European Technical Assessment

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UBAtc Assessment Operator

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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® HL
Product family to which the construction product belongs:	Thermally-insulating and load-bearing units made of cellular glass
Manufacturer:	Pittsburgh Corning Europe NV/SA Albertkade 1 B-3980 Tessenderlo Belgium
Manufacturing plant(s):	01 & 06
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): EAD 170018-00-0305
This version replaces	ETA 18/0636 version 1, issued 2018-12-20
This European Technical Assessment contains:	10 pages, including 4 annexes which form an integral part of the document.

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) No 305/2011[1] 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) No 1062/2013[2] of 30 October 2013 on the format of the European Technical Assessment for construction products.
- European Assessment Document (EAD) : 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) No 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) No 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 was first issued by UBAtc on: 20-12-2018. The current ETA, issued on 29-04-2024 contains editorial modifications and technical modifications regarding squareness on length and width and tolerances of the product width and height.

[1] OJEU, L 88 of 2011/04/04

[2] OJEU, L 289 of 2013/10/31

Technical Provisions

1 Technical description of the product

1.1 General

Perinsul® HL is a factory-made thermally-insulating and loadbearing unit made of cellular glass, with liner(s) on the bed faces.

The products are manufactured by Pittsburgh Corning Europe at production plants 01 and 06 (known by UBAtc).

1.2 Geometry and density

The geometry and density of Perinsul® HL are given in Table 1.

Table 1 – Geometry and density of Perinsul® HL

Characteristic	Evaluation method	Performance
Length (L)	EN 772-16	450 mm
Width (w)		90 - 365 mm (5 mm steps)
Height (h)		50 – 200 mm
Squareness	EN 824	$S_{l,b} \leq 6$ mm/m $S_d \leq 2$ mm
Flatness of the bed faces	EN 772-20	$S_{max} \leq 2$ mm
Density	EN 1602	200 kg/m³

1.3 Ancillary products

Ancillary products referred to in this ETA, as a part of installation provisions or in the framework of determining performances (e.g. fire resistance), are not covered by this ETA and may not be CE-marked on the basis of it.

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

2.1 Intended uses

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 II).

The provisions made in this European Technical Assessment are based on the assumed working life of 50 years [3].

2.2 Assumptions under which the fitness of the product(s) for the intended use was favourably assessed

2.2.1 Manufacturing directives

The European technical assessment is issued for the product on the basis of agreed data/information, deposited with the approved body, which identifies the product that has been assessed and judged. Changes to the product or production process, which could result in this deposited data/information being incorrect, should be notified to the approved body before the changes are introduced. The approved body will decide whether or not such changes affect the ETA and consequently the validity of the CE marking on the basis of the ETA and if so whether further assessment or alterations to the ETA, shall be necessary.

2.2.2 Design

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

2.2.3 Installation

The positioning of the Perinsul® HL 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® HL 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® HL 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® HL 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.

For the position under windows and sills: So as to prevent punctual loads, in between the Perinsul® HL 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 Recommendations

2.3.1 Recommendations on packaging, transport and storage

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

2.3.2 Recommendations on use, maintenance and repair

Given that the Perinsul® HL 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] 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.

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

3.1 Mechanical resistance and stability (BWR1)

3.1.1 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 masonry units (f_b) and compressive strength of the mortar (f_m) used during the assessment

Masonry Unit	f_b N/mm²	General purpose mortar	f_m N/mm²
Calcium Silicate units; Group 1*	12,0	M10	10
Clay units; Group 1* – solid clay bricks without any voids	15,0		
Clay units; Group 2**	17,5		
Concrete blocks Group 2*** with shell and web thickness of 30 mm	8,0		
Clay units; Group 2**	18,0		
Clay units; Group 2**	12,0		

* Solid blocks with volume of all holes ≤ 25% and the volume of any hole ≤ 12,5% (% of the gross volume)
** Perforated clay blocks, for which the volume of the perforations is > 25% and ≤ 50% (% of the gross volume), the volume of each of multiple holes ≤ 2% (% of the gross volume), the volume of grip holes up to a total of 12.5% (% of the gross volume), the combined thickness of webs and shells(volume of the overall width) ≥ 16%, and the thicknesses of the web ≥ 5mm and shell ≥ 8 mm.
*** hollow concrete blocks for which the volume of the vertical holes is > 25% and ≤ 60% (% of the gross volume), the volume of each of multiple holes ≤ 30% (% of the gross volume), the volume of gripholes up to a total of 30% (% of the gross volume), the thickness of the web ≥ 15mm and shells ≥ 18mm, the combined thickness of webs and shells(volume of the overall width) ≥ 18%

3.1.2 Compressive strength as part of masonry with a layer made out of thermally-insulating and load-bearing units made of cellular glass

The compressive strength of masonry f_k with Perinsul® HL blocks is specified in Table 3 where:

- $f_{b,tb}$ is the normalized compressive strength of the thermal break units, in the direction of the applied action effect according to Clause 3.1.4, in N/mm².
- f_b is the normalised compressive strength of masonry units, in the direction of the applied action effect according EN 772-1 for the clay bricks, EN 771-2 for the Calcium Silicate units and EN 771-3 for the concrete 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® HL blocks: see Clause 3.1.7.

Table 3 – f_k of masonry with Perinsul® HL with compressive strength $f_{b,tb}$ = 2,9 N/mm² (MPa)

Masonry Units	f_b N/mm²	General purpose mortar	f_m N/mm²	f_k N/mm²
Calcium Silicate units; Group 1	12,0	M10	10,0	**1,6**
Clay units; Group 1 – solid clay bricks without any voids	15,0			**1,6**
Clay units; Group 2	17,5			**1,5**
Concrete blocks Group 2	8,0			**1,4**
Clay units; Group 2	18,0			**1,5**
Clay units; Group 2	12,0			**1,4**

3.1.3 Shear strength as part of masonry with a layer made out of thermally-insulating and load-bearing units made of cellular glass

The initial shear strength of masonry f_{vk0} with Perinsul® HL blocks and the characteristic value of the coefficient of friction μ', are specified in Table 4 where:

- f_b is the normalized compressive strength of masonry units, in the direction of the applied action effect according to EN 771-1, in N/mm².
- f_m is the compressive strength of the mortar according to EN 1015-11 in N/mm².
- f_{vk0} is the characteristic initial shear strength of the masonry with the thermal break included according to EN 1052-3 in N/mm².
- μ' is the characteristic value of the coefficient of friction according to EN 1052-3.
- $f_{b,tb}$ is the normalized mean compressive strength of the thermal break units, in the direction of the applied action effect according to EAD 170018-00-0305, in N/mm².

This value is only valid for short time loading.

Table 4 – f_{vk0} for Perinsul® HL with compressive strength $f_{b,fb}$ = 2,9 N/mm² (MPa)

Masonry Units	f_b	General purpose mortar	f_m	f_{vk0}	μ'
	N/mm²		N/mm²	N/mm²	
All masonry units	≤18,0	M10	10,0	**0,05**	**0,40**

3.1.4 Compressive strength and normalised compressive strength of thermally-insulating and load-bearing units made of cellular glass

The mean compressive strength of 2,9 N/mm² is given with a probability of failure to reach it not exceeding 5% (masonry unit of category I (see definition in EN 771-1 to 6).

The normalised compressive strength of Perinsul® HL (f_{bfb}) 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® HL units:

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

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

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

- The mean compressive strength of the specified number of Perinsul® HL units is not less than the result of the assessment (= 2,9 N/mm²):
- Individual strengths of specimens measured within the test sample shall not be less than 80% of the result of the assessment (= 2,32 N/mm²).
- The coefficient of variation of the strength of the Perinsul® HL units is not more than 25%.

3.1.5 Creep – long term behaviour

In accordance with EN 1606, at the specified stress of at least 35% of the initial compressive strength of 2.9 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 5.

Table 5 – Compressive creep, total deformation and total strain

Type of the units	Load	Compressive creep deformation	Total deformation	Total strain
	N/mm²	mm	mm	
Perinsul® HL h =100 mm	1,2	0,1	1,0	**1,0 %**

3.1.6 Eccentric loading behaviour

From the eccentric loading tests on Perinsul® HL units according to EAD 170018-00-0305, 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:

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

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

with:

- e_t: eccentricity.
- t: thickness.
- Ø: capacity reduction factor.

3.1.7 Long term compressive strength

The mean value of the long-term normalsed compressive strength of the Perinsul® HL units, according to EAD 170018-00-0305, Clause 2.2.6 and tested in accordance with EN 772-1 of the Perinsul® HL blocks is specified in Table 6 and given as a percentage of the short term normalised compressive strength

Table 6 – Residual Compressive strength after long term load

Load during one year	Long term compressive strength
N/mm²	N/mm²
1.2	1,4

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

3.2 Safety in case of fire (BWR2)

3.2.1 Reaction to fire

The core material of Perinsul® HL is cellular glass with class A1 according to Commission Delegated Regulation (EU) 2016/364[4]. Together with the liner, Perinsul® HL is classified class E.

3.2.2 Propensity to undergo continuous smouldering

No performance assessed.

3.3 Hygiene, health and the environment (BWR3)

3.3.1 Dimensional stability at specified temperature and humidity

The relative changes in length, $\Delta\varepsilon_l$, width, $\Delta\varepsilon_b$, after storage for 48 h at (70 ± 2) °C and (90 ± 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 %.

3.3.2 Water absorption by immersion – long term

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

[4] 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)

3.3.3 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 ± 0,2) min. does not exceed 0.3 g/m²s.

3.3.4 Water vapour resistance

For the vapour diffusion resistance, μ, the tabulated value specified in EN ISO 10456 shall be used, i.e. μ = infinite (∞).

3.3.5 Release of dangerous substances

No performance assessed.

3.4 Safety and accessibility in use (BWR4)

3.4.1 Geometry (length, width, thickness, plane parallelism, squareness and flatness)

Characteristic	Evaluation method	Tolerance
Length (L)	EN 772-16	± 2 mm
Width (w)		± 3 mm
Height (h)		± 3 mm
Plane parallelism of the bed faces		NPA
Squareness	EN 824	$S_{l,b} \leq 6$ mm/m $S_d \leq 2$ mm
Flatness of the bed faces	EN 772-20	$S_{max} \leq 2$ mm

3.4.2 Density

The density of the units, determined according to EN 1602 is 200 kg/m³ (± 15 %)

3.4.3 Thickness of liner

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

3.5 Protection against noise (BWR5)

3.5.1 Sound insulation

No performance assessed.

3.6 Energy economy and heat retention (BWR6)

3.6.1 Thermal insulation

The thermal conductivity of Perinsul® HL blocks in accordance with EN 12667 and determined according to EN 1745 is $\lambda_D \leq 0{,}058$ W/mK.

Examples of the thermal resistance of Perinsul® HL blocks are given in this ETA, Annex III.

3.6.2 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 IV.

3.7 Aspects of durability

3.7.1 Durability

No performance assessed.

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, 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/EC[5] 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 7.

Table 7 – 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]
For uses subject to reaction to fire regulations	A1*, A2*, B*, C*	1
	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)

[5] 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, as foreseen in EAD 170018-00-0305

5.1 Tasks for the manufacturer

5.1.1 Factory production control (FPC)

The manufacturer shall set up a production control system at his factory and perform regular controls of the production process according to the control plan[6].

This ensures that the product shows the properties stated in this ETA.

The manufacturer may only use incoming materials according to the material data sheets. He shall control the incoming materials according to the provisions specified in the factory production control plan.

The results of the factory production control shall be recorded and evaluated. The records shall include at least the following information:

- Name of the product,
- Date of manufacturing of the product, batch N° if needed, and date of inspection or control of the product,
- Result of inspections or controls and, as far as applicable, comparison with the requirements,
- Signature of the person responsible for the factory production control.

The records shall be kept for at least five years. On request they shall be presented to UBAtc.

Details concerning extent, type and frequency of the tests or inspections to be performed within the scope of the factory production control shall correspond to the factory production control plan.

5.2 Tasks for the Notified Body

5.2.1 Assessment of the construction product

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

These assessment results should be used for the purposes of assessment of the performance of the construction product in accordance with Regulation (EU) N° 305/2011, Annex V, clause 1.6.

5.2.2 Initial inspection and continuous surveillance of the factory production

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.

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 by UBAtc asbl, in Sint-Stevens-Woluwe, on the basis of the technical work carried out by the Assessment Operator, BCCA.

On behalf of UBAtc asbl,

Eric Winnepenninckx
secretary general

Benny De Blaere,
director

On behalf of the Assessment Operator,
Buildwise and SECO Belgium, responsible for the technical content of the ETA,

Olivier Vandooren,
CEO Buildwise

Bernard Heiderscheidt,
CEO SECO Belgium

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

[6] The control plan is a confidential part of the technical file and deposited with UBAtc and contains the required information on the factory production control and on the initial type-testing.

Annexes

Annex I : References

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 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 13167	Thermal insulation products for buildings - Factory made cellular glass (CG) products – Specification
EN ISO 6946	Building components and building elements - Thermal resistance and thermal transmittance - Calculation methods
EN ISO 10211	Thermal bridges in building construction - Heat flows and surface temperatures - Detailed calculations
EN ISO 10456	Building materials and products - Hygrothermal properties -Tabulated design values and procedures for determining declared and design thermal values
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 14683	Thermal bridges in building construction - Linear thermal transmittance - Simplified methods and default values

NOTE: The editions of reference documents given above are those which have been adopted by the UBAtc for its specific use when establishing this ETA. When new editions become available, these supersede the editions mentioned only when confirmed by the UBAtc.

Annex II: Possible applications of Perinsul® HL

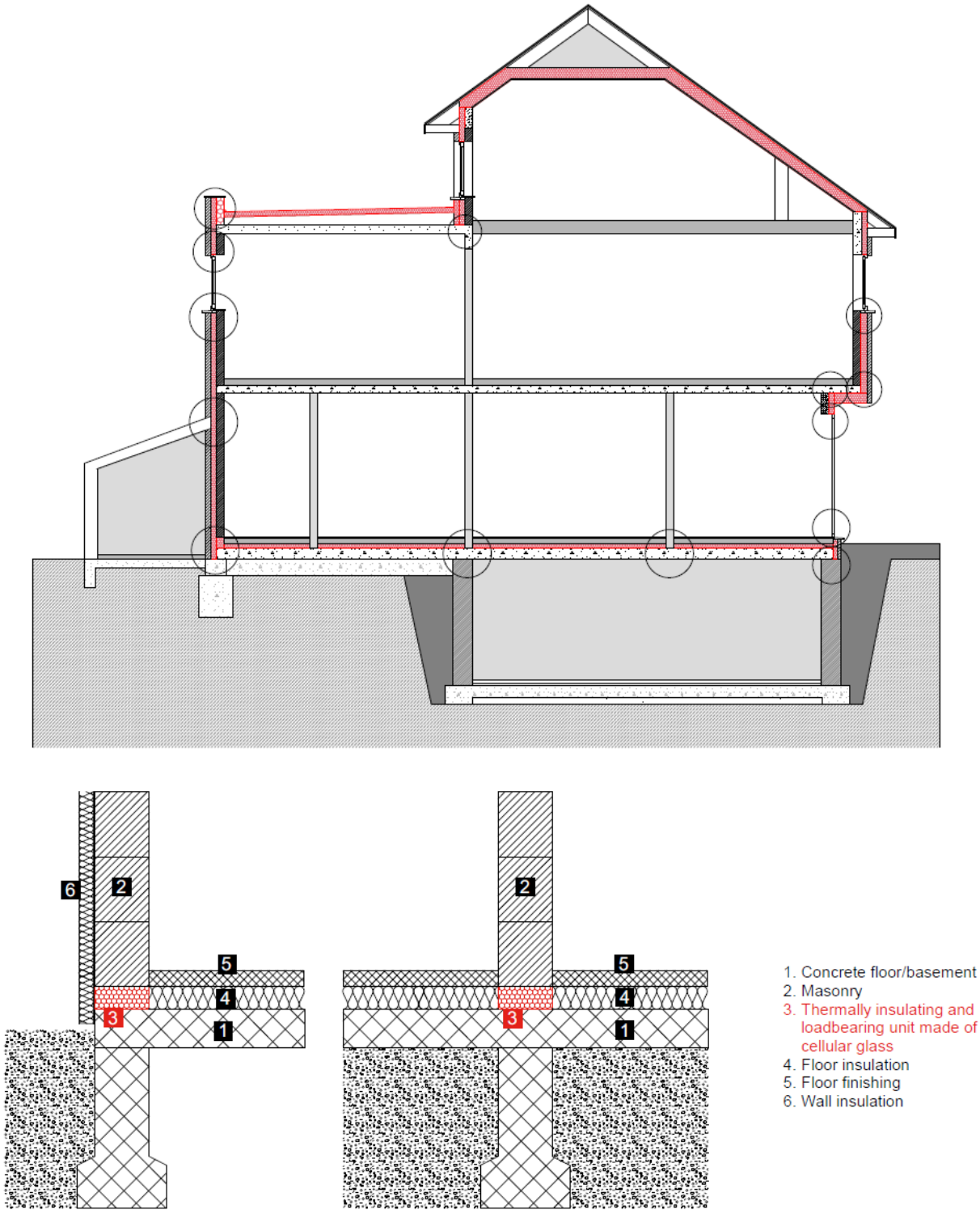
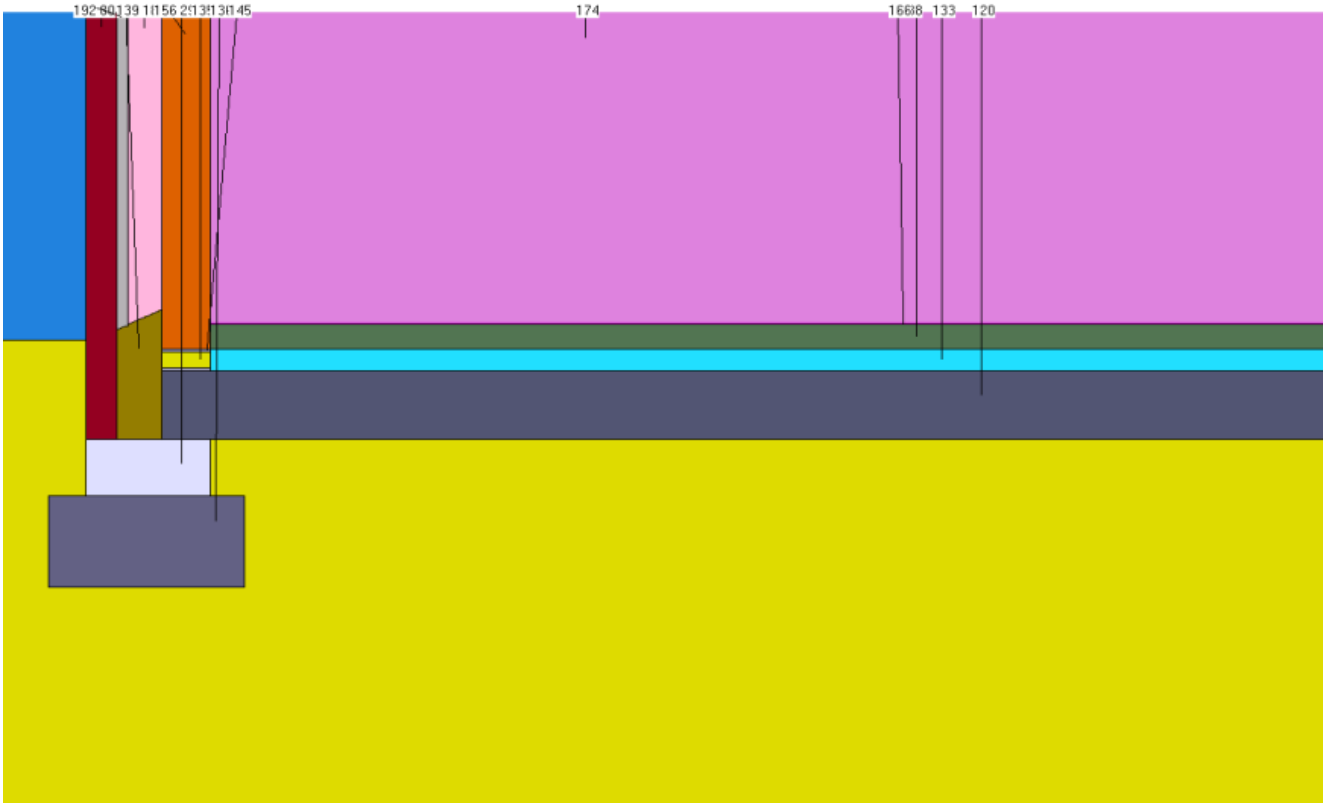


Figure 1: Example of the application of the thermally-insulating and loadbearing units of cellular glass

Annex III: Thermal resistance Perinsul® HL – Standard length 450 mm

Thickness (mm)	Width (mm)	R_{Dvert} (m.K/W)	R_{Dhor} (m.K/W)	Thickness (mm)	Width (mm)	R_{Dvert} (m.K/W)	R_{Dhor} (m.K/W)
50	90	0,85	1,55	100	100	1,70	1,70
50	110	0,85	1,90	100	140	1,70	2,40
50	115	0,85	1,95	100	190	1,70	3,25
50	140	0,85	2,40	100	215	1,70	3,70
50	175	0,85	3,00	115	115	1,95	1,95
50	190	0,85	3,25	115	175	1,95	3,00
50	240	0,85	4,10	115	240	1,95	4,10
50	300	0,85	5,15	120	140	2,05	2,40
65	100	1,10	1,70	120	175	2,05	3,00
65	140	1,10	2,40	120	190	2,05	3,25
65	215	1,10	3,70	120	240	2,05	4,10

Annex IV: Thermal linear transmittance – Example roof construction



Wall U_{max}	Roof U_{max}	Floor U_{max}	Floor R_{min}
0,4	0,3	0,4	1
0,4	0,3	0,4	1
0,32	0,27	0,35	1,3
0,32	0,27	0,35	1,3
0,24	0,24	0,3	1,75
0,24	0,24	0,3	1,75

Perinsul® HL Thickness (cm)	U-wall W/m².K	R-floor m².K/W	PSI (Ψ_e) W/m.K	f-factor	Min. temp. °C
5	0,361	1,28	-0,059	0,88	17,6
5	0,361	2,725	-0,0514	0,892	17,84
5	0,287	1,53	-0,0264	0,887	17,74
5	0,287	3,07	-0,023	0,897	17,94
5	0,22	2,018	-0,007	0,898	17,96
5	0,22	3,76	-0,0056	0,907	18,14
Outside temperature 0 °C			Inside temperature 20 °C		