wallboard.

The panels are connected alongside with a spring and sealed at the upper groove with PUR.

Corbels in the length of the panel until 300 mm as well as corbels across until 150 mm do not require any additional provisions. Contact the manufacturer about larger corbels.

Holes are allowed if they do not exceed 1/4 of the width provided that no ribs are damaged. Contact the manufacturer for larger holes.

After assembling the roof elements, the roof has to be fitted, as soon as possible, with a roof covering. In any case, measures have to be taken to protect the element against rainfall by sealing the upper grooves as soon as possible sealing of the side seams is carried out in accordance with the panel type, by means of a spring and by filling the upper core with PUR. The cross seams have to be avoided for as far as possible. If there are cross seams anyway, then these have to be located as close as possible to the ridge. Sealing of the cross seam is done with PUR foam and water tight sealing tape.

After assembling the roof elements, the space situated under the roof elements has to be ventilated sufficiently during the rest of the construction process. Especially if construction activities take place during the building process (e.g. installing flooring, etc.) that can cause an indoor climate that is more humid than is usual for the occupied state.

The space between the upper side of the roof element and the cladding is well ventilated.

5 Recommendations from the manufacturer

5.1 Recommendations on packaging, transport and storage

For elements longer than 3 m, the manipulation of the element has to be transported in such a way that damage is avoided especially elements have to be sufficiently supported to avoid breakage. The assembly on the work has to take place in dry conditions

The elements shall be protected against harmful wetting during transport and storage and stored only temporarily on the building site.

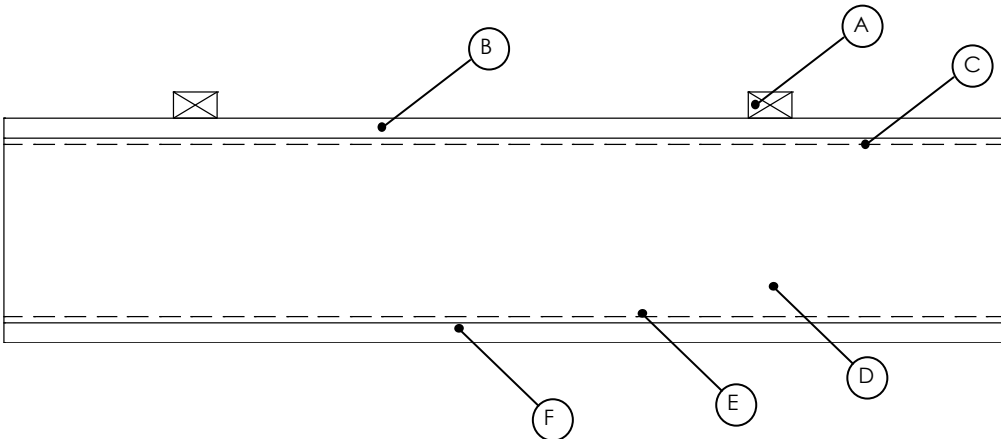
Elements shall be stored on a plane underlay using a sufficient number of supports according to manufacturer's instructions so that the elements do not have contact with water on the ground.

Annex I Description of product

Sandwich-type elements (SW)

The sandwich-type elements are pure sandwich type elements. The width of the element is 600 mm, 800 mm or 1200 mm. The total height may vary in function of the design (mechanical resistance or thermal resistance).

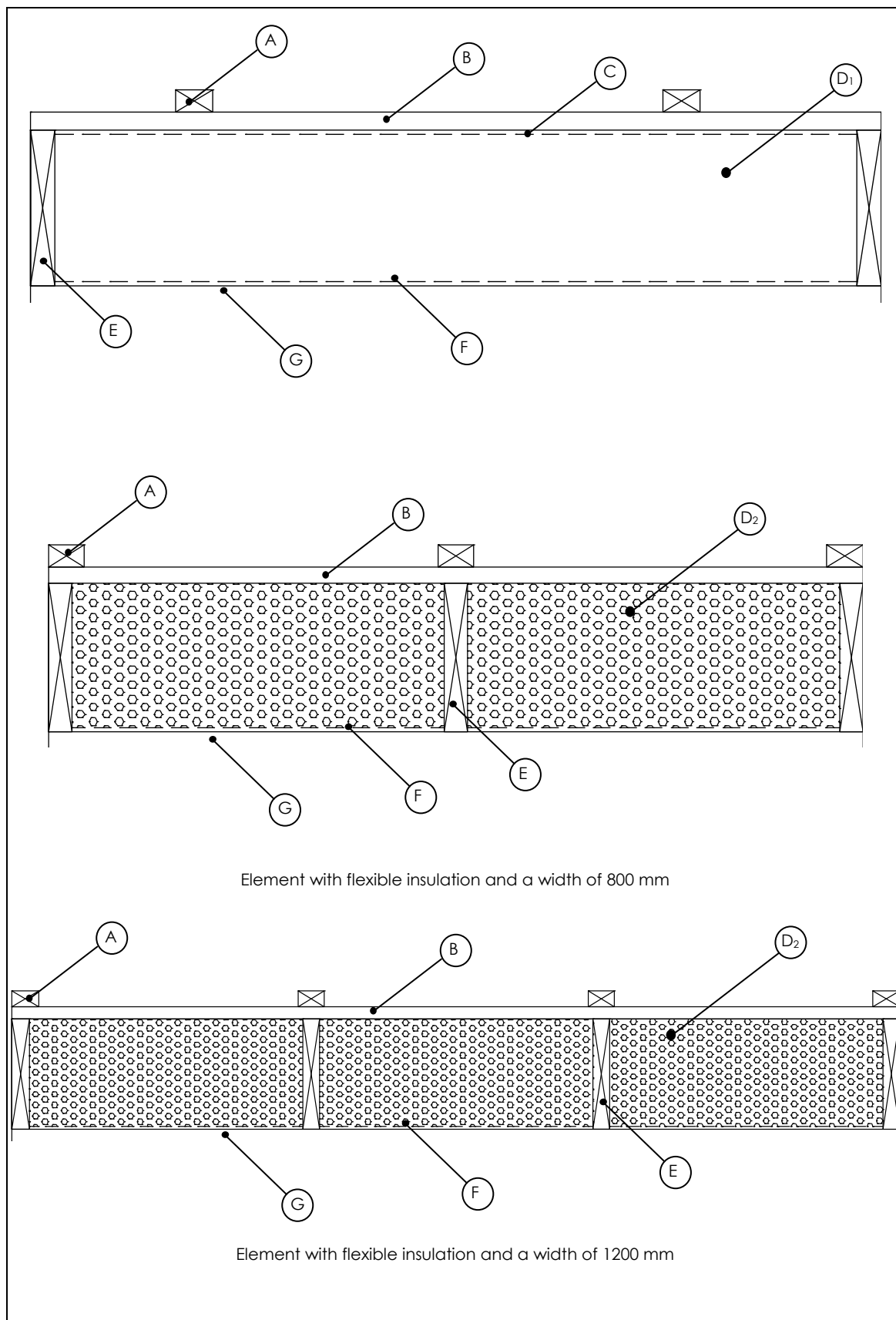
The element is identified by SW, followed by the type of insulation material used as core (EPS / PUR / XPS).

	
A	Counter battens (optional)
B	Upper skin: - Particle board type P5 with a minimal thickness of 3 mm; - or OSB type 3 panel with a minimal thickness of 9 mm; - or plywood with a minimal thickness of 9 mm; - or MDF-HLS panel with a minimal thickness of 3 mm;
C	Vapour barrier (optional)
D	Insulation material - Polyurethane (SW- PUR) with a maximal thermal conductivity of $\lambda_D \leq 0,029$ W/mK for a core thickness smaller than 80 mm $\lambda_D \leq 0,028$ W/mK for a core thickness between 80 mm and 120 mm and $\lambda_D \leq 0,027$ W/mK for a core thickness larger than 120 mm. When the insulation material is in between two vapour barriers the thermal conductivity is $\lambda_D \leq 0,023$ W/mK; - or expanded polystyrene (SW-EPS) with a maximal thermal conductivity of $\lambda_D \leq 0,038$ W/mK; - or extruded polystyrene (SW-XPS) with a maximal thermal conductivity of $\lambda_D \leq 0,038$ W/mK.
E	Vapour barrier (optional)
F	Inner skin: - Particle board type P5 with a minimal thickness of 3 mm; - or OSB type 3 panel with a minimal thickness of 9 mm; - or plywood with a minimal thickness of 9 mm; - or MDF-HLS panel with a minimal thickness of 3 mm; - or gypsum fibreboard with a minimal thickness of 12,5mm; - or gypsum plasterboard with a minimal thickness of 9,5 mm; - or calcium silicate board with a minimal thickness of 12 mm.

Closed box-type elements (SW-ML)

The closed box-type elements have intermediate wooden ribs. The skins are glued to the ribs and and, in case of a rigid insulation material, to the insulation material. The width of the element can be 800 mm, 1200 mm or 1225 mm. The total thickness of the element varies in function of design (mechanical resistance or thermal resistance).

The element is identified by SW – xxx – ML, where xxx identifies the type of insulation material used as core (PUR / WOOL / ALT / FLAX).

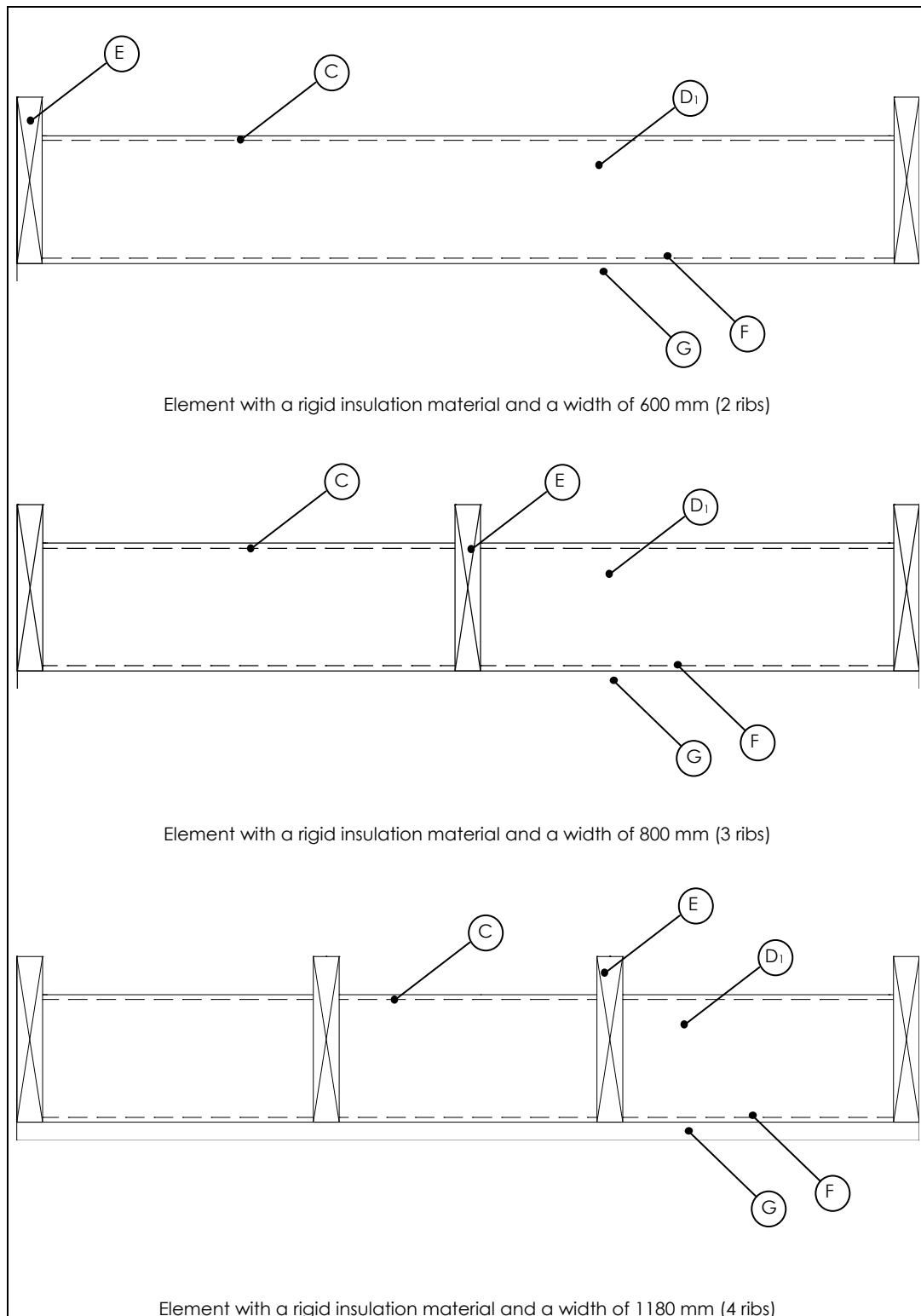


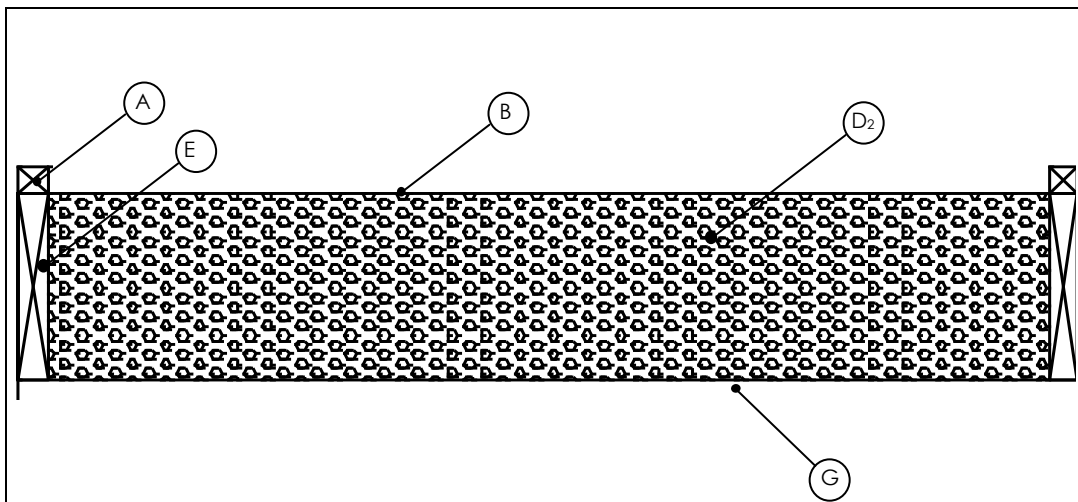
A	Counter battens (optional)
B	Upper skin: • Particle board type P5 with a minimal thickness of 3 mm; • or OSB type 3 panel with a minimal thickness of 9 mm; • or plywood with a minimal thickness of 9 mm; • or MDF-HLS panel with a minimal thickness of 3 mm; • or MDF.RWH panel with a minimal thickness of 16 mm
C	Vapour barrier (optional)
D ₁	Rigid insulation material : Polyurethane (SW-PUR-ML) with a maximal thermal conductivity of $\lambda_D \leq 0,029$ W/mK for a core thickness smaller than 80 mm $\lambda_D \leq 0,028$ W/mK for a core thickness between 80 mm and 120 mm and $\lambda_D \leq 0,027$ W/mK for a core thickness larger than 120 mm. When the insulation material is in between two vapour barriers the thermal conductivity is $\lambda_D \leq 0,023$ W/mK;
D ₂	Flexible insulation material: • Mineral wool (SW – WOOL – ML); with a maximal thermal conductivity of $\lambda_D \leq 0,037$ W/mK; • or wood fibre insulation (SW-ALT-ML) with a maximal thermal conductivity of $\lambda_D \leq 0,040$ W/mK; • or flax (SW-FLAX-ML) with a maximal thermal conductivity of $\lambda_D \leq 0,040$ W/mK
E	Ribs: • solid wood, C18 or better; • or glued laminated timber, GL24h or better; • or I-joists. For elements with a rigid insulation material, there are two ribs per element. For elements with a flexible insulation material, the distance between the ribs is limited to 400 mm.
F	Vapour barrier • in combination with flexible insulation material $s_d \geq 50$ m • optional in case of rigid insulation material.
G	Inner skin: • Particle board type P5 with a minimal thickness of 3 mm; • or OSB type 3 panel with a minimal thickness of 9 mm; • or plywood with a minimal thickness of 9 mm; • or MDF-HLS panel with a minimal thickness of 3 mm; The following inner skins are also possible, but not in combination with MDF.RWH at position B: • or gypsum plasterboard with a minimal thickness of 12,5 mm; • or gypsum fibreboard with a minimal thickness of 12,5 mm; • or calcium silicate board with a minimal thickness of 12 mm

Open-type elements (OPEN)

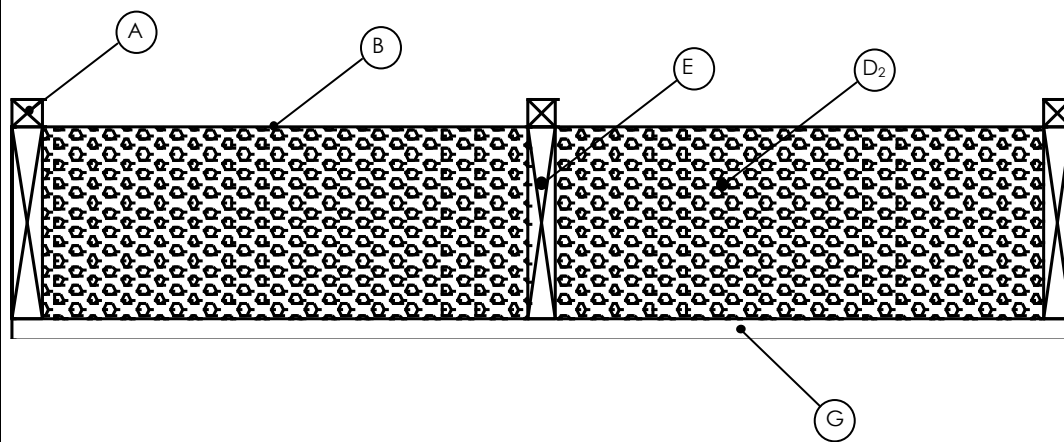
The open-type elements have a single skin glued to wooden ribs. In case of a rigid insulation material, the skin is also glued to the insulation material. The width of the element is 600 mm, 800 mm or 1180 mm. The total thickness of the element may vary and is dependent on the design (mechanical resistance or thermal resistance).

The element is identified by OPEN, followed by the type of insulation material used as core (PUR / WOOL / ALT / FLAX).

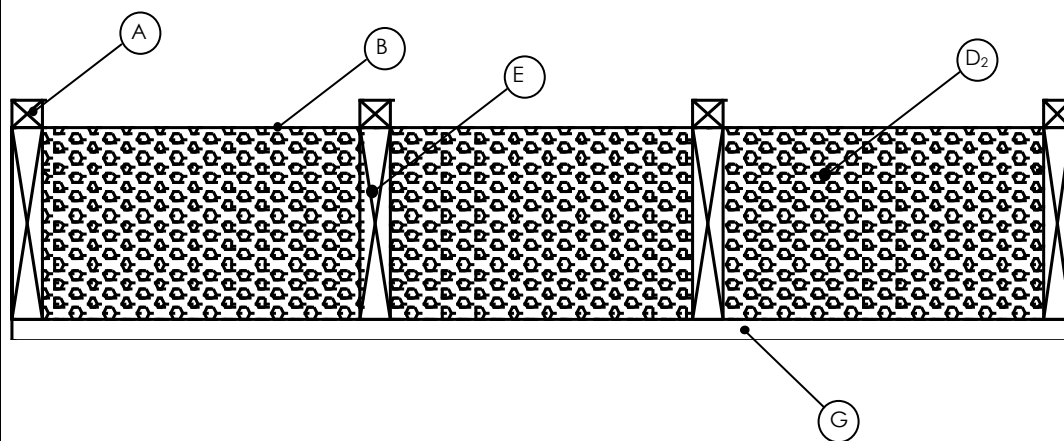




Element with a flexible insulation material and a width of 600 mm (2 ribs)



Element with a flexible insulation material and a width of 800 mm (3 ribs)



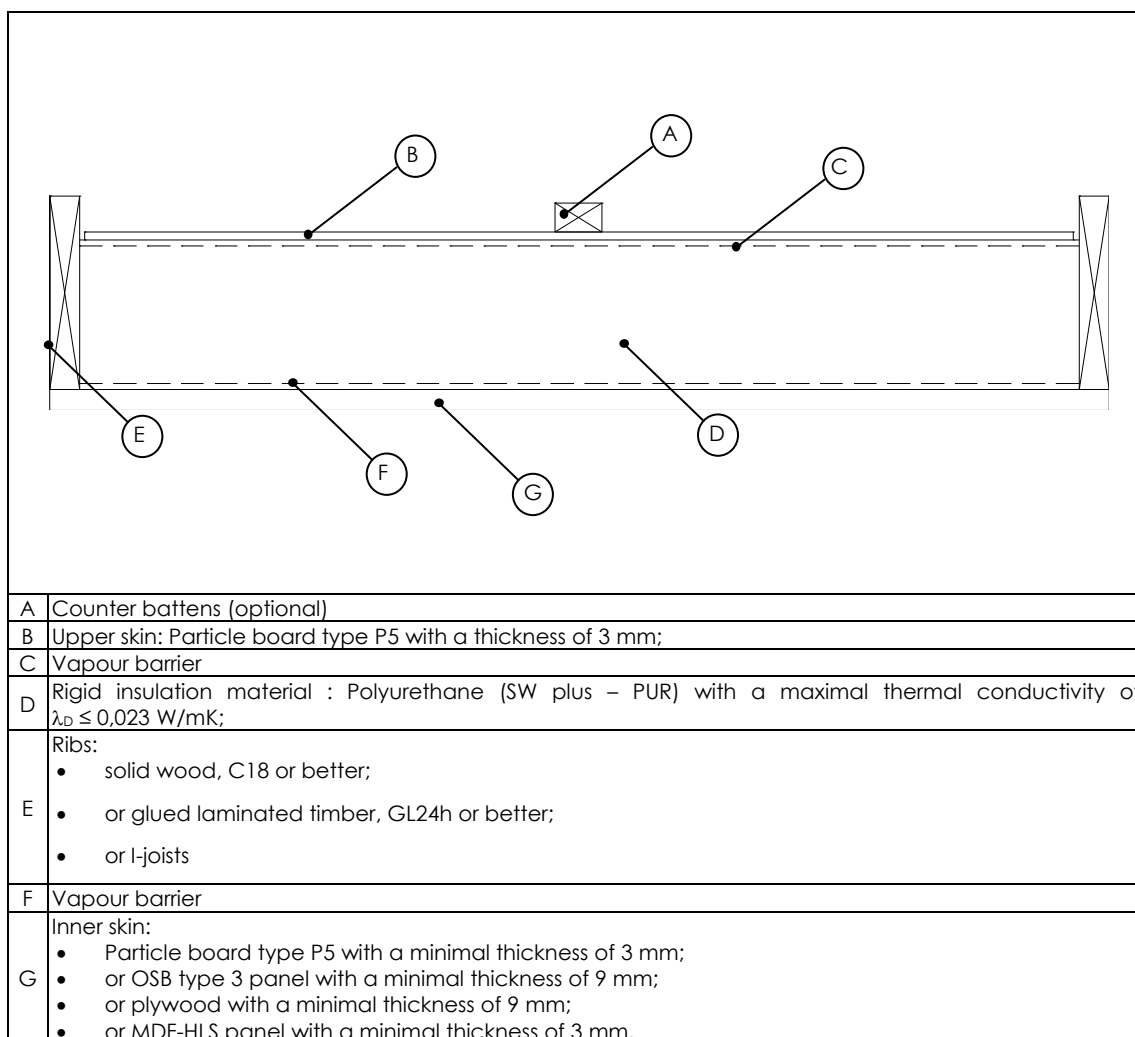
Element with a flexible insulation material and a width of 1180 mm (4 ribs)

A	Counter battens (optional)
B	Water tight vapour open barrier (only in combination with flexible insulation material)
C	Vapour barrier (optionally - only in combination with a rigid insulation material)
D ₁	Rigid insulation material : Polyurethane (OPEN PUR) with a maximal thermal conductivity of $\lambda_D \leq 0,029$ W/mK for a core thickness smaller than 80 mm $\lambda_D \leq 0,028$ W/mK for a core thickness between 80 mm and 120 mm and $\lambda_D \leq 0,027$ W/mK for a core thickness larger than 120 mm. When the insulation material is in between two vapour barriers the thermal conductivity is $\lambda_D \leq 0,023$ W/mK;
D ₂	Flexible insulation material: • Mineral wool (OPEN – WOOL);with a maximal thermal conductivity of $\lambda_D \leq 0,037$ W/mK; • or wood fibre insulation (OPEN - ALT) with a maximal thermal conductivity of $\lambda_D \leq 0,040$ W/mK; • or flax (OPEN - FLAX) with a maximal thermal conductivity of $\lambda_D \leq 0,040$ W/mK
E	Ribs : • solid wood, C18 or better; • or glued laminated timber, GL24h or better; • or I-joists The number of ribs is dependent on the width of the element. There are two ribs for a width of 600mm, three ribs for a width of 800 mm and four ribs for a width of 1180 mm.
F	Vapour barrier (optionally – only in combination with rigid insulation material)
G	Inner skin: • Particle board type P5 with a minimal thickness of 3 mm; • or OSB type 3 panel with a minimal thickness of 9 mm; • or plywood with a minimal thickness of 9 mm; • or MDF-HLS panel with a minimal thickness of 3 mm;

Sandwich plus-type elements : SW plus - PUR

The sandwich plus-type element is a combined open box / sandwich element. The element has intermediate wooden ribs. The lower skin is glued to the wooden ribs and the insulation material. The upper skin is only glued to the insulation material. The width of the element can be 800 mm. The total thickness of the element may vary and is dependent of the design (mechanical resistance or thermal resistance).

The element is identified by SW plus followed by the type of insulation material.



Dimensions and tolerances

The maximum length of the elements is 8 m. The width and the height of the element may vary. The following tolerances are allowed:

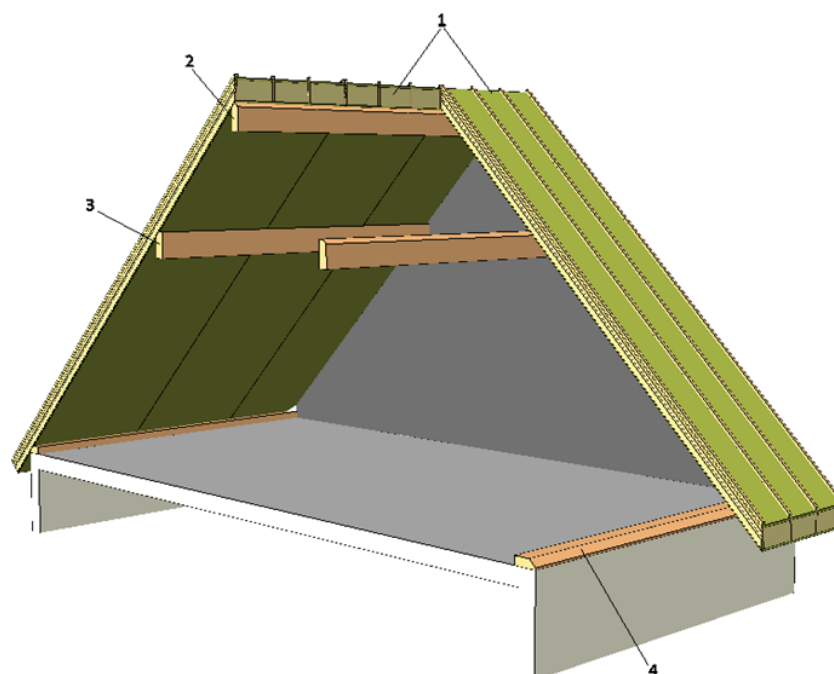
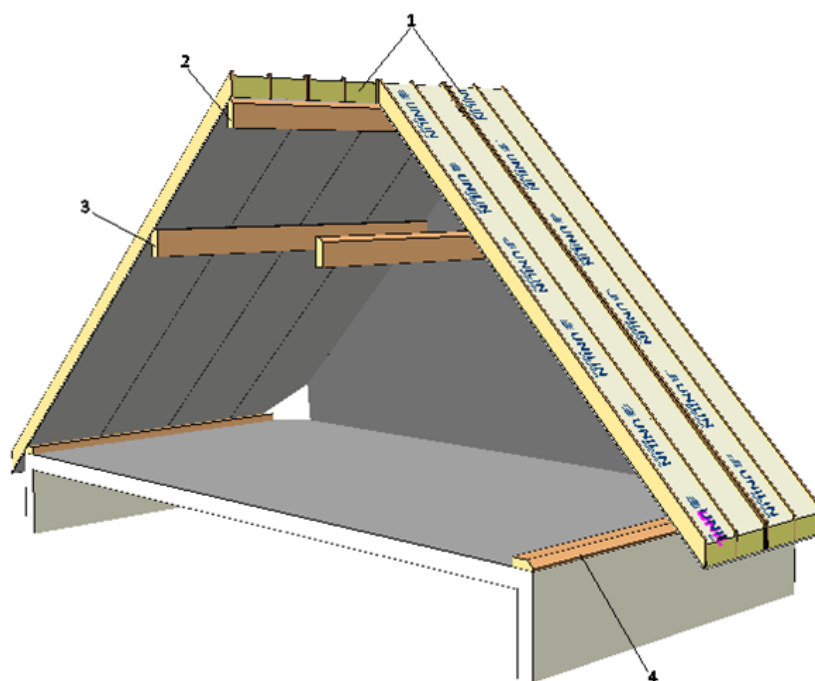
- nominal length $\pm 15 \text{ mm}$
- width $\pm 3 \text{ mm}$;
- height: $\pm 5 \text{ mm}$

The tolerance on the insulation thickness for the open PUR element:

- thickness PUR $\leq 100 \text{ mm}$ $\pm 5 \text{ mm}$
- thickness PUR $> 100 \text{ mm}$ $\pm 5 \%$

Annex II Construction principles of the roof elements

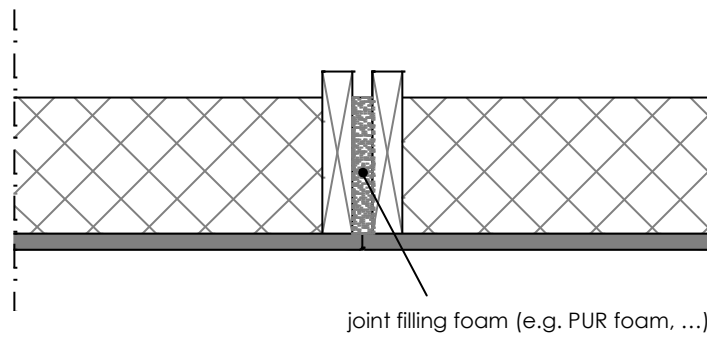
Construction principles of the roof



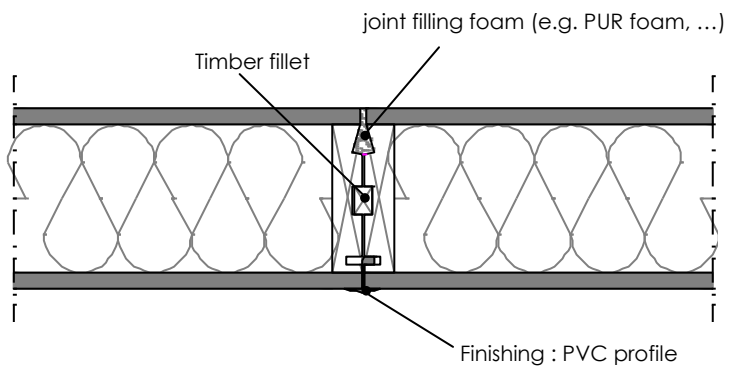
- 1 Roof element
- 2 Ridge purlin
- 3 Purlin
- 4 Wall plate

Joints

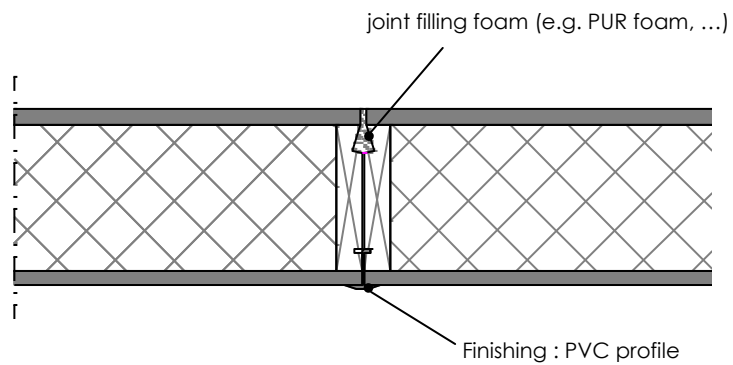
OPEN PUR
OPEN WOOL
OPEN ALT
OPEN FLAX
SW plus PUR



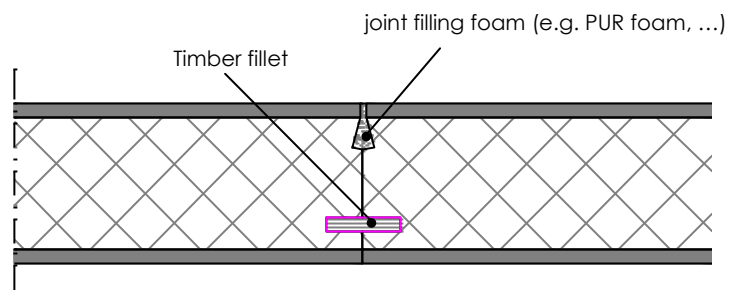
SW-WOOL-ML
SW – ALT – ML
SW – FLAX- ML



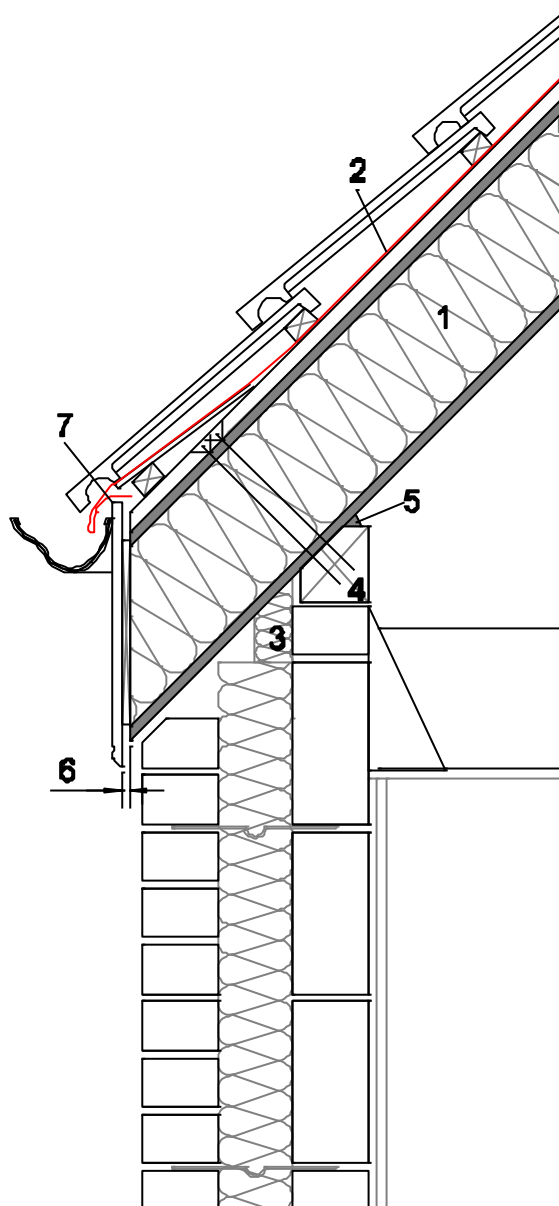
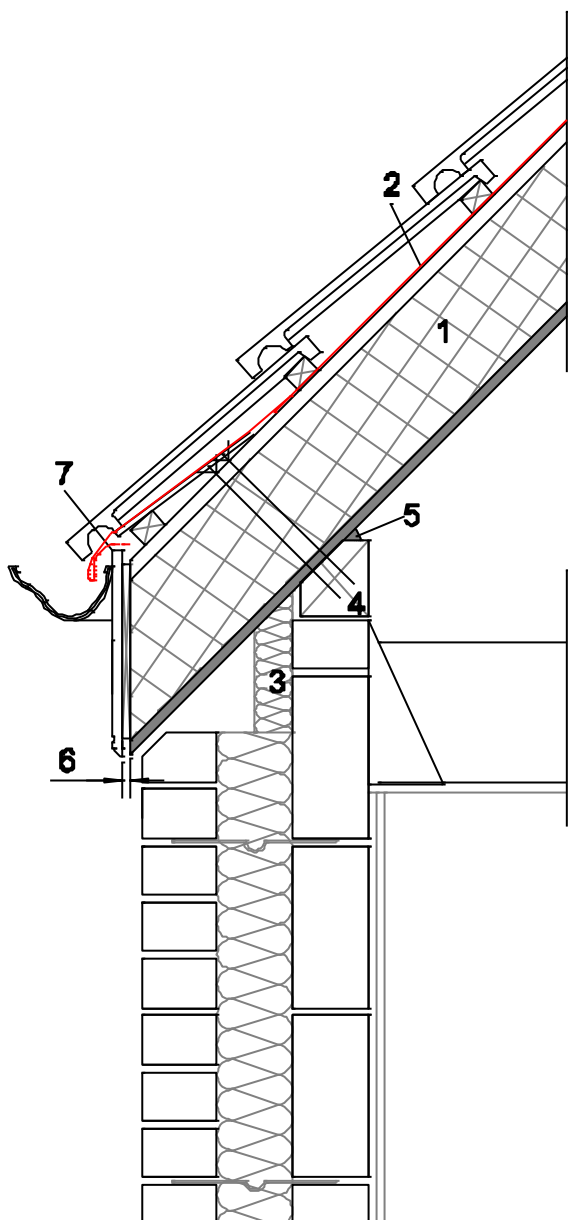
SW – PUR- ML



SW - PUR
SW – EPS
SW - XPS

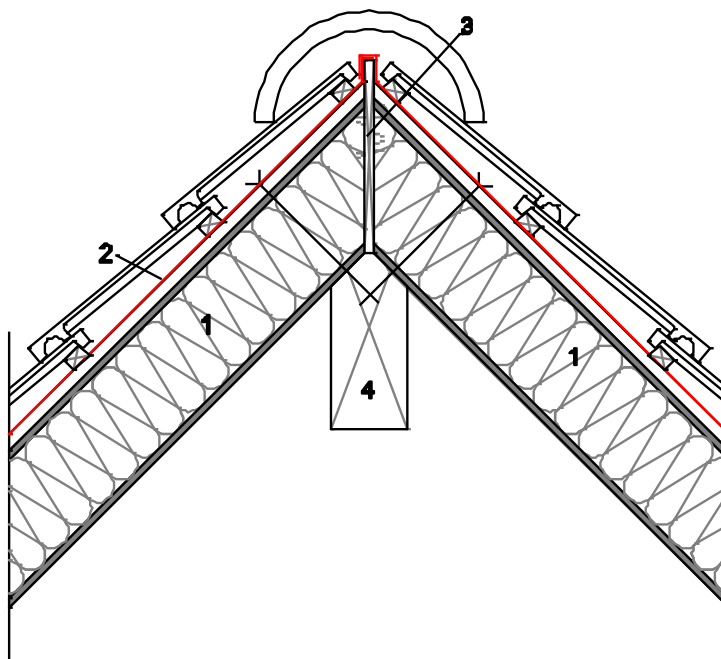
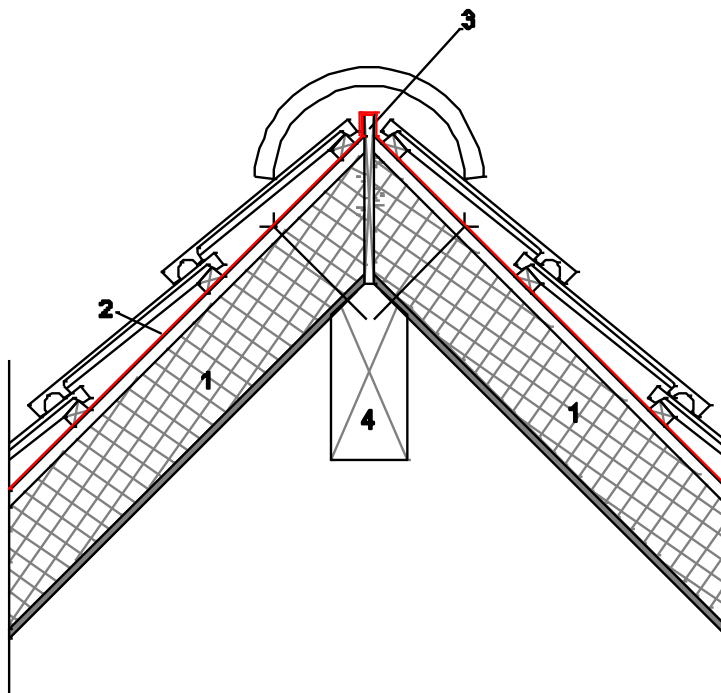


Eaves



- 1 Roof element
- 2 Optional breathable felt
- 3 Rigid insulation board
- 4 Min. 75 mm chamfered wall plate
- 5 Air tight silicone seal
- 6 Air gap (± 10 mm)
- 7 Optional over fascia vent

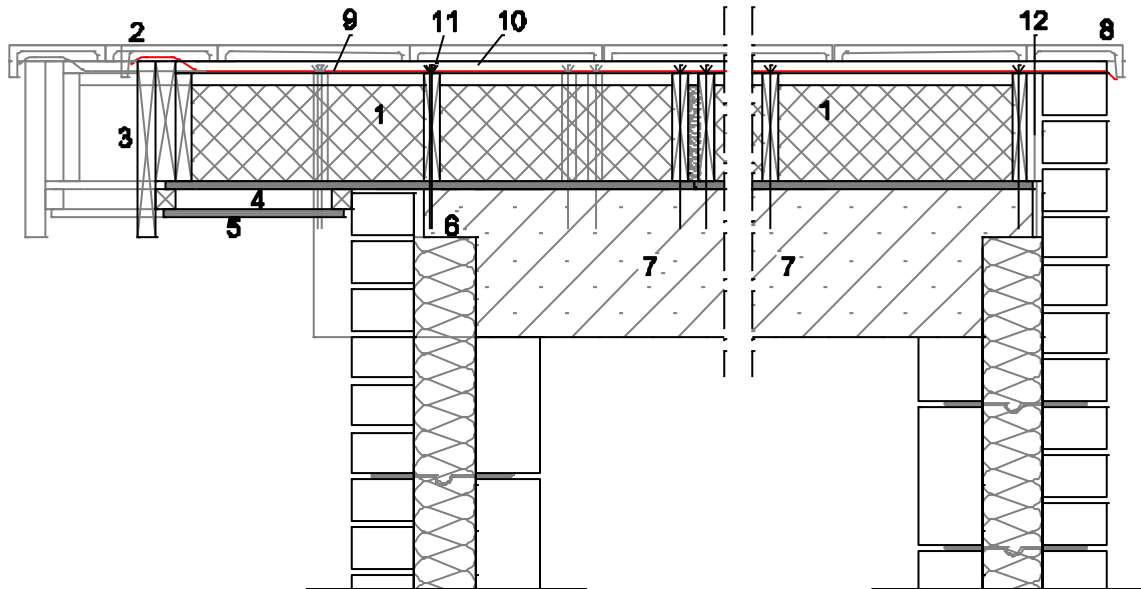
Ridge



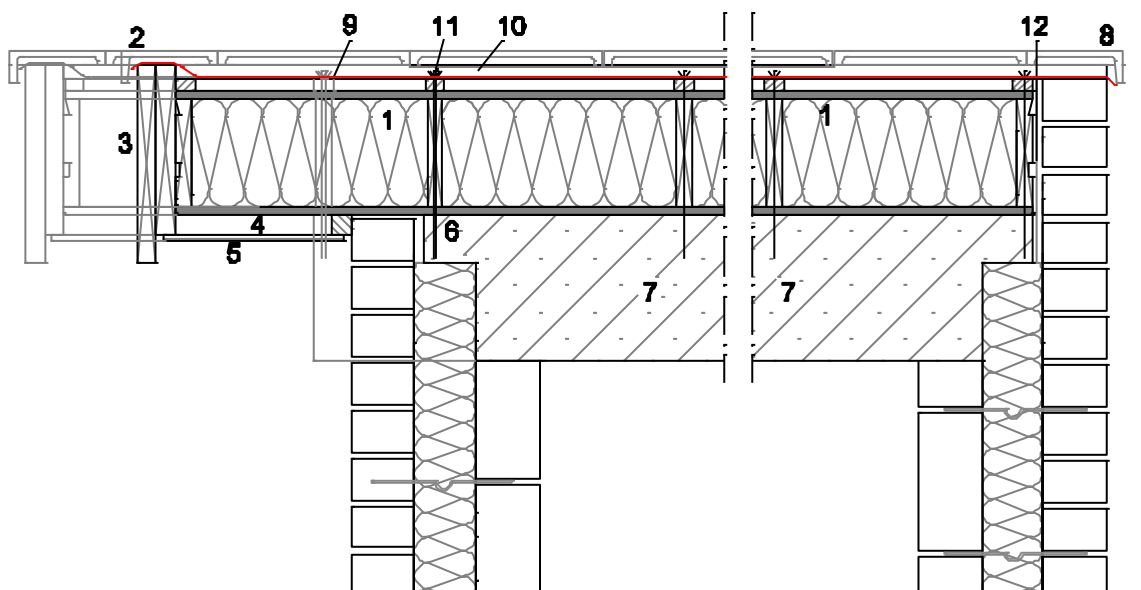
- 1 Roof element
- 2 Optional breathable felt
- 3 Optional ridge board or fill with foam
- 4 Ridge beam

Verge

OPEN ELEMENTS



SW ELEMENTS



- 1 Roof element
- 2 Left verge tile
- 3 Bargeboard to architects design
- 4 Air space
- 5 Soffit to architects design
- 6 Chamfered edge
- 7 Purlin (fixed to internal wall)
- 8 Right verge tile
- 9 Optional breathable felt
- 10 Tiling batten
- 11 Double fixing necessary at verge
- 12 Compressible insulation

Annex III Specification of materials -

Material/ component	Reference to European standard or relevant product specification	Type	Dimensions (mm)	λ_d W/m.K	μ (-)	c_p J/kg.K	ρ kg/m³	Reaction to fire	Remarks
WOODEN RIBS									
Solid wood	EN 14081	C18 or better	Minimal thickness of 21 mm, the height is depending on design	0,13	50	1600	450	D-s2,d0	CE-marked
I-joist	According to ETA		Dependent on design						CE-marked
Glued laminated timber	EN 14080	GL24h or better	Minimal thickness of 21 mm, the height is depending on design	0,13	50	1600		D-s2,d0	CE-marked

Material/ component	Reference to European standard or relevant product specification	Type	Dimensions (mm)	λ_d W/m.K	μ (-)	c_p J/kg.K	ρ kg/m³	Reaction to fire	Remarks
BOARDS									
Particle board	EN 13986 – EN 312-3 or EN 312-5	Type 3 or type 5	≥ 3	0,14	50	1700	≥ 600	D-s2,d0	CE-marked
OSB	EN 13986 – EN 300	Type 3	≥ 9	0,13	50	1700	≥ 600	D-s2,d0	CE-marked
Plywood	EN 13986 – EN 636-2	Type 2	≥ 9	0,13	200	1600	≥ 500	D-s2,d0	CE-marked
MDF	EN 13986 – EN 622-5	Type HLS	≥ 3	≤ 0,32					CE-marked
MDF.RWH	EN 13986 – EN 622-5	Type RWH	≥ 12	≤ 0,09	11	2100	≥ 540	D-s1,d0	CE-marked
Gypsum fibreboard	According to ETA or EN 15283-2		≥ 12,5	≤ 0,32	20	1000	≥ 900	A2-s1,d0	CE-marked
Gypsum plasterboard	EN 520	H3 or better	≥ 9,5	0,25	10	1000	≥ 900	A2-s1,d0	CE-marked
Calcium silicate board	According to ETA		≥ 15					A2	CE-marked
Planking			≥ 12	0,13	50	1600	≥ 900	D-s2,d2	

Material/ component	Reference to European standard or relevant product specification	Type	Dimensions (mm)	λ_d W/m.K		μ (-)	c_p J/kg.K	ρ kg/m³	Reaction to fire	Remarks
INSULATION MATERIALS										
Polyurethane – PUR	EN 13165	Open elements CS(10\Y) 100 DS(TH) 8	Dependent on element height	$\leq 0,029$	Thickness < 80 mm	60	1400	≥ 30	F	CE - marked
				$\leq 0,028$	e ≥ 80 mm e < 120 mm					
		$\leq 0,027$		e ≥ 120 mm						
		$\leq 0,023$ (Between 2 vapour barriers)								
EPS	EN 13163	EPS 60 T1, L1, W1, S1, P4 DS(N) 5 DS(70-)3	Dependent on element height	$\leq 0,038$		60	1450	≥ 15	E	CE - marked
XPS	EN 13164	CS(10\Y)300	Dependent on element height	$\leq 0,038$		150	1450	≥ 30	E	CE - marked
Mineral wool	EN 13162		Dependent on element height	$\leq 0,037$		1	1030	≥ 16	A1	CE - marked
Wood fibre	EN 13171		Dependent on element height	$\leq 0,040$		5	2100	≥ 40	E	CE - marked
Flax	According to ETA		Dependent on element height	$\leq 0,040$						CE - marked

Material/ component	Reference to European standard or relevant product specification	Type	Dimensions (mm)	λ_d W/m.K	μ (-)	c_p J/kg.K	ρ kg/m ³	Reaction to fire	Remarks
FOILS									
Vapour barrier					$s_d \geq 50$ m				
Watertight vapour open barrier	EN 13859-1				$s_d \leq 0,03$ m				

Material/ component	Reference to European standard or relevant product specification	Type	Dimensions (mm)	λ_d W/m.K	μ (-)	c_p J/kg.K	ρ kg/m³	Reaction to fire	Remarks
GLUE									
One component polyurethane glue	EN 15425	Type I							Board/ribs Counter batten/board Board core Finger joint in ribs
MUF glue	EN 301	Type I							Scarf joints board
Non-structural glue	EN 204	Minimal D3							Non-load bearing panels/ribs Non load bearing panels/core