

European Technical Assessment

ETA 18/0627

Version 01

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UBAtc Assessment Operator:
Belgian Construction Certification Association
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**Technical Assessment Body issuing the European Technical Assessment: UBAtc.
UBAtc has been designated according to Article 29 of Regulation (EU) No 305/2011
and is member of EOTA (European Organisation for Technical Assessment)**

Trade name of the construction product:

Perinsul® S

Product family to which the construction product belongs:

Thermally-insulating and loadbearing units made of cellular glass

Manufacturer:

Pittsburgh Corning Europe NV/SA
Albertkade 1
B-3980 Tessenderlo
Belgium

Manufacturing plants:

PCE Plants Be-Tlo & Cz-

Website:

www.foamglas.com

This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of:

European Assessment Document (EAD): 170018-00-0305

This version replaces:

ETA 13/0004, issued by SGS Intron Certificatie B.V. on 13 May 2013

This European Technical Assessment contains:

11 pages, with 3 Annexes, which form an integral part of this ETA



European Organisation for Technical Assessment

Legal bases and general conditions

- 1 This European Technical Assessment is issued by UBAtc (Union belge pour l'Agrément technique de la construction, i.e. Belgian Union for technical Approval in construction), in accordance with:
 - Regulation (EU) N° 305/2011¹ of the European Parliament and of the Council of 9 March 2011 laying down harmonised conditions for the marketing of construction products and repealing Council Directive 89/106/EEC
 - Commission Implementing Regulation (EU) N° 1062/2013² of 30 October 2013 on the format of the European Technical Assessment for construction products
 - European Assessment Document (EAD) 170018-00-0305
- 2 Under the provisions of Regulation (EU) No 305/2011, UBAtc is not authorized to check whether the provisions of this European Technical Assessment are met once the ETA has been issued.
- 3 The responsibility for the conformity of the performances of the products with this European Technical Assessment and the suitability of the products for the intended use remains with the holder of the European Technical Assessment.
- 4 Depending on the applicable Assessment and verification of constancy of performance (AVCP) system, (a) notified body(ies) may carry out third-party tasks in the process of assessment and verification of constancy of performance under this Regulation once the European Technical Assessment has been issued.
- 5 This European Technical Assessment allows the manufacturer of the construction product covered by this ETA to draw up a declaration of performance for the construction product.
- 6 CE marking should be affixed to all construction products for which the manufacturer has drawn up a declaration of performance.
- 7 This European Technical Assessment is not to be transferred to other manufacturers, agents of manufacturers, or manufacturing plants other than those indicated on page 1 of this European Technical Assessment.
- 8 The European Technical Assessment holder confirms to guarantee that the product(-s) to which this assessment 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 assessment is issued under the condition that the aforementioned guarantee by the ETA-holder will be continuously observed.
- 9 According to Article 11(6) of Regulation (EU) N° 305/2011, when making a construction product available on the market, the manufacturer shall ensure that the product is accompanied by instructions and safety information in a language determined by the Member State concerned which can be easily understood by users. These instructions and safety information should fully correspond with the technical information about the product and its intended use, which the manufacturer has submitted to the responsible Technical Assessment Body for the issuing of the European Technical Assessment.
- 10 Pursuant to Article 11(3) of Regulation (EU) N° 305/2011, manufacturers shall adequately take into account changes in the product-type and in the applicable harmonised technical specifications. Therefore, when the contents of the issued European Technical Assessment do not any longer correspond to the product-type, the manufacturer should refrain from using this European Technical Assessment as the basis for their declaration of performance.
- 11 All rights of exploitation in any form and by any means of this European Technical Assessment is reserved for UBAtc and the ETA-holder, subject to the provisions of the applicable UBAtc regulations.
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- 13 Subject to the application introduced, this European Technical Assessment is issued in English and may be issued by the UBAtc in its official languages. The translations correspond fully to the English reference version circulated in EOTA.
- 14 This European Technical Assessment, ETA 18/0627, was first issued on 20 December 2018 and replaces European Technical Approval, ETA 13/0004, issued by SGS Intron Certificatie B.V.³ on 13 May 2013. Compared with that ETA, this document comprises the following changes:
 - Change of wording : blocks by units and 'cellular glass with bitumen/PE liner' by 'cellular glass with liner(s) on the bed faces'
 - Completion of
 - the definition of masonry units 'Group 1' and 'Group 2'
 - the definition of 'normalised compressive strength'
 - Change
 - of 'Category II units' to 'Category I units'
 - in 'Eccentric loading behaviour' 'from 'block-stress behaviour' to 'linear behaviour'
 - of the 'determination of dimensions according to EN 822 & EN 823' by the 'determination of dimensions according to EN 772-16'
 - of the determination of the 'flatness of the faces according to EN 825' by 'flatness of the faces according to EN 772-20'
 - Introduction of 'water absorption by capillarity according to 772-11'
 - Modification of clause 'Fire Protective' into Clause 'Fire Resistance'
 - Deletion of the clauses 'Anti Biological Attack' and 'Chemical Resistance': see EAD 170018-00-305
 - Editorial changes

¹ OJEU, L 88 of 2011/04/04

² OJEU, L 289 of 2013/10/31

³ SGS Intron Certificatie B.V., Venusstraat 2, P.O. Box 267, NL-4100 AG Culemborg

Technical Provisions

1 Technical description of the product

1.1 Characteristics of the products

1.1.1 General

This ETA is being issued for the products specified on the cover page on the basis of agreed data/information, deposited with the UBAtc, which identifies the products that have been assessed. Changes to the product/production process, which could result in the deposited data/information being incorrect, should be notified to the UBAtc before the changes are introduced. The UBAtc will decide whether such changes affect the ETA

1.1.2 Perinsul® S

1.1.2.1 General

This ETA specifies factory-made thermally-insulating and loadbearing blocks, made of cellular glass, with liner(s) on the bed faces.

1.1.2.2 Geometry (length, width, thickness, squareness and flatness)

The geometry of the elements is adapted to the masonry unit types used in the various Member States. The ranges are presented in Table 1.

Table 1: Geometry of Perinsul® S units

Characteristic	Evaluation method	Performance	Tolerance
Length		450 mm	± 2 mm
Width	EN 772-16	90 mm - 365 mm	± 1 mm
Height		50 mm - 200 mm	± 1 mm
Squareness	EN 824	$S_{lb} \leq 5 \text{ mm/m}$ $S_d \leq 2 \text{ mm}$	± 1 mm over 45 cm length
Flatness	EN 772-20	$S_{max} \leq 2 \text{ mm}$	± 1 mm

1.1.2.3 Density

Density of the units, determined according to EN 1602 is 165 kg/m³ (± 15%)

1.1.2.4 Thickness of liner

The thickness of the bituminous liner is ≤ 0,5 mm

2 Specification of the intended use(s) in accordance with the applicable EAD

2.1 General

The product is used in masonry constructions to eliminate structural thermal bridging, reduce the risk of condensation and mould growth. The cellular glass unit with liner on the bed faces is compatible with mortar.

This EAD deals with the application as a thermal break in masonry walls. The masonry walls with the thermal break shall assure the stability in accordance with the EN 1996-1-1 and the energy performances to prevent heat losses and mould growth/surface condensation.

Both concerning design and installation, the use of the thermally-insulating and loadbearing units is subject to the standards and regulations in force at the place of use (see this ETA, Annex 1.

The provisions made in this European Technical Assessment are based on the assumed working life of 50 years⁴.

2.2 Provisions related to manufacturing, packaging and storage

The Perinsul® S units are packaged in boxes, transported and stored on pallets, to prevent damages from occurring.

2.3 Provisions related to the design and use of the product

2.3.1 Design rules

In the design and the calculation of the ultimate stresses, the Eurocode 6 (EN 1996-1-1) in local design requirements shall be respected.

2.3.2 Installation

The positioning of the Perinsul® S units shall respect the installation requirements of the manufacturer and be in conformity with the state of the art and good workmanship of building masonry walls, applicable in the country of use.

All masonry dilatation joints and other constructive joints shall be respected.

The Perinsul® S units are horizontally positioned one against the other in the mortar and slightly and gently pushed or knocked with a trowel until the mortar on all slides is flowing out and a perfect adhesion is reached.

Knocking or banging with the sharp edges of the trowel or other objects shall be avoided. The vertical joints in between the Perinsul® S blocks are closely positioned without mortar in between. As with all protected masonry, direct exposure to wetting and freeze/thaw cycling should be avoided.

For the position at the bottom of the masonry wall: upon the positioned Perinsul® S units, the first layer of bricks are fully placed into the mortar and shall be installed in such a way that the loads are uniformly spread over the surface.

⁴ The indications given as to the working life of the products cannot be interpreted as a guarantee given by the ETA-holder or the assessment body. It should only be regarded as a means for specifiers to choose the appropriate criteria for this product in relation to the expected, economically reasonable working life of the works.

For the position under windows and sills: So as to prevent punctual loads, in between the Perinsul® S blocks and the window a repartition (e.g. fibre-cement board) shall be foreseen. Sills on the insulation blocks shall be placed in a full mortar bed.

2.3.3 Recommendation for maintenance and repair

Given that the Perinsul® S blocks layer is integrated into the masonry, no extra attention for maintenance or repair is necessary. Within the disposal and discharge, treatment to thermal breaks may be considered on the basis of the same waste/reuse procedures as for the masonry elements.

3 Performance of the product and references to the methods used for its assessment

3.1 General

The procedure described in the EN 1996-1-1:2005, Clause 3.6.1.2 (1)(i) and the following masonry units and mortar types have been used during the assessment of mechanical performances.

The information given below is only valid for brick types, which are at least equivalent to the types given in the notes below the Table 2. For the use, the design and the installation of the thermal break, the design values of the mechanical strength shall further consider local specifications in force at the place of use.

Table 2: Normalised compressive strength of the masonry units (f_b) and compressive strength of the mortar (f_m) used during the assessment

Masonry Units	f_b N/mm ² (MPa)	General purpose mortar	f_m N/mm ² (MPa)
Calcium Silicate units; Group 1*	12,0		
Clay units; Group 1* – solid clay bricks without any voids	15,0	M5	5,0
Clay units; Group 2**	17,5		

* Solid blocks with volume of all holes $\leq 25\%$ and the volume of any hole $\leq 12,5\%$ (% of the gross volume)

** Perforated clay blocks, for which the volume of the perforations is $> 25\%$ and $\leq 50\%$ (% of the gross volume), the volume of each of multiple holes $\leq 2\%$ (% of the gross volume), the volume of gripholes up to a total of 12.5%, the combined thickness of webs and shells(volume of the overall width) $\geq 16\%$, and the thicknesses of the web $\geq 5\text{mm}$ and shell $\geq 8\text{mm}$.

3.2 Compressive strength of masonry (f_k) with a layer made out of Perinsul S®

The compressive strength of masonry f_k with Perinsul® S blocks is specified in Table 3.

Table 3: f_k of masonry with Perinsul® S with compressive strength $f_{b,fb} = 1,8\text{ N/mm}^2$ (MPa)

Masonry Units	f_b N/mm ² (MPa)	General purpose mortar	f_m N/mm ² (MPa)	f_k N/mm ² (MPa)
Calcium Silicate units; Group 1*	12,0		5,0	1,2
Clay units; Group 1 – solid clay bricks without any voids	15,0	M5	5,0	0,9
Clay units; Group 2**	17,5		5,0	0,9

Where:

- $f_{b,ib}$ is the normalized mean compressive strength of the thermal break units, in the direction of the applied action effect according to Clause 3.4, in N/mm².
- f_b is the normalised mean compressive strength of masonry units, in the direction of the applied action effect according EN 771-1 for the clay bricks and EN 771-2 for the Calcium Silicate units, in N/mm²
- f_m is the compressive strength of the mortar according EN 1015-11, in N/mm²
- f_k is the characteristic compressive strength of the masonry with the thermal break included according to EN 1052-1 in N/mm²; as for the design value for the long-term compressive strength of Perinsul® S blocks: see Clause 3.7.

3.3 Shear strength as part of masonry with a layer of Perinsul® S blocks

No performance assessed

3.4 Compressive strength and normalised compressive strength of the Perinsul® S block

The mean compressive strength of 1.8 N/mm² is given with a probability of failure to reach it not exceeding 5%. With regard to the compressive strength, Perinsul® S is in accordance with masonry units of category I, according to EN 1996-1-1:2005+AC:2009, clause 2.4.3 and EN 771-1 to 6 : definition 'category I unit'.

The normalised compressive strength of Perinsul® S ($f_{b,ib}$) is the compressive strength of the unit, converted to the air dried compressive strength to an equivalent 100 wide x 100 mm high unit. Since for the Perinsul® S units

- the conditioning factor is 1;
- the shape factor is 1.

The normalised compressive strength = the mean compressive strength of the Perinsul® S unit.

When the Perinsul® S units are sampled from a consignment in accordance with EN 771-1, Annex A and tested in accordance with EN 772-1 with mortar capping, then:

- the mean compressive strength of the specified number of Perinsul® S units is not less than the result of the assessment (= 1.8 N/mm²)
- individual strengths of specimens measured within the test sample shall be not less than 80% of the result of the assessment (=1,44 N/mm²)
- The coefficient of variation of the strength of the Perinsul® S units is not more than 25%.

3.5 Creep long-term behaviour

In accordance with EN 1606, at the specified stress of at least 35% of the initial compressive strength of 1.8 N/mm²), during at least one year the specified level i_2 of compressive creep corresponding to fifty years and the specified level of total thickness reduction i_1 are specified in Table 4.

Table 4: Compressive creep, total deformation and total strain

Type of the units	Load N/mm ² (MPa)	Compressive creep deformation mm	Total deformation mm	Total strain %
Perinsul S	0,7	0,2	1,6	1,6 %

height
100 mm

3.6 Eccentric loading behaviour

From the eccentric loading tests on Perinsul® S units according to EAD 17-0018-00-0305, clause 2.2.5, it is concluded that the influence of eccentric loading may be determined assuming linear behaviour. As a result the capacity reduction factor shall be calculated as follows:

$$e_t < \frac{t}{6} \quad \phi = \frac{1}{1 + 6 \cdot \frac{e_t}{t}}$$

$$e_t > \frac{t}{6} \quad \phi = \frac{3}{4} \cdot \left(1 - 2 \frac{e_t}{t}\right)$$

with:

- e_t : eccentricity
- t : thickness
- ϕ : capacity reduction factor

3.7 Residual Compressive strength after long term load

The mean value of the long-term normalised compressive strength of the Perinsul® S blocks, according EAD 170018-00-0305, Clause 2.2.6 and tested in accordance with EN 772-1 is specified in Table 5 and given as a percentage of the short term normalised compressive strength

Table 5: Residual Compressive strength after long-term load

Load during one year N/mm ² (MPa)	Long term compressive strength	
	N/mm ²	%
0,7	1,1	63

For the design values of the mechanical strength further local specifications in force at the place of use shall be respected.

3.8 Reaction to fire

The core material of Perinsul® S is cellular glass with class A1 according to Commission Delegated Regulation (EU) 2016/364⁵. Together with the liner, Perinsul® S is classified class E.

3.9 Fire resistance

No performance assessed.

Note: Perinsul® S blocks shall be installed in such a way that these are always covered by renders (wall) or screeds (flooring), so that – in practice, in principal, the Perinsul® S blocks as part of the masonry and following its installation rules is never directly exposed to fire conditions.

If stability and fire resistance is required, an extra layer of fire protective products shall be positioned in front of the Perinsul® S blocks.

⁵ Commission Delegated Regulation (EU) 2016/364 of 1 July 2015 on the classification of the reaction to fire performance of construction products pursuant to Regulation (EU) No 305/2011 of the European Parliament and of the Council (OJ L 68, 15.3.2016, p. 4)

3.10 Dimensional stability specified at temperature and humidity

The relative changes in length, $\Delta\varepsilon_l$, width, $\Delta\varepsilon_b$, after storage for 48 h at $(70 \pm 2)^\circ\text{C}$ and $(90 \pm 5)\%$ relative humidity in accordance with EN 1604, do not exceed 0,5 %. The relative change in thickness, $\Delta\varepsilon_d$, does not exceed 1,0 %.

3.11 Water absorption by immersion – long term

Long-term water absorption by partial immersion, W_{ip} , in accordance with EN 12087:2013, method B, does not exceed 0,5 kg/m².

3.12 Water absorption by capillarity

The water absorption by capillarity of the bed faces in accordance with EN 772-11 for an immersion time of $(10 \pm 0,2)$ min. does not exceed 0.3 g/m²s.

3.13 Water vapour resistance

For the vapour diffusion resistance, μ , the tabulated value specified in EN ISO 10456 shall be used, i.e. $\mu = \infty$.

3.14 Resistance to moulds

Perinsul[®] S blocks are resistant to moulds.

3.15 Thermal resistance

The thermal conductivity of Perinsul[®] S blocks in accordance with EN 12667 and determined according to EN 1745 is $\lambda_b \leq 0,050$ W/mK.

Examples of the thermal resistance of Perinsul[®] S blocks are given in this ETA, Annex 2.

3.16 Thermal linear transmittance

A number of default values of thermal linear transmittance, determined according to EN ISO 10211/EN ISO 14683, have been specified in this ETA, Annex 3.

4 Assessment and verification of constancy of performance (AVCP) system applied, with reference to its legal base

In accordance with Regulation (EU) N° 305/2011, Article 65, Directive 89/106/EEC is repealed, but references to the repealed Directive shall be construed as references to the Regulation.

For the products covered by this ETA the applicable European legal act is Commission Decision 1997/740/EC⁶ of the European Commission for masonry and related products, as amended.

The systems to be applied for the products covered by this EAD have been specified in Table 6.

Table 6 - System of assessment and verification of constancy of performance applicable to products covered by this EAD

Intended use(s)	Level(s) or class(es)	AVCP system(s) ^a
	A1*, A2*, B*, C*	1
For uses subject to reaction to fire regulations	A1**, A2**, B**, C**, D, E, F	3
	(A1 to F)***, NPD****	4
Units with a specified mean compressive strength with a probability of failure to reach it not exceeding 5 %	-	2+
^a See Annex V to Regulation (EU) N° 305/2011		
* Products/materials for which a clearly identifiable stage in the production process results in an improvement of the reaction to fire classification (e.g. an addition of fire retardants or a limiting of organic material).		
** Products/materials not covered by footnote (*).		
*** Products/materials that do not require to be tested for reaction to fire (e.g. products/materials of Class A1 according to Commission Decision 96/603/EC).		
**** 'No Performance Declared' in accordance with Regulation (EU) N° 305/2011, Article 6(f)		

⁶ Commission Decision 97/740/EC of 14 October 1997 on the procedure for attesting the conformity of construction products pursuant to Article 20 (2) of Council Directive 89/106/EEC as regards masonry and related products (OJ L 299, 4.11.1997, p. 42)

5 Technical details necessary for the implementation of the AVCP system

5.1 Tasks for the ETA-holder

5.1.1 Factory production control (FPC)

5.1.1.1 General

The manufacturer shall establish, document and maintain a FPC system to ensure that the products placed on the market conform to the stated performance characteristics. The FPC system shall consist of procedures, regular inspections and tests and/or assessments and the use of the results to control raw and other incoming materials or components, equipment, the production process and the product.

A FPC system conforming with the requirements of EN ISO 9001, and made specific to the requirements of this ETA, is considered to satisfy the above requirements.

The results of inspections, tests or assessments requiring action shall be recorded, as shall any action taken. The action to be taken when control values or criteria are not met shall be recorded.

5.1.1.2 Equipment

All weighing, measuring and testing equipment shall be calibrated and regularly inspected according to documented procedures, frequencies and criteria.

5.1.1.3 Raw materials and components

The specifications of all incoming raw materials and components shall be documented, as shall the inspection scheme for ensuring their conformity.

5.1.1.4 Non-conforming products

In the event of any non-conformity of any product, that product shall be placed into quarantine and action taken to rectify the cause of the non-conformity. Products may not subsequently be dispatched until the problem has been resolved.

5.1.1.5 Tests and frequencies

All the elements, requirements and provisions adopted by the manufacturer are documented in a systematic manner in the form of written policies and procedures. This production control system ensures that the product is in conformity with the European Technical Assessment (ETA).

5.2 Tasks for the Technical Assessment Body

5.2.1 Initial Type Testing

Assessment tests on the product have been conducted under the responsibility by the Technical Assessment Body (UBAtc) in accordance with EAD 170018-00-0305.

UBAtc has assessed the results of these tests in accordance with EAD 170018-00-0305, as part of the ETA issuing procedure. In accordance with Regulation (EU) N° 305/2011, Annex V, 1.6, these tests should be used for the purposes of Initial Type Testing.

5.2.2 Assessment of the factory production control - Initial inspection and continuous surveillance

Assessment of the FPC is the responsibility of a Notified Body

An assessment shall be carried out on the required manufacturing steps of each manufacturing plant to demonstrate that the factory production control is in conformity with the ETA and any subsidiary information. This assessment is based on an initial inspection of the factory.

Subsequently continuous surveillance of factory production control is necessary to ensure continuing conformity with the ETA.

It is recommended that surveillance inspections should be conducted at least twice a year.

6 Bibliography

EN 771-1	Specification for masonry units - Part 1: Clay masonry units
EN 772-1	Methods of test for masonry units - Part 1: Determination of compressive strength
EN 772-11	Methods for test for masonry units – Part 11: Determination of water absorption of aggregate concrete, autoclaved aerated concrete, manufactured stone and natural stone masonry units due to capillary action and the initial rate of water absorption of clay masonry units
EN 772-16	Methods for test for masonry units – Part 16: Determination of dimensions
EN 772-20	Methods for test for masonry units – Part 20: Determination of flatness of faces of masonry units
EN 824	Thermal insulating products for building applications - Determination of squareness
EN 825	Thermal insulating products for building applications - Determination of flatness
EN 1015-11	Methods of test for mortar for masonry - Part 11: Determination of flexural and compressive strength of hardened mortar
EN 1052-1	Methods of test for masonry - Part 1: Determination of compressive strength
EN 1052-3	Methods of test for masonry - Part 3: Determination of initial shear strength
EN 1602	Thermal insulating products for building applications - Determination of the apparent density
EN 1604	Thermal insulating products for building applications - Determination of dimensional stability under specified temperature and humidity conditions
EN 1606	Thermal insulating products for building applications - Determination of compressive creep
EN 1745	Masonry and masonry products - Methods for determining thermal properties
EN 1996-1-1:2005+A1:2012	Eurocode 6 - Design of masonry structures - Part 1-1: General rules for reinforced and unreinforced masonry structures
EN 1996-1-2	Eurocode 6 - Design of masonry structures - Part 1-2: General rules - Structural fire design
EN 12086	Thermal insulating products for building applications - Determination of water vapour transmission properties
EN 12087:2013	Thermal insulating products for building applications - Determination of long term water absorption by immersion

EN 12667	Thermal performance of building materials and products - Determination of thermal resistance by means of guarded hot plate and heat flow meter methods - Products of high and medium thermal resistance	EN ISO 10456	Building materials and products - Hygrothermal properties - Tabulated design values and procedures for determining declared and design thermal values
EN 13167	Thermal insulation products for buildings - Factory made cellular glass (CG) products - Specification	EN ISO 13788	Hygrothermal performance of building components and building elements - Internal surface temperature to avoid critical surface humidity and interstitial condensation - Calculation methods
EN ISO 6946	Building components and building elements - Thermal resistance and thermal transmittance - Calculation methods	EN ISO 14683	Thermal bridges in building construction - Linear thermal transmittance - Simplified methods and default values
EN ISO 10211	Thermal bridges in building construction - Heat flows and surface temperatures - Detailed calculations		

UBAtc asbl is a non-profit organization according to Belgian law. It is a Technical Assessment Body notified by the Belgian notifying authority, the Federal Public Services Economy, SMEs, Self-Employed and Energy, on 17 July 2013 in the framework of Regulation (EU) No 305/2011 of the European Parliament and of the Council of 9 March 2011 laying down harmonised conditions for the marketing of construction products and repealing Council Directive 89/106/EEC and is member of the European Organisation for Technical Assessment, EOTA (www.eota.eu).

This European Technical Assessment has been issued, in Sint-Stevens-Woluwe, by UBAtc asbl on the basis of the technical work carried out by the Assessment Operator, BCCA.

On behalf of UBAtc asbl,



Peter Wouters,
Director

On behalf of the Assessment Operator, BCCA, responsible for the technical content of the ETA,



Benny De Blaere,
Director general

The most recent version of this European Technical Assessment may be consulted on the UBAtc website (www.ubatc.be).

Annex 1: Possible applications of Perinsul® S

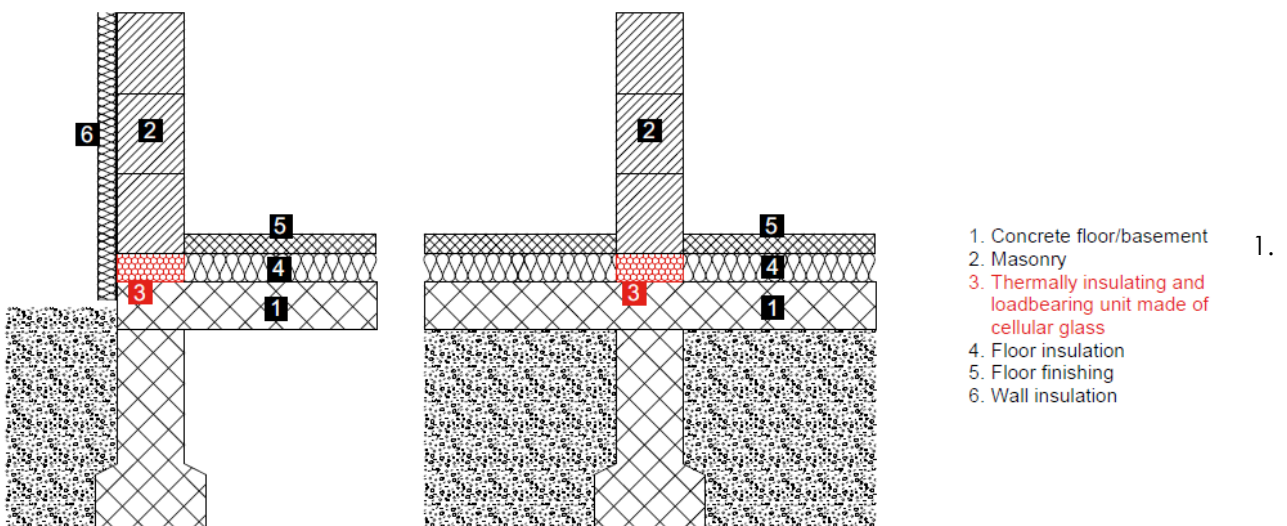
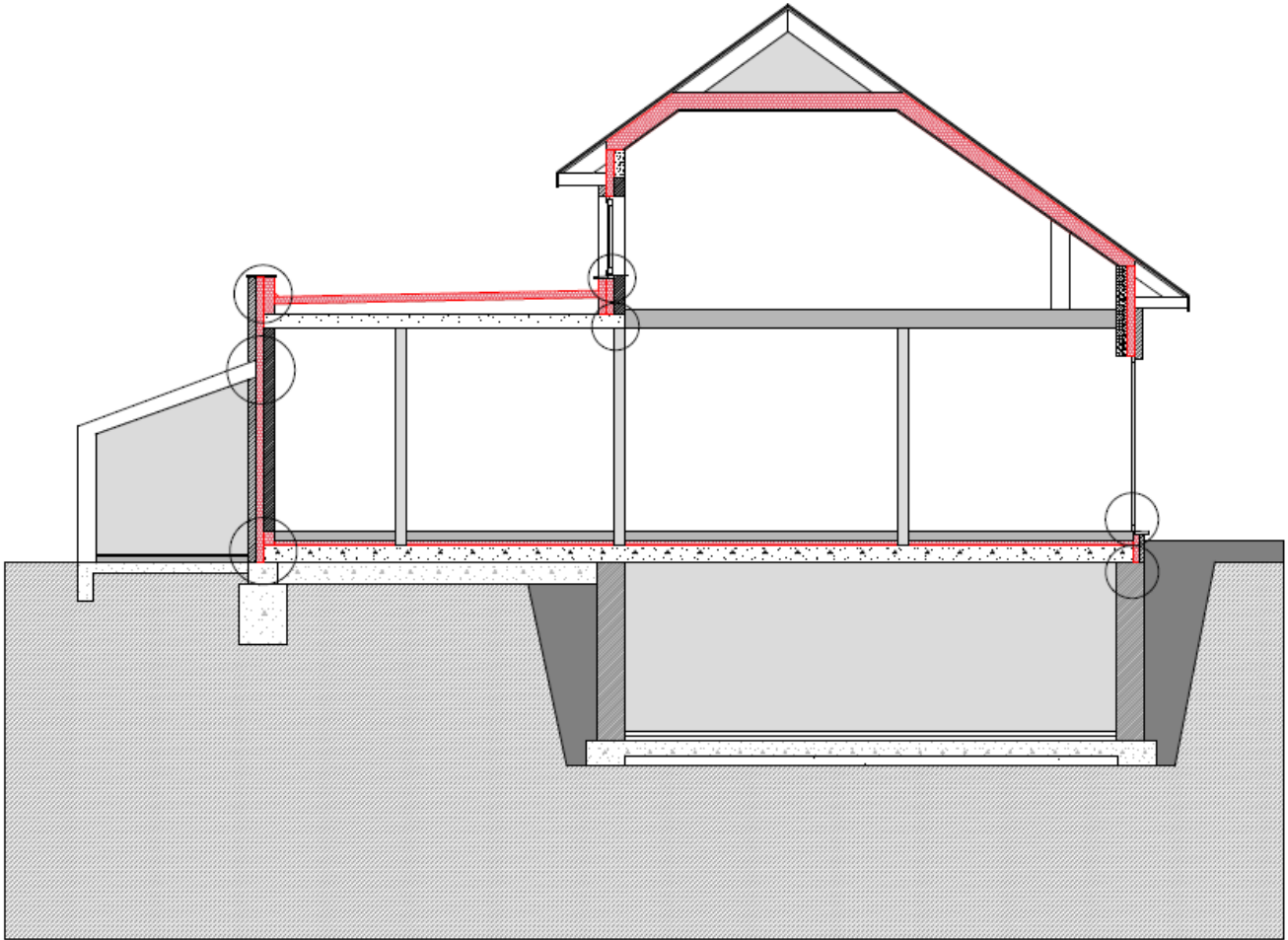
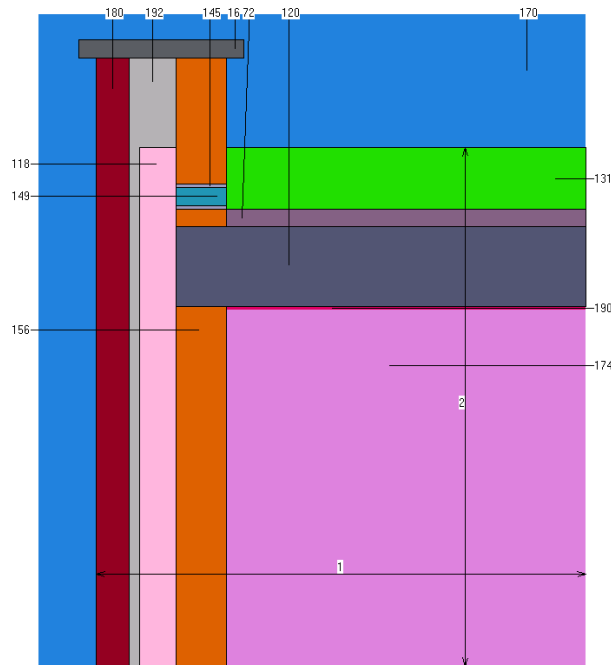


Figure 1: Example of the application of the thermally-insulating and loadbearing units of cellular glass

Annex 2: Thermal resistance Perinsul® S – Standard length 450 mm

50	90	1,00	1,80	100	100	2,00	2,00
50	110	1,00	2,20	100	140	2,00	2,80
50	115	1,00	2,30	100	190	2,00	3,80
50	140	1,00	2,80	100	215	2,00	4,30
50	175	1,00	3,50	115	115	2,30	2,30
50	190	1,00	3,80	115	175	2,30	3,50
50	240	1,00	4,80	115	240	2,30	4,80
50	300	1,00	6,00	120	140	2,40	2,80
65	100	1,30	2,00	120	175	2,40	3,50
65	140	1,30	2,80	120	190	2,40	3,80
65	215	1,30	4,30	120	240	2,40	4,80

Annex 3: Thermal linear transmittance – Example roof construction



4.5.1.1 When	4.5.1.2 Wall U_{max}	4.5.1.3 Roof U_{max}	4.5.1.4 Floor U_{max}
Starting 2011	0,4	0,3	0,4
Starting 2012	0,32	0,27	0,35
Starting 2014	0,24	0,24	0,3
Starting 015	0,15	0,15	0,15
Passive 01	0,1	0,1	0,1

Perinsul S® Thickness (cm)	U-wall $W/m^2.K$	U-roof $W/m^2.K$	PSI (Ψ_e) $W/m.K$	f-factor	Min. temp. $^{\circ}C$
5	0,361	0,291	-0,044	0,899	17,98
5	0,287	0,255	-0,039	0,914	18,28
5	0,22	0,227	-0,034	0,927	18,54
5	0,142	0,146	-0,026	0,947	18,94
5	0,097	0,097	-0,025	0,961	19,22
Outside temperature $0^{\circ}C$			Inside temperature $20^{\circ}C$		