EUROPEAN ASSESSMENT DOCUMENT

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POLYSTYRENE CONCRETE MASONRY UNITS AND WALL KITS MADE FROM THE UNITS

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This European Assessment Document (EAD) has been developed taking into account up-to-date technical and scientific knowledge at the time of issue and is published in accordance with the relevant provisions of Regulation (EU) No 305/2011 as a basis for the preparation and issuing of European Technical Assessments (ETA).

Contents

1 SCOPE OF THE EAD

1.1 Description of the construction product

This EAD specifies assessment methods for polystyrene concrete masonry units and also for wall kits made from the units.

The polystyerene concrete masonry units can be assessed separately so that they can be made available on the market on its own.

The wall kits are not preassembled, the manufacturer just supplies components of the kit accompanied by instructions on how to assemble them.

1.1.1 Polystyrene concrete masonry units

Factory made polystyrene concrete masonry units are made from new EPS beads or recycled EPS granules, cement to EN 197-1[1], additives such as plasticizers, fire retardants, accelerators/retarders and water. The polystyrene concrete units are common masonry units and they are solid without any voids. The polystyrene concrete has an apparent density of 300 kg/m^3 ± 50 kg/m^3 to EN 1602.

Dimensions of the units:

- length (a): up to 700 mm

- width (b): up to 500 mm

- height (c): up to 350 mm

Example shapes of the polystyrene concrete masonry units and interpretation of dimensions are shown in Annex A.

The product is not fully covered by harmonised European standard EN 771-3 as the following essential characteristics and their assessment methods are not covered:

- compressive creep
- deformation under specified load and temperature conditions,
- dimensional stability under specified temperature conditions.

It can be noted that the definition of lightweight aggregate in EN 206 refers to mineral origin as opposed to organic material like EPS.

1.1.2 Wall kits made from polystyrene concrete masonry units

Minimum components of the wall kit:

- polystyrene concrete masonry units as described in Clause 1.1.1

- polyurethane (PUR) foam adhesive in horizontal and vertical joints

Optional components of the wall kit:

- glass fibre mesh plaster and render reinforcement to EAD 040016-00-0404 on each side

- thin gypsum plaster to EN 13279-1 on internal surfaces

- thin render to EN 15824 on external surfaces

The components shall be described in detail in the ETA.

[1] All undated references to standards or to EADs in this EAD are to be understood as references to the dated versions listed in Chapter 4.

Example vertical sections of the wall kits are shown in Annex B.

The product is not covered by a harmonised European standard (hEN).

1.1.3 Packaging, transport, storage, maintenance, replacement, repair and installation

Concerning product packaging, transport, storage, maintenance, replacement and repair it is the responsibility of the manufacturer to undertake the appropriate measures and to advise his clients on the transport, storage, maintenance, replacement and repair of the product as he considers necessary.

It is assumed that the product will be installed according to the manufacturer's instructions or (in absence of such instructions) according to the usual practice of the building professionals.

Relevant manufacturer's stipulations having influence on the performance of the product covered by this European Assessment Document shall be considered for the determination of the performance and detailed in the ETA.

1.2 Information on the intended uses of the construction product

1.2.1 Intended uses

Intended uses of the polystyrene concrete masonry units and the wall kits made from the units:

- internal or external load bearing walls (up to one floor level and a wall height of 3 m) or

- internal or external non-load bearing walls as an infill structure in a load bearing frame or as an internal non-load bearing partition.

In end use conditions the faces of the polystyrene concrete masonry units are not left visible and are not directly exposed to external climatic conditions. They are not in direct contact with indoor air either.

1.2.2 Working life/Durability

The assessment methods included or referred to in this EAD have been written based on the manufacturer's request to take into account a working life of the polystyrene concrete masonry units and wall kits made from the units for the intended use of internal or external load bearing or non-load bearing walls of 50 years when installed in the works. These provisions are based upon the current state of the art and the available knowledge and experience.

When assessing the product the intended use as foreseen by the manufacturer shall be taken into account. The real working life may be, in normal use conditions, considerably longer without major degradation affecting the basic requirements for works[2].

The indications given as to the working life of the construction product cannot be interpreted as a guarantee neither given by the product manufacturer or his representative nor by EOTA when drafting this EAD nor by the Technical Assessment Body issuing an ETA based on this EAD, but are regarded only as a means for expressing the expected economically reasonable working life of the product.

[2] The real working life of a product incorporated in a specific works depends on the environmental conditions to which that works is subject, as well as on the particular conditions of the design, execution, use and maintenance of that works. Therefore, it cannot be excluded that in certain cases the real working life of the product may also be shorter than referred to above.

1.3 Specific terms used in this EAD

For the purpose of this document the following symbols apply.

1.3.1 Symbols

b	thickness of polystyrene concrete masonry without plastering and rendering [m]
c	height of polystyrene concrete masonry units [mm]
d_p	thickness of the internal plaster [m]
d_r	thickness of the external render [m]
d_s	thickness of test specimens for compressive creep test [mm]
f_{cm}	mean compressive strength of polystyrene concrete masonry units [N/mm^2]
f_{ck}	characteristic compressive strength of polystyrene concrete masonry units [N/mm^2]
f_k	characteristic compressive strength of polystyrene concrete masonry [N/mm^2]
f_{xk}	characteristic flexural strength of polystyrene concrete masonry [N/mm^2]
f_{vko}	characteristic initial shear strength of polystyrene concrete masonry [N/mm^2]
$f_{vko,long}$	characteristic long-term shear strength of polystyrene concrete masonry [N/mm^2]
f_u	mass-related moisture conversion coefficient [-]
m_{dry}	mass of dry test specimens [kg]
$m_{23,50}$	mass of test specimens conditioned at (23 ± 2) °C and (50 ± 5) % relative humidity [kg]
n	number of horizontal joints when compressive creep of masonry is calculated expressed as an integer
$\Delta l_c/l$	total movement coefficient of polystyrene concrete masonry units when tested for dimensional stability (moisture movement) [mm/m]
u_1	moisture content mass by mass of the first set of conditions with a default value of 0 [-]
u_2	moisture content mass by mass of the second set of conditions with a default value of 0,05 [-]
u_{dry}	moisture content mass by mass of dry test specimens with a value of 0 [-]
$u_{23,50}$	moisture content mass by mass of test specimens conditioned at (23 ± 2) °C and (50 ± 5) % relative humidity [-]
t_{so}	immersion time for polystyrene concrete masonry units when tested for water absorption [min]
E	mean secant modulus of elasticity of polystyrene concrete masonry [N/mm^2]
F_m	moisture conversion factor [-]
H_{mas}	initial height of polysyterene concrete masonry before loading used in compressive creep calculations [mm]

H_{max}	maximum height of the polystyrene concrete masonry with a default value of 3000 mm [mm]
R_{mas}	thermal resistance of polystyrene concrete masonry without plastering and rendering [m^2K/W]
$R_{10,dry,mas}$	thermal resistance of polystyrene concrete masonry without plastering and rendering at an average temperature of 10ºC in dry state [m^2K/W]
R_{si}	internal surface resistance of polystyrene concrete masonry with plastering [m^2K/W]
R_{se}	external surface resistance of polystyrene concrete masonry with rendering [m^2K/W]
R_{wall}	thermal resistance of polystyrene concrete masonry with plastering and rendering [m^2K/W]
$R_w(C;C_{tr})$	weighted airborne sound insulation index of masonry [dB]
U_{wall}	thermal transmittance of polystyrene concrete masonry with plastering and rendering [W/m^2K]
$X_{ct,50y}$	compressive creep of polystyrene concrete masonry units extrapolated to 50 years [mm]
$X_{t,50y}$	total deformation of polystyrene concrete masonry units under creep extrapolated to 50 years [mm]
$X_{mas,ct,50y}$	compressive creep of polystyrene concrete masonry extrapolated to 50 years for the whole wall height [mm]
$X_{units,ct,50y}$	summarised compressive creep of polystyrene concrete masonry units extrapolated to 50 years for the whole wall height [mm]
$X_{PUR,ct,50y}$	summarised compressive creep of PUR foam adhesive extrapolated to 50 years for the whole wall height [mm]
$X_{mas,t,50y}$	total deformation of polystyrene concrete masonry extrapolated to 50 years for the whole wall height [mm]
$X_{units,t,50y}$	summarised total deformation of polystyrene concrete masonry units extrapolated to 50 years for the whole wall height [mm]
$X_{PUR,t,50y}$	summarised total deformation of PUR foam adhesive extrapolated to 50 years for the whole wall height [mm]
β_{mean}	mean value of the bond strength between polystyrene concrete masonry units and PUR foam adhesive [MPa]
ε_0	initial relative deformation of polystyrene concrete masonry units when tested for compressive creep [%]
$\varepsilon_{ct,50y}$	relative compressive creep of polystyrene concrete masonry units extrapolated to 50 years [%]
$\varepsilon_{t,50y}$	relative total deformation of polystyrene concrete masonry units under creep extrapolated to 50 years [%]
$\varepsilon_{ct,50y,units}$	relative compressive creep of polystyrene concrete masonry units extrapolated to 50 years, equivalent to $\varepsilon_{ct,50y}$ [%]
$\varepsilon_{ct,50y,PUR}$	relative compressive creep of PUR foam adhesive extrapolated to 50 years determined in accordance with EN 1606 [%]

$\varepsilon_{t,50y,units}$	relative total deformation of polystyrene concrete masonry units extrapolated to 50 years, equivalent to $\varepsilon_{t,50y}$ [%]
$\varepsilon_{t,50y,PUR}$	relative total deformation of PUR foam adhesive extrapolated to 50 years determined in accordance with EN 1606 [%]
$\lambda_{10,dry}$	thermal conductivity of polystyrene concrete material in dry state at an average temperature of 10°C [W/mK]
$\lambda_{10,dry,unit}$	thermal conductivity of polystyrene concrete masonry units in dry state at an average temperature of 10°C [W/mK]
$\lambda_{10,(23,50)}$	thermal conductivity of test specimens conditioned at (23 ± 2) °C and (50 ± 5) % relative humidity [W/mK]
μ	water vapour diffusion resistance factor of polystyrene concrete masonry units [-]
$\rho_{g,u}$	gross dry density of polystyrene concrete masonry units [kg/m^3]
σ_c	compressive stress at which compressive creep tests of polystyrene concrete masonry units are carried out [N/mm^2]
$Ø_{c,50y}$	compressive creep coefficient of polystyrene concrete masonry units for 50 years [-]

2 ESSENTIAL CHARACTERISTICS AND RELEVANT ASSESSMENT METHODS AND CRITERIA

2.1 Essential characteristics of the product

Table 2.1.1 shows how the performance of polystyrene concrete masonry units are assessed in relation to the essential characteristics.

Table 2.1.2 shows how the performance of wall kits made from polystyrene concrete masonry units are assessed in relation to the essential characteristics.

Table 2.1.1 Essential characteristics of polystyrene concrete masonry units and methods and criteria for assessing the performance of the product in relation to those essential characteristics

No	Essential characteristic	Assessment method	Type of expression of product performance
Basic Works Requirement 1: Mechanical resistance and stability (for load bearing use)			
1	Compressive strength	2.2.1.1	Level f_{cm} or f_{ck} [N/mm^2]
2	Compressive creep	2.2.1.2	Level $\varepsilon_{ct,50y}$, $\varepsilon_{t,50y}$ [%], $Ø_{c,50y}$ [-]
3	Deformation under specified load and temperature conditions	2.2.1.3	Level [%]
Basic Works Requirement 2: Safety in case of fire			
4	Reaction to fire	2.2.1.4	Class
Basic Works Requirement 3: Hygiene, health and the environment			
5	Water vapour permeability	2.2.1.5	Level μ [-]
6	Water absorption (by capillarity)	2.2.1.6	Level [g/m^{2}s]
7	Dimensional stability (moisture movement)	2.2.1.7	Level $\Delta l_c/l$ [mm/m]
8	Content, emission and/or release of dangerous substances	2.2.1.8	--
	- Chromium VI	2.2.1.8.1	Level
	- Hexabromo-cyclododecane (HBCDD)	2.2.1.8.2	Level
	- SVOC and VOC	2.2.1.8.3	Description
Basic Works Requirement 4: Safety and accessibility in use			
9	Dimensions and dimensional tolerances	2.2.1.9	Level Dimensions [mm] Tolerance category

No	Essential characteristic	Assessment method	Type of expression of product performance
10	Configuration	in accordance with hEN 771-3, clause 5.3.1	Description
11	Gross (dry) density	2.2.1.10	Level $\rho_{g,u}$ [kg/m^3]
12	Dimensional stability under specified temperature conditions	2.2.1.11	Level [%]
Basic Works Requirement 6: Energy economy and heat retention			
13	Thermal resistance (thermal properties)	2.2.1.12	Level $\lambda_{10,dry,unit}$ [W/mK], f_u
Aspects of durability			
14	Durability against freeze/thaw	in accordance with hEN 771-3, clause 5.14	Description

Table 2.1.2 Essential characteristics of wall kits made from polystyrene concrete masonry units and methods and criteria for assessing the performance of the product in relation to those essential characteristics

No	Essential characteristic	Assessment method	Type of expression of product performance
Basic Works Requirement 1: Mechanical resistance and stability (for load bearing use)			
1	Compressive strength	2.2.2.1	Level f_k [N/mm^2]
2	Secant modulus of elasticity	2.2.2.2	Level E [N/mm^2]
3	Compressive creep	2.2.2.3	Level $X_{mas,ct,50y}$ [mm], $X_{mas,t,50y}$ [mm], $\varepsilon_{mas,ct,50y}$ [%], $\varepsilon_{mas,t,50y}$ [%]
4	Flexural strength	2.2.2.4	Level f_{xk} [N/mm^2]
5	Initial shear strength	2.2.2.5	Level f_{vko} [N/mm^2]
6	Long-term shear strength	2.2.2.6	Level $f_{vk,long}$ [N/mm^2]
Basic Works Requirement 2: Safety in case of fire			
7	Reaction to fire	2.2.2.7	Class
8	Resistance to fire	2.2.2.8	Class
Basic Works Requirement 3: Hygiene, health and the environment			
9	Risk of interstitial condensation	2.2.2.9	Description

No	Essential characteristic	Assessment method	Type of expression of product performance
Basic Works Requirement 4: Safety and accessibility in use			
10	Resistance to damage from soft body and hard body impact load	2.2.2.10	Level [J]
11	Bond strength between polystyrene concrete masonry units and PUR adhesive	2.2.2.11	Level β_{mean} [MPa]
Basic Works Requirement 5: Protection against noise			
12	Airborne sound insulation	2.2.2.12	Level $R_w(C;C_{tr})$ [dB]
Basic Works Requirement 6: Energy economy and heat retention			
13	Thermal resistance and thermal transmittance	2.2.2.13	Level R_{mas}, R_{wall} [m^2K/W]; U_{wall} [W/m^2K]

2.2 Methods and criteria for assessing the performance of the product in relation to essential characteristics of the product

This chapter is intended to provide instructions for TABs. Therefore, the use of wordings such as “shall be stated in the ETA” or “it has to be given in the ETA” shall be understood only as such instructions for TABs on how results of assessments shall be presented in the ETA. Such wordings do not impose any obligations for the manufacturer and the TAB shall not carry out the assessment of the performance in relation to a given essential characteristic when the manufacturer does not wish to declare this performance in the Declaration of Performance.

Testing will be limited only to the essential characteristics which the manufacturer intends to declare. If for any components covered by harmonised standards or European Technical Assessments the manufacturer of the component has included the performance regarding the relevant characteristic in the Declaration of Performance, retesting of that component for issuing the ETA under the current EAD is not required.

2.2.1 Polystyrene concrete masonry units

2.2.1.1 Compressive strength

The compressive strength shall be tested in accordance with EN 772-1.
To eliminate protuberances or indentations on the load bearing surface of the polystyrene concrete masonry units or for polystyrene concrete masonry units with a length (a) $\geq$ 500 mm, the specimens shall be cut from the units.
Conditioning shall be done in accordance with section 7.3.2(a) of EN 772-1 (air dry condition).
The performance level can be given as either the characteristic (f_{ck}) or the mean (f_{cm}) compressive strength value in accordance with EN 771-3 and it shall be indicated in the ETA.

2.2.1.2 Compressive creep

The compressive creep of the polystyrene concrete material of which the units are made shall be tested to EN 1606.
The specimens shall be squarely cut from the units with a dimension of 300 x 300 mm. At least three specimens shall be used for each of compressive stress levels. The specimens shall be conditioned for at least 24 h under the test conditions ((23$\pm$2)°C, (50$\pm$5)% relative humidity).

The tests shall be carried out at least at the following stress levels:
$\sigma_c = 0{,}15 \times f_{cm}$
$\sigma_c = 0{,}25 \times f_{cm}$
$\sigma_c = 0{,}35 \times f_{cm}$
where,

f_{cm} is the mean compressive strength as given in Clause 2.2.1.1.

The test time shall be at least 608 days to extrapolate the test results to 50 years. Extrapolation shall be done in accordance with Annex A of EN 1606 provided that linear regression analysis according to formula A.2 of EN 1606 fits with a coefficient of determination $r^2 \geq 0{,}90$. Otherwise general rules laid down in A.1 of EN 1606 shall be followed.

Relative compressive creep, $\varepsilon_{ct,50y}$, and relative total deformation, $\varepsilon_{t,50y}$, for 50 years as a percentage shall be calculated as follows:

$$\varepsilon_{ct,50y} = \frac{X_{ct,50y}}{d_S}\ x\ 100 \quad (1)$$

$$\varepsilon_{t,50y} = \frac{X_{t,50y}}{d_S}\ x\ 100 \quad (2)$$

where

$X_{ct,50y}$ is the compressive creep as defined in section 3.5 of EN 1606 extrapolated to 50 years, in mm,
$X_{t,50y}$ is the total deformation extrapolated to 50 years, in mm,
d_S is the thickness of the test specimen as defined in 3.1 of EN 1606, in mm.

Relative compressive creep, $\varepsilon_{ct,50y}$, and relative total deformation, $\varepsilon_{t,50y}$, extrapolated to 50 years as percentages shall be given in the ETA along with the corresponding stress levels the compressive creep tests are carried out at.

Compressive creep properties of the polystyrene concrete material is representative for the whole unit as it is solid and homogeneous.

Compressive creep coefficient for 50 years, $Ø_{c,50y}$, for a given compressive stress level can be calculated as follows:

$$\emptyset_{c,50y} = \frac{\varepsilon_{ct,50y}}{\varepsilon_0} \quad (3)$$

where,

$\varepsilon_{ct,50y}$ is the relative compressive creep for 50 years as given above, and
ε_0 is the initial relative deformation belonging to the initial deformation of X_0 as defined in section 3.5 of EN 1606.

Compressive creep coefficient for 50 years, $Ø_{c,50y}$, shall also be given in the ETA along with the corresponding stress level.

2.2.1.3 Deformation under specified load and temperature conditions

The deformation under specified load and temperature conditions of the polystyrene concrete material of which the units are made shall be tested in accordance with EN 1605. The sizes of the test specimens shall be 70 x 70 x 50 mm. Set of test conditions 2 shall be applied in accordance with section 7.2 of EN 1605 (40 kPa, 23°C/48h, 70°C/168h).
The deformation of the polystyrene concrete material is representative for the whole unit as it is solid and homogeneous. The level of performance shall be stated in the ETA.

2.2.1.4 Reaction to fire

The polystyrene concrete masonry units shall be tested according to the method(s) referred to in EN 13501-1 and relevant for the corresponding reaction to fire class. The product shall be classified according to the Commission Delegated Regulation (EU) No 2016/364.

Mounting and fixing conditions for SBI test to EN 13823 and product parameters to be considered for reaction to fire are given in Annex D.
The reaction to fire class shall be stated in the ETA.

2.2.1.5 Water vapour permeability

The water vapour permeability of the polystyrene concrete material of which the units are made shall be tested in accordance with EN 12086. The thickness of the test specimens shall be 50 mm. Set of test conditions B shall be applied in accordance with section 7.1 of EN 12086 (23-0/85).
The water vapour permeability of the polystyrene concrete material is representative for the whole unit as it is solid and homogeneous. The level of performance as the water vapour diffusion resistance factor, μ, shall be stated in the ETA.

2.2.1.6 Water absorption (by capillarity)

The water absorption by capillarity shall be tested in accordance with section 5.8 of EN 771-3. Drying temperature shall be 70 ± 5ºC in accordance with section 6.2 of EN 772-11. The immersion time, t_{so}, shall be $(10 \pm 0{,}2)$ min. Coefficient of water absorption shall be calculated in accordance with section 8.1 of EN 772-11.
The level of performance shall be stated in the ETA.

2.2.1.7 Dimensional stability (moisture movement)

The moisture movement shall be tested in accordance with section 5.9 of EN 771-3 and the level of performance as the total movement coefficient ($\Delta l_c/l$) in accordance with section 9 of EN 772-14 shall be stated in the ETA.

2.2.1.8 Content, emission and/or release of dangerous substances

The performance of the product related to the emissions and/or release and, where appropriate, the content of dangerous substances will be assessed on the basis of the information provided by the manufacturer[3] after identifying the release scenarios -taking into account the intended use of the product and the Member States where the manufacturer intends his product to be made available on the market.
The identified intended release scenarios for this product and intended use with respect to dangerous substances are:

IA2: Product with indirect contact to indoor air (e.g., covered products) but possible impact on indoor air

S/W3: Product with no contact to soil, ground- and surface water

2.2.1.8.1 Content of Chromium VI

The content of Chromium VI of the cement shall be tested in accordance with EN 196-10.

The content of Chromium VI shall be stated in the ETA.

2.2.1.8.2 Content of Hexabromocyclododecane (HBCDD)

The content of Hexabromocyclododecane (HBCDD) of the EPS granules shall be tested in accordance with Annex B of EAD 040635-00-1201.

The content of HBCDD shall be stated in the ETA.

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3 The manufacturer may be asked to provide to the TAB the REACH related information which he must accompany the DoP with (cf. Article 6(5) of Regulation (EU) No 305/2011).
The manufacturer is **not** obliged:
- to provide the chemical constitution and composition of the product (or of constituents of the product) to the TAB, or
- to provide a written declaration to the TAB stating whether the product (or constituents of the product) contain(s) substances which are classified as dangerous according to Directive 67/548/EEC and Regulation (EC) No 1272/2008 and listed in the "Indicative list on dangerous substances" of the SGDS.

Any information provided by the manufacturer regarding the chemical composition of the products may not be distributed to EOTA or to TABs.

2.2.1.8.3 SVOC and VOC

For the intended use covered by the release scenario IA2 semi-volatile organic compounds (SVOC) and volatile organic compounds (VOC) shall be determined in accordance with EN 16516. The loading factor used for emission testing shall be 1,0 m^2/m^3.

The preparation of the test specimen is performed by using a representative sample of the product installed in accordance with the manufacturer's product installation instructions or in absence of such instructions the usual practice of the product installation. The size of the test specimen has to be chosen in consideration of the test chamber size and the intended loading factor (see above).

Once the test specimen has been produced, as described above, it should immediately be placed in the emission test chamber. This time is considered the starting time of the emission test.

The test results have to be reported for the relevant parameters (e.g. chamber size, temperature and relative humidity, air exchange rate, loading factor, size of test specimen, conditioning, production date, arrival date, test period, test result) after 3 and/or 28 days testing.

The product performance shall be expressed in [$\mu g/m^3$ or mg/m^3] and stated in the ETA.

2.2.1.9 Dimensions and dimensional tolerances

The dimensions and dimensional tolerances for unit length, width and height shall be determined in accordance with clauses 5.2.1 and 5.2.2.1 of EN 771-3 respectively and the level of performance as dimensions and a tolerance category as described in Table 1 of EN 771-3 shall be stated in the ETA.

Where relevant, height and positions of protuberances or indentations on the top of the units and also depth and positions of recesses on the bottom of units shall also be measured. Measurements shall be carried out at three separate positions for each type of protuberance, indentation or recess. The dimensional tolerances shall be given in the ETA.

The flatness of bed faces shall be determined in accordance with section 5.2.2.2 of EN 771-3 and the level of performance as the maximum deviation from flatness of the bed faces shall be stated in the ETA.

2.2.1.10 Gross (dry) density

The gross dry density shall be tested in accordance with section 5.4.1 of EN 771-3.
Drying temperature shall be 70$\pm$5ºC in accordance with section 5.2 of EN 772-13.
The level of performance as gross dry density ($\rho_{g,u}$) in accordance with section 7.3 of EN 772-13 shall be stated in the ETA.

2.2.1.11 Dimensional stability under specified temperature conditions

The deformation under specified temperature and humidity conditions of the polystyrene concrete material of which the units are made shall be tested in accordance with EN 1604. The test shall be carried out at 70$\pm$2°C with an exposure duration of 48$\pm$1 h.

The deformation of the polystyrene concrete material is representative for the whole unit as it is solid and homogeneous. The level of performance shall be stated in the ETA.

2.2.1.12 Thermal resistance (thermal properties)

Thermal conductivity

The thermal conductivity of the polystyrene concrete material ($\lambda_{10,dry}$) of which the units are made shall be tested in accordance with EN 12667.
The heat flow meter measurement shall be used with one test specimen. The minimum size of the test specimen shall be 300 x 300 mm with a corresponding measured area of 100 x 100 mm.
To determine $\lambda_{10,dry}$ see also Annex E, test conditions set 1.

The thermal conductivity of the polystyrene concrete masonry units ($\lambda_{10,dry,unit}$) can be taken as the thermal conductivity of the polystyrene concrete material ($\lambda_{10,dry}$) since the units are solid and homogenous.

The level of performance as a $\lambda_{10,dry,unit}$ mean value shall be stated in the ETA.

Mass-related moisture conversion coefficient (f_u)

The mass-related moisture conversion coefficient, f_u, shall be determined in accordance with Annex E and stated in the ETA.

2.2.2 Wall kits made from polystyrene concrete masonry units

General

The test specimens for the assessment of compressive strength, secant modulus of elasticity, flexural strength, initial shear strength, long-term shear strength, resistance to damage from soft body and hard body impact load and airborne sound insulation shall be conditioned and made as follows.

The test specimens shall be conditioned for at least 24 h under (23±2)°C and (50±5)% relative humidity before testing. The polysyterene concrete masonry units shall be bonded together with the PUR foam adhesive. Before applying the PUR foam adhesive, the units shall be wetted with water spray and any dust from the surfaces to be bonded shall be removed. PUR foam adhesive shall be placed in both horizontal and vertical joints with a thickness of 5-8 mm by continuous pumping 1-3 cm from the edge of the polystyrene concrete masonry units and also in both diagonal directions. The polystyrene concrete masonry units shall be bonded together immediately after the PUR foam adhesive is applied with staggered vertical joints. Any gripping grooves, holes, joints shall also be filled with the PUR foam adhesive.

2.2.2.1 Compressive strength

The compressive strength shall be determined in accordance with EN 1052-1.
The characterstic compressive strength, f_k, shall be determined in accordance with EN 1052-1, section 10.2(a), equation (3).

The test specimens shall be conditioned and made in accordance with general part of Clause 2.2.2.

The level of performance as characteristic compressive strength of the masonry, f_k, shall be stated in the ETA as described in EN 1052-1.

2.2.2.2 Secant modulus of elasticity

The secant modulus of elasticity shall be determined in accordance with EN 1052-1.

The test specimens shall be conditioned and made in accordance with general part of Clause 2.2.2.

The level of performance as mean secant modulus of elasticity of the masonry, E, shall be stated in the ETA as described in EN 1052-1.

2.2.2.3 Compressive creep

Compressive creep of the masonry shall be assessed based on the compressive creep properties of the polystyrene concrete masonry unit as given in Clause 2.2.2.2 and the compressive creep properties of the PUR foam adhesive.

The compressive creep, $X_{mas,ct,50y}$, for 50 years of the masonry, in mm, shall be calculated as follows:

$$X_{mas,ct,50y} = X_{units,ct,50y} + X_{PUR,ct,50y} \quad (4)$$

where

$X_{units,ct,50y}$ is the summarised compressive creep for 50 years of polystyrene concrete masonry units, in mm,

$X_{PUR,ct,50y}$ is the summarised compressive creep for 50 years of PUR foam adhesive, in mm.

The compressive creep, $X_{units,ct,50y}$, for 50 years of polystyrene concrete masonry units, in mm, can be calculated as follows:

$$X_{units,ct,50y} = (\varepsilon_{ct,50y,units} / 100) \times n \times c \quad (5)$$

where

$\varepsilon_{ct,50y,units}$	is the relative compressive creep for 50 years of the units in percentage and can be taken as $\varepsilon_{ct,50y}$ as described in Clause 2.2.1.2,
n	is the number of horizontal joints of the masonry assessed,
c	is the height of the units as given in Clause 2.2.1.8., in mm.

The compressive creep, $X_{PUR,ct,50y}$, for 50 years of PUR foam adhesive, in mm, can be calculated as follows:

$$X_{PUR,ct,50y} = (\varepsilon_{ct,50y,PUR} / 100) \times n \times t \quad (6)$$

where

$\varepsilon_{ct,50y,PUR}$	is the relative compressive creep for 50 years of the PUR foam adhesive in percentage determined in accordance with EN 1606,
n	is the number of horizontal joints of the masonry assessed,
t	is the initial thickness of the PUR foam adhesive horizontal joints, in mm.

Test specimens of the PUR foam adhesive for the compressive creep tests shall be made in accordance with section 5.1 of EN 14315-1. The specimens shall be conditioned for at least 16 h under the test conditions ((23±2)°C, (50±5)% relative humidity).

Stress levels for which $\varepsilon_{ct,50y,units}$ and $\varepsilon_{ct,50y,PUR}$ are determined must be the same.

The total deformation, $X_{mas,t,50y}$, for 50 years of the masonry, in mm, shall be calculated as follows:

$$X_{mas,t,50y} = X_{units,t,50y} + X_{PUR,t,50y} \quad (7)$$

where

$X_{units,t,50y}$	is the summarised total deformation for 50 years of polystyrene concrete masonry units, in mm
$X_{PUR,t,50y}$	is the summarised total deformation for 50 years of PUR foam adhesive, in mm

The total deformation, $X_{units,t,50y}$, for 50 years of polystyrene concrete masonry units, in mm, can be calculated as follows:

$$X_{units,t,50y} = (\varepsilon_{t,50y,units} / 100) \times n \times c \quad (8)$$

where

$\varepsilon_{t,50y,units}$	is the relative total deformation for 50 years of the units in percentage and can be taken as $\varepsilon_{t,50y}$ as described in Clause 2.2.1.2,
n	is the number of horizontal joints of the masonry assessed,
c	is the height of the units as given in Clause 2.2.1.8., in mm.

The total deformation, $X_{PUR,t,50y}$, for 50 years of PUR foam adhesive, in mm, can be calculated as follows:

$$X_{PUR,t,50y} = (\varepsilon_{t,50y,PUR} / 100) \times n \times t \quad (9)$$

where

$\varepsilon_{t,50y,PUR}$	is the relative total deformation for 50 years of the PUR foam adhesive in percentage determined in accordance with EN 1606,
n	is the number of horizontal joints of the masonry assessed,
t	is the initial thickness of the PUR foam adhesive horizontal joints, in mm.

Test specimens of the PUR foam adhesive for the total deformation tests shall be made in accordance with section 5.1 of EN 14315-1. The specimens shall be conditioned for at least 16 h under the test conditions ((23±2)°C, (50±5)% relative humidity).

Stress levels for which $\varepsilon_{t,50y,units}$ and $\varepsilon_{t,50y,PUR}$ are determined must be the same.

The number of horizontal joints, n, shall be calculated as follows:

$$n = H_{max} / c \quad (10)$$

where

H_{max}	is the maximum height of the masonry and shall be taken as a default value of 3000 mm
c	is the height of the units as given in Clause 2.2.1.8., in mm.

The value of n must be rounded down to an integer.

The initial height of masonry assessed, H_{mas}, shall be calculated, in mm, as follows:

$$H_{mas} = n \times c \quad (11)$$

where

n	is the number of horizontal joints of the masonry assessed,
c	is the height of the units as given in Clause 2.2.1.8., in mm.

Relative compressive creep, $\varepsilon_{mas,ct,50y}$, and relative total deformation, $\varepsilon_{mas,t,50y}$, for 50 years for the masonry as a percentage shall be calculated as follows:

$$\varepsilon_{mas,ct,50y} = \frac{X_{mas,ct,50y}}{H_{mas}} \; x \; 100 \quad (12)$$

$$\varepsilon_{mas,t,50y} = \frac{X_{mas,t,50y}}{H_{mas}} \; x \; 100 \quad (13)$$

where

$X_{mas,ct,50y}$	is the compressive creep of the masonry for 50 years, in mm, as given above,
$X_{mas,t,50y}$	is the total deformation of the masonry for 50 years, in mm, as given above,
H_{mas}	is the initial height of the masonry assessed, as given above.

Compressive creep, $X_{mas,ct,50y}$, total deformation, $X_{mas,t,50y}$, relative compressive creep, $\varepsilon_{mas,ct,50y}$, and relative total deformation, $\varepsilon_{mas,t,50y}$, for 50 years for the masonry shall be given in the ETA along with the corresponding stress levels the calculations were carried out at. The initial height of the masonry, H_{mas}, shall also be given.

2.2.2.4 Flexural strength

The flexural strength shall be determined in accordance with EN 1052-2.
The characteristic flexural strength shall be given both in the plane of failure perpendicular and parallel to the bed joints.
The number of specimens to be tested is five. The characteristic flexural strength of the masonry, f_{xk}, shall be determined in accordance with EN 1052-2, section 10(a).

The test specimens shall be conditioned and made in accordance with general part of Clause 2.2.2.

The level of performance as characteristic flexural strength of the masonry, f_{xk}, shall be stated in the ETA as described in EN 1052-2.

2.2.2.5 Initial shear strength

The initial shear strength shall be determined in accordance with EN 1052-3.
The test shall be done to section 8.2.2 of EN 1052-3, Procedure B, without prestressing. The characteristic initial shear strength of the masonry, f_{vko}, shall be determined in accordance with EN 1052-3, section 10.2.2.

The test specimens shall be conditioned and made in accordance with general part of Clause 2.2.2.

The level of performance as characteristic initial shear strength of the masonry, f_{vko}, shall be stated in the ETA as described in EN 1052-3.

2.2.2.6 Long-term shear strength

The long-term shear strength shall be determined in accordance with the test procedure given in EN 1052-3. Before testing accelerated aging shall be done by modifying the storage conditions of the samples to 60ºC temperature and 80% relative humidity for a time period of 168 hours.

The test shall be done in accordance with section 8.2.2 of EN 1052-3, Procedure B, without prestressing. The characteristic long-term shear strength of the masonry, $f_{vko,long}$, shall be determined in accordance with EN 1052-3, section 10.2.2.

The test specimens shall be conditioned and made in accordance with general part of Clause 2.2.2.

The level of performance as characteristic long-term shear strength of the masonry, $f_{vko,long}$, shall be stated in the ETA.

2.2.2.7 Reaction to fire

Reaction to fire of the whole kit shall be assessed either by considering the reaction to fire of the components, or by testing the whole wall kit in accordance with the relevant test method(s) to EN 13501-1 in order to be classified in accordance with Commission Delegated Regulation (EU) 2016/364.

Mounting and fixing conditions for SBI test to EN 13823 and product parameters to be considered for reaction to fire are given in Annex D.

When assessing the reaction to fire performance of the entire kit by consideration of the reaction to fire performance of the components, the relevant classes can be taken from their own DoP for the following components:
- glass wire mesh
- gypsum plaster in accordance with EN 13279-1
- render in accordance with EN 15824 and
- PU foam adhesive.

The reaction to fire class of the wall kit shall be stated in the ETA.

When the reaction to fire of the whole kit is determined by considering the components, it shall be based on the worst class of any component. In this case reaction to fire class of all components shall also be stated in the ETA.

2.2.2.8 Resistance to fire

The resistance to fire shall be tested in accordance with EN 1365-1 and EN 1364-1 for load bearing and non-load bearing use respectively and the walls shall be classified to EN 13501-2.
The resistance to fire class shall be stated in the ETA.

For load bearing applications, the load level to be applied during the fire test depends on the load bearing capacity of masonry which can vary and shall be estimated in each case. The load level applied (kN/m) along with the eccentricity set in the fire test shall also be given in the ETA for the corresponding resistance to fire class.

2.2.2.9 Risk of interstitial condensation

The risk of interstitial condensation shall be calculated in accordance with EN ISO 13788. The risk of condensation shall be given in the ETA as follows:
- the structure is free of interstitial condensation or
- condensation occurs but it is predicted to evaporate during the summer months.

The results of the calculation are affected by the internal and external humidity and temperature conditions which can vary depending on the intended use.
Therefore, the ETA shall also include the following calculation input data for each result:
- internal humidity load class to Annex A of EN ISO 13788,
- external mean temperature and relative humidity values for each calendar month.

2.2.2.10 Resistance to damage from soft body and hard body impact load

The resistance to damage from soft body and hard body impact load shall be assessed in accordance with section 2.2.6.1 and 2.2.6.2 of EAD 210005-00-0505.

The test specimens shall be conditioned and made in accordance with general part of Clause 2.2.2.

The level of performance as energy levels and area categories to Table B2 and B4 of EAD 210005-00-0505 shall be stated in the ETA.

2.2.2.11 Bond strength between polystyrene concrete masonry units and PUR adhesive

The bond strength between polystyrene concrete masonry units and PUR foam adhesive shall be assessed in accordance with Annex F. The number of specimens to be tested is five. The test shall be done at standard application conditions to F.5.1.
The level of performance as mean value of the bond strength, β_{mean}, shall be stated in the ETA.

2.2.2.12 Airborne sound insulation

The airborne sound insulation shall be tested in accordance with EN ISO 10140-1, EN ISO 10140-2, EN ISO 10140-4 and EN ISO 10140-5.

The test specimens shall be conditioned and made in accordance with general part of Clause 2.2.2.

The measured airborne sound insulation shall be expressed as a single number rating, $R_w(C;C_{tr})$, in accordance with EN ISO 717-1 and it shall be given in the ETA.

2.2.2.13 Thermal resistance and thermal transmittance

Thermal resistance of the polystyrene concrete masonry without plastering and rendering

The thermal resistance of the polystyrene concrete masonry without plastering and rendering, R_{mas} (m^2K/W), shall be determined by the following formula:

$$R_{mas} = \frac{R_{10,dry,mas}}{F_m} \quad (14)$$

where,

$R_{10,dry,mas}$ is the thermal resistance of the polystyrene concrete masonry without plastering and rendering at an average temperature of 10ºC in m^2K/W in dry state, and
F_m is the moisture conversion factor

The value of R_{mas} shall be rounded to two decimal places and it shall be stated in the ETA. Moisture conditions for which the value of R_{mas} was calculated shall also be given in the ETA.

Determination of $R_{10,dry,mas}$ by calculation

Thermal resistance of the polystyrene concrete masonry without plastering and rendering in dry state, $R_{10,dry,mas}$ shall be determined by the following formula:

$$R_{10,dry,mas} = \frac{b}{\lambda_{10,dry,mas}} \quad (15)$$

where,

b is thickness of the polystyrene concrete masonry without any plastering or rendering in m,
$\lambda_{10,dry,mas}$ is the thermal conductivity of the polystyrene concrete masonry without plastering and rendering at an average temperature of 10ºC in dry state in W/mK, as given in Clause 2.2.1.11.

Since the thermal conductivity of the PUR foam adhesive is smaller than the thermal conductivity of the polystyrene concrete masonry unit, the thermal bridge effect of the vertical and horizontal joints can be neglected and the value of the $\lambda_{10,dry,mas}$ can be the same as the thermal conductivity of the polystyrene concrete masonry units ($\lambda_{10,dry,unit}$) as given in Clause 2.2.1.11. This is a conservative approach.

Determination of $R_{10,dry,mas}$ by testing

The thermal resistance of the masonry with PUR foam adhesive joints and without plastering and rendering in dry state can also be tested in accordance with EN 1934. This is considered as an equivalent method to the calculation given above and can be presented as the reference method to be used in case of dispute.

The dimensions of the tested area shall be 2000 mm. The size of the metering section of the heat flow meter shall be 500 mm and the width of the guarded area shall be 750 mm. If the width of the test specimen is greater than 450 mm edge insulation shall also be used.

When making the test specimen, the polysyterene concrete masonry units shall be bonded together with the PUR foam adhesive. Before applying the PUR foam adhesive, the units shall be wetted with water spray and any dust from the surfaces to be bonded shall be removed. PUR foam adhesive shall be placed in both horizontal and vertical joints with a thickness of 5-8 mm by continuous pumping 1-3 cm from the edge of the polystyrene concrete masonry units and also in both diagonal directions. The polystyrene concrete masonry units shall be bonded together immediately after the PUR foam adhesive is applied with staggered vertical joints. Any gripping grooves, holes, joints shall also be filled with the PUR foam adhesive. The measurement shall be done without plastering and rendering.

The test specimen shall be dry in accordance with section 5.3.3 (1) of EN 1934. The test specimen shall be conditioned in accordance with section 8.2(a) of EN 1934.

The test shall be carried out at an average temperature of 10°C. The test result can be taken as dry thermal resistance of the polystyrene concrete masonry without plastering and rendering, $R_{10,dry,mas}$.

Determination of the moisture conversion factor, F_m

The moisture conversion factor shall be determined by the following formula:

$$F_m = e^{f_u(u_2-u_1)} \quad (16)$$

where,

f_u is the mass-related moisture conversion coefficient as given in Clause 2.2.1.11
u_2 is the moisture content mass by mass of the second set of conditions the conversion is intended to be made to,
u_1 is the moisture content mass by mass of the first set of conditions, which is the same as u_{dry} and defined to be 0.

For u_2 a default value of 0,05 shall be used. Other values can also be used in addition to meet manufacturer's expectations.

Thermal resistance of the polystyrene concrete masonry with plastering and rendering

The thermal resistance of the polystyrene concrete masonry with plastering and rendering, R_{wall} (m^2K/W), shall be determined by the following formula:

$$R_{wall} = R_{mas} + \frac{d_p}{\lambda_p} + \frac{d_r}{\lambda_r} \quad (17)$$

where,

R_{mas} is the thermal resistance of the polystyrene concrete masonry without plastering and rendering as given above,
d_p is the thickness of the internal plaster in m,
λ_p is the thermal conductivity of the internal plaster in W/mK,
d_r is the thickness of the external render in m,
λ_r is the thermal conductivity of the external render in W/mK,

The value of R_{wall} shall be rounded to two decimal places and it shall be stated in the ETA. Moisture conditions for which the value of R_{wall} was calculated shall also be given in the ETA.

Thermal transmittance of the masonry with plastering and rendering

The thermal transmittance of the polystyrene concrete masonry with plastering and rendering, U_{wall} (W/m²K), shall be calculated in accordance with the simplified method given in EN ISO 6946 as follows:

$$U_{wall} = \frac{1}{R_{si}+R_{wall}+R_{se}} \quad (18)$$

where,

R_{si} is the internal surface resistance in m²K/W to EN ISO 6946,
R_{wall} is the thermal transmittance of the wall kit in m²K/W as given above,
R_{se} is the external surface resistance in m²K/W to EN ISO 6946.

The value of U_{wall} shall be rounded to two decimal places and it shall be stated in the ETA. Moisture conditions for which the value of U_{wall} was calculated shall also be given in the ETA.

3 ASSESSMENT AND VERIFICATION OF CONSTANCY OF PERFORMANCE

3.1 Systems of assessment and verification of constancy of performance to be applied

For the products covered by this EAD the applicable European legal act is: Commission Decision 1997/740/EC (14 October 1997) amended by Commission Decision 2001/596/EC (8 January 2001).

The applicable AVCP systems are as follows for any use except for uses subject to regulations on reaction to fire:

For polystyrene concrete masonry units (category I)* and wall kits made from the units: system 2+

For polystyrene concrete masonry units (category II) and wall kits made from the units: system 4

For uses subject to regulations on reaction to fire the applicable AVCP systems for polystyrene concrete masonry units and wall kits made from the units regarding reaction to fire are 1, or, 3 or 4 depending on the conditions defined in the said Decision.

*Units with a declared compressive strength with a probability of failure to reach it not exceeding 5%.

3.2 Tasks of the manufacturer

The cornerstones of the actions to be undertaken by the manufacturer of the product in the procedure of assessment and verification of constancy of performance are laid down in Table 3.2.1.

For kits: The manufacturer (regarding the components he buys from the market with DoP) shall to take into account the Declaration of Performance issued by the manufacturer of that component. No retesting is necessary.

Table 3.2.1 Control plan for the manufacturer; cornerstones

No	Subject/type of control	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control
Factory production control (FPC) [including testing of samples taken at the factory in accordance with a prescribed test plan]					
Polystyrene concrete masonry units					
1	Incoming raw materials (EPS beads, cement, additives)	Checking of suppliers' documents	As defined in the Control Plan	-	Each delivery
2	Apparent density of the polystyrene concrete material	EN 1602	As defined in the Control Plan	EN 1602	Daily
3	Dimensions	See Clause 2.2.1.7	As defined in the Control Plan	EN 772-13	EN 771-3 Table D.1
4	Dry density	See Clause 2.2.1.8	As defined in the Control Plan	EN 772-13	EN 771-3 Table D.1
5	Compressive strength	See Clause 2.2.1.1	As defined in the Control Plan	EN 772-1	EN 771-3 Table D.1

No	Subject/type of control	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control
6	Thermal conductivity	See Clause 2.2.1.10	As defined in the Control Plan	EN 771-3 Table A.1	EN 771-3 Table D.1
7	Reaction to fire - SBI test - non-combustibility (or gross heat of combustion) (2) - single flame source test (3)	See Clause 2.2.1.3	As defined in the Control Plan	EN 13823(1) EN ISO 1182 (or EN ISO 1716) (2) EN ISO 11925-2 (3)	Every two years
8	HBCDD content	See Clause 2.2.1.8.2	As defined in the Control Plan	See Clause 2.2.1.8.2	Each incoming EPS batch
Components of the wall kit					
9	Characteristics of polystyrene concrete masonry units	See above	See above	See above	See above
10	Characteristics of PUR foam adhesive	See Annex C	As defined in the Control Plan	As defined in the Control Plan	See Annex C
11	Characteristics of glass fibre mesh reinforcement	EAD 040016-00-0404	EAD 040016-00-0404	EAD 040016-00-0404	EAD 040016-00-0404
12	Characteristics of gypsum plaster	EN 13279-1	EN 13279-1	EN 13279-1	EN 13279-1
13	Characteristics of external render	EN 15824	EN 15824	EN 15824	EN 15824
Wall kit made from polystyrene concrete masonry units					
14	Compressive strength	See Clause 2.2.2.1	As defined in the Control Plan	EN 1052-1	Once a year or as defined in the control plan
15	Secant modulus of elasticity	See Clause 2.2.2.2	As defined in the Control Plan	EN 1052-1	Once a year or as defined in the control plan
16	Flexural strength	See Clause 2.2.2.3	As defined in the Control Plan	EN 1052-2	Once a year or as defined in the control plan
17	Initial shear strength	See Clause 2.2.2.4	As defined in the Control Plan	EN 1052-3	Once a year or as defined in the control plan

No	Subject/type of control	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control
18	Bond strength between polystyrene concrete masonry units and PUR foam adhesive	See Clause 2.2.2.10	As defined in the Control Plan	Annex F	Once a year or as defined in the control plan
19	Reaction to fire(4) - SBI test - non-combustibility (or gross heat of combustion) (2) - single flame source test (3)	See Clause 2.2.2.6	As defined in the Control Plan	EN 13823(1) EN ISO 1182 (or EN ISO 1716) (2) EN ISO 11925-2 (3)	Every two years

(1) With reduced specimen number (one specimen)
(2) For products with a reaction to fire class of A2
(3) For products with a reaction to fire class of B or lower
(4) If the reaction to fire of the whole kit is determined by testing

3.3 Tasks of the notified body

The cornerstones of the actions to be undertaken by the notified body in the procedure of assessment and verification of constancy of performance for the polystyrene concrete masonry units and wall kits made from the units are laid down in Table 3.3.1.

Table 3.3.1 Control plan for the notified body; cornerstones

No	Subject/type of control	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control
Initial inspection of the manufacturing plant and of factory production control *(for system 2+ only)*					
1	The notified body shall verify the ability of the manufacturer for a continuous and orderly manufacturing of the product. In particular, the following items shall be appropriately considered – personnel and equipment – the suitability of the factory production control established by the manufacturer – full implementation of the prescribed test plan.	As defined in the Control Plan	As defined in the Control Plan	As defined in the Control Plan	When starting the production or after its modification
Continuous surveillance, assessment and evaluation of factory production control *(for system 2+ only)*					
2	The notified body shall verify the requirements on – the manufacturing processes – the system of factory production control – the implementation of the test plan prescribed by the manufacturer is continuously maintained.	As defined in the Control Plan	As defined in the Control Plan	As defined in the Control Plan	Once per year

The intervention of the notified body under AVCP system 1 is only necessary for reaction to fire for 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).

In this case the cornerstones of the tasks to be undertaken by the notified body under AVCP system 1 are laid down in Table 3.3.2.

Table 3.3.2 Control plan for the notified body; cornerstones

No	Subject/type of control	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control
Initial inspection of the manufacturing plant and of factory production control carried out by the manufacturer regarding the constancy of performance related to reaction to fire and taking into account a limiting of organic material and/or the addition of fire retardants. *(for system 1 only)*					
1	The notified body shall verify the ability of the manufacturer for a continuous and orderly manufacturing of the product, taking especially into account the limitation of organic material (e.g. limitation of EPS content/cement content ratio), the addition of fire retardants and/or another clearly identifiable stage in the production process which results in the improvement of the reaction to fire classification. In particular, the following items shall be appropriately considered – personnel and equipment – the suitability of the factory production control established by the manufacturer – full implementation of the prescribed test plan.	As defined in the Control Plan	As defined in the Control Plan	As defined in the Control Plan	When starting the production or after its modification
Continuous surveillance, assessment and evaluation of factory production control carried out by the manufacturer regarding the constancy of performance related to reaction to fire and taking into account a limiting of organic material and/or the addition of fire retardants. *(for system 1 only)*					
2	The notified body shall verify the requirements, taking especially into account the limitation of organic material (e.g. limitation of EPS content/cement content ratio), the addition of fire retardants and/or another clearly identifiable stage in the production process which results in the improvement of the reaction to fire classification, on – the manufacturing processes – the system of factory production control – the implementation of the prescribed test plan is continuously maintained.	As defined in the Control Plan	As defined in the Control Plan	As defined in the Control Plan	Once per year

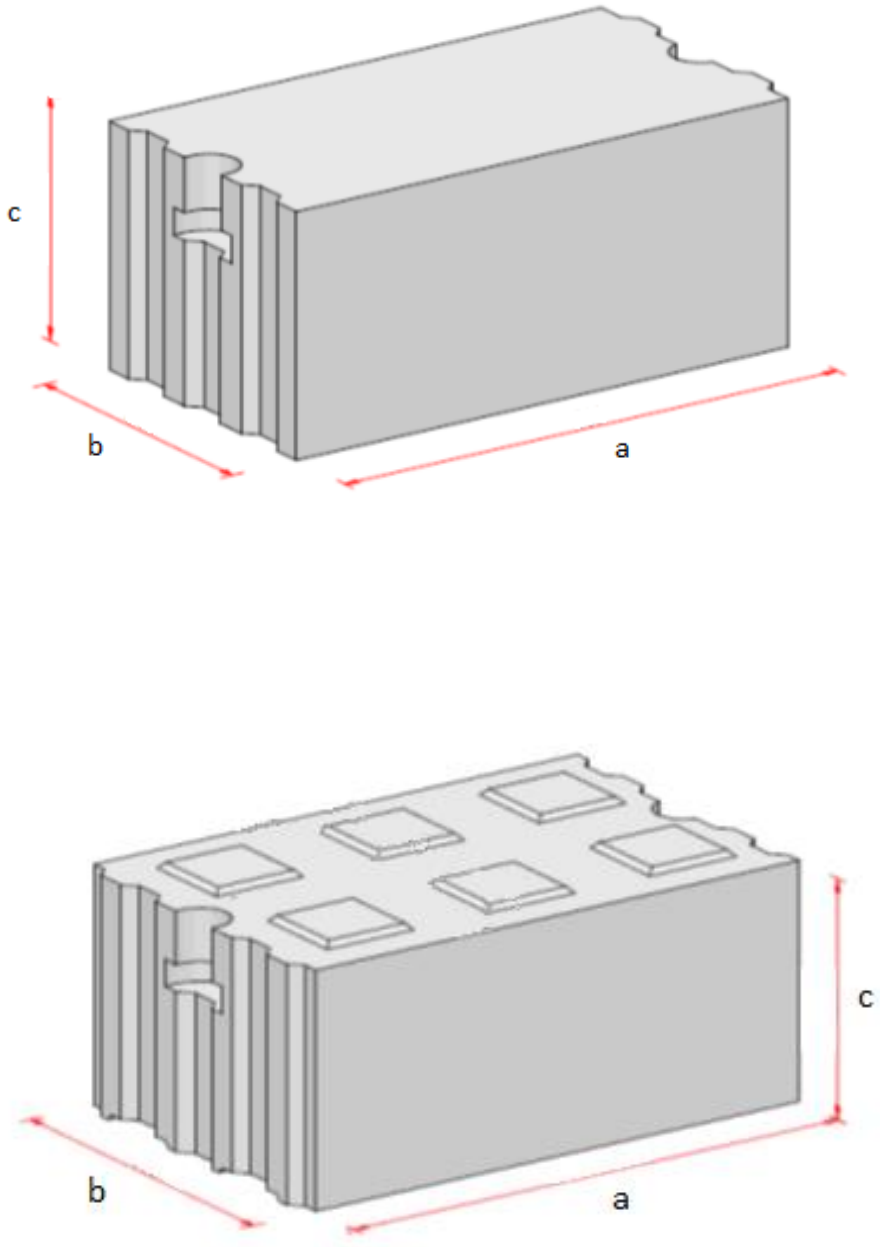
4 REFERENCE DOCUMENTS

EN 196-10:2016	Methods of testing cement. Part 10: Determination of the water-soluble chromium (VI) content of cement
EN 197-1:2011	Cement - Part 1: Composition, specifications and conformity criteria for common cements
EN 206:2013+A1:2016	Concrete - Specification, performance, production and conformity
EN 771-3:2011+A1:2015	Specification for masonry units — Part 3: Aggregate concrete masonry units (Dense and lightweight aggregates)
EN 772-1:2011+A1:2015	Methods of test for masonry units - Part 1: Determination of compressive strength
EN 772-11:2011	Methods of 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 772-13:2000	Methods of test for masonry units - Part 13: Determination of net and gross dry density of masonry units (except for natural stone)
EN 772-14:2001	Methods of test for masonry units - Part 14: Determination of moisture movement of aggregate concrete and manufactured stone masonry units
EN 826:2013	Thermal insulating products for building applications - Determination of compression behaviour
EN 1052-1:1998	Methods of test for masonry - Part 1: Determination of compressive strength
EN 1052-2:2016/AC:2017	Methods of test for masonry - Part 2: Determination of flexural strength
EN 1052-3:2002/A1:2007	Methods of test for masonry - Part 3: Determination of initial shear strength
EN 1364-1:2015	Fire resistance tests for non-loadbearing elements - Part 1: Walls
EN 1365-1:2012/AC:2013	Fire resistance tests for loadbearing elements - Part 1: Walls
EN 1602:2013	Thermal insulating products for building applications - Determination of the apparent density
EN 1604:2013	Thermal insulating products for building applications - Determination of dimensional stability under specified temperature and humidity conditions
EN 1605:2013	Thermal insulating products for building applications - Determination of deformation under specified compressive load and temperature conditions
EN 1606:2013	Thermal insulating products for building applications - Determination of compressive creep
EN 1609:2013	Thermal insulating products for building applications. Determination of short term water absorption by partial immersion
EN 1934:1998	Thermal performance of buildings - Determination of thermal resistance by hot box method using heat flow meter - Masonry
EN 12086:2013	Thermal insulating products for building applications - Determination of water vapour transmission properties

EN 12667:2001	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 13171:2012+A1:2015	Thermal insulation products for buildings - Factory made wood fibre (WF) products - Specification
EN 13238:2010	Reaction to fire tests for building products - Conditioning procedures and general rules for selection of substrates
EN 13279-1:2008	Gypsum binders and gypsum plasters - Part 1: Definitions and requirements
EN 13501-1:2018	Fire classification of construction products and building elements - Part 1: Classification using data from reaction to fire tests
EN 13501-2:2016	Fire classification of construction products and building elements - Part 2: Classification using data from fire resistance tests, excluding ventilation services
EN 13823:2010+A1:2014	Reaction to fire tests for building products - Building products excluding floorings exposed to the thermal attack by a single burning item
EN 14315-1:2013	Thermal insulating products for buildings. In-situ formed sprayed rigid polyurethane (PUR) and polyisocyanurate (PIR) foam products. Part 1: Specification for the rigid foam spray system before installation
EN 15824:2017	Specifications for external renders and internal plasters based on organic binders
EN 16516:2017+A1:2020	Construction products: Assessment of release of dangerous substances. Determination of emissions into indoor air
EN ISO 717-1:2013	Acoustics - Rating of sound insulation in buildings and of building elements - Part 1: Airborne sound insulation
EN ISO 1182:2010	Reaction to fire tests for products - Non-combustibility test
EN ISO 1716:2018	Reaction to fire tests for products – Determination of the gross heat of combustion (calorific value)
EN ISO 4590:2016	Rigid cellular plastics — Determination of the volume percentage of open cells and of closed cells
EN ISO 6946:2017	Building components and building elements – Thermal resistance and thermal transmittance – Calculation methods
EN ISO 10140-1:2016	Acoustics – Laboratory measurement of sound insulation of building elements – Part 1: Application rules for specific products
EN ISO 10140-2:2010	Acoustics – Laboratory measurement of sound insulation of building elements – Part 2: Measurement of airborne sound insulation
EN ISO 10140-4:2010	Acoustics – Laboratory measurement of sound insulation of building elements – Part 4: Measurement procedures and requirements
EN ISO 10140-5:2010	Acoustics – Laboratory measurement of sound insulation of building elements – Part 5: Requirements for test facilities and equipment
EN ISO 10456:2007	Building materials and products - Hygrothermal properties -Tabulated design values and procedures for determining declared and design thermal values

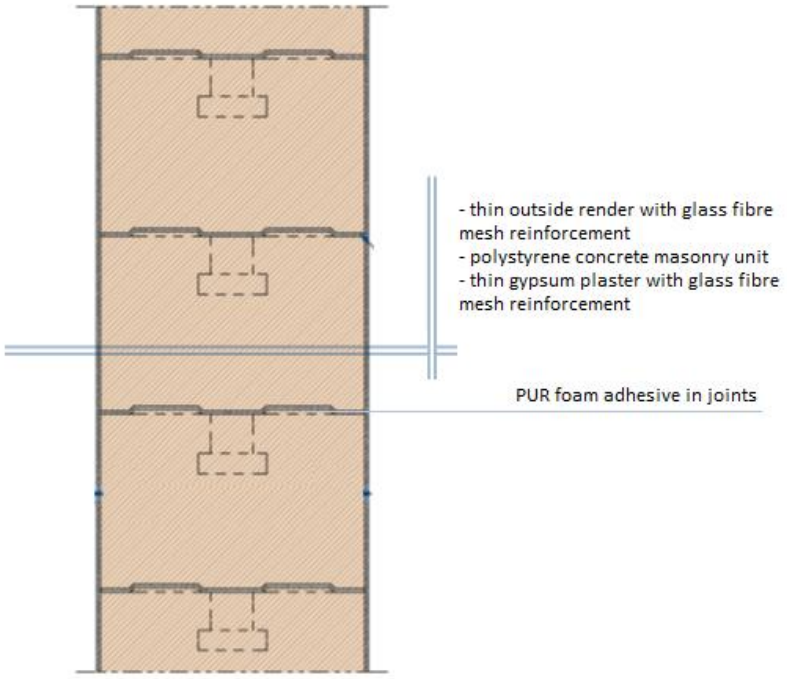
EN ISO 11925-2:2010	Reaction to fire tests - Ignitability of products subjected to direct impingement of flame - Part 2: Single-flame source test
EN ISO 13788:2012	Hygrothermal performance of building components and building elements - Internal surface temperature to avoid critical surface humidity and interstitial condensation - Calculation methods
EAD 040016-00-0404: 02/2016	Glass fibre mesh for reinforcement of cement based renderings
EAD 040635-00-1201: 10/2017	Thermal and/or sound insulation based on bound expanded polystyrene bulk material
EAD 210005-00-0505: 03/2019	Internal partition kits for use as non-loadbearing walls

ANNEX A: EXAMPLE PRODUCT DRAWINGS OF POLYSTYRENE CONCRETE MASONRY UNITS

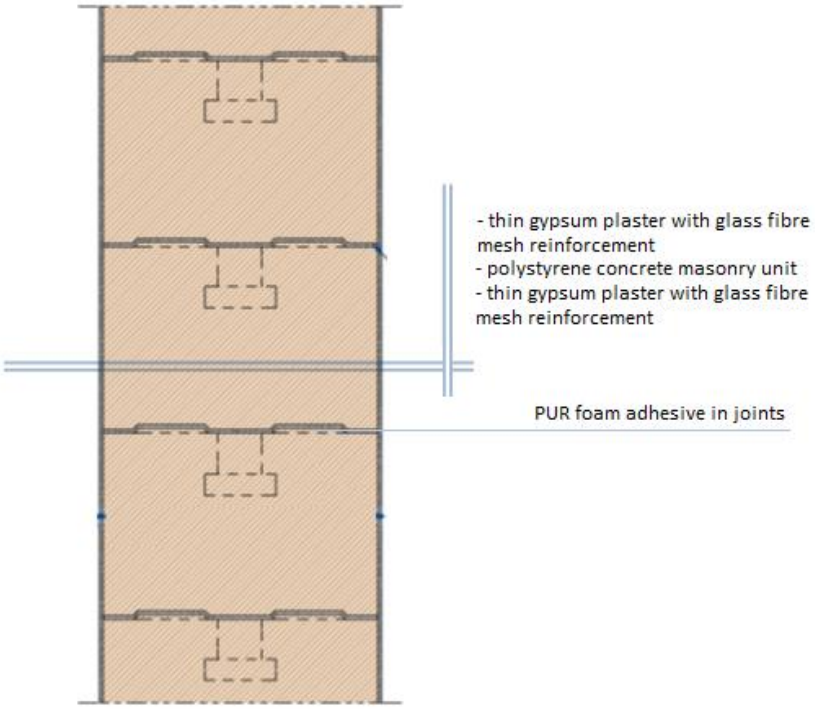


Example shapes of polystyrene concrete masonry units

ANNEX B: EXAMPLE PRODUCT DRAWINGS OF WALL KITS MADE FROM POLYSTYRENE CONCRETE MASONRY UNITS



Example vertical section of an assembled external wall



Example vertical section of an assembled internal wall

ANNEX C: RELEVANT CHARACTERISTICS AND TEST/CONTROL METHODS FOR PUR FOAM ADHESIVE

Table C.1 Relevant component characteristics and test/control methods for the PUR foam adhesive are given in Table C.1.

Relevant component characteristics	Test/control method	Minimum frequency of control during FPC
Thermal conductivity [W/mK]	EN 12667	Every 2 years
Reaction to fire class	Relevant test methods for the corresponding reaction to fire class in accordance with EN 13501-1(1)	Every 2 years
Closed cell content [%]	EN ISO 4590	Every 3 months
Water vapour permeability [μ]	EN 12086, Method A	Every 5 years
Short-term water absorption by partial immersion [kg/m2]	EN 1609, Method B	Every 5 years
Compressive stress at 10% deformation [kPa]	EN 826	Every 3 months
Compressive creep [%]	EN 1606	Every 10 years
Free-rise density [kg/m^3]	EN 1602	Every batch
Deformation under specified load and temperature conditions [%]	EN 1605	Every 5 years
Dimensional stability under specified temperature and humidity conditions [%]	EN 1604	Every 5 years

(1) The assessment of reaction to fire of the PUR foam adhesives shall be performed in accordance with EN ISO 11925-2, taking into account the following parameters:

- each different composition,
- highest organic content (where relevant),
- highest thickness and
- highest coverage.

The tests shall be performed on specimens applied to an appropriate standard substrate to EN 13238.

ANNEX D: GUIDANCE FOR TEST OF REACTION TO FIRE

D.1 Polystyrene concrete masonry units

D.1.1 Testing in accordance with EN ISO 1182 and EN ISO 1716

These methods are needed to determine classes A1 and A2. The specimens shall be prepared and tested in accordance with the provisions given in test standards EN ISO 1182 and EN ISO 1716. All specimens shall be conditioned in accordance with provisions given in EN 13238 before testing. Each different composition has to be considered when testing. In case of products with the same composition but different densities and different amount of organic compound in particular expanded polystyrene, the variation with the lowest density of the polystyrene concrete masonry unit and the highest amount of polystyrene and additional organic components shall be tested. If the product contains flame retardant the variation with the lowest amount of the flame retardant shall be tested.

The test result is valid for that variation tested and all of the following variations of the product:

- with the same product variations / part of a product family (as defined by a certain combination of raw materials and a certain type of production process)
- with higher densities,
- of any dimensions,
- with lower amounts of polystyrene and additional organic components and
- with higher amounts of the same type of flame retardant as the one which has been tested.

D.1.2 Testing in accordance with EN 13823 (SBI)

This method is relevant for determining classes A2, B, C and D as well as for the additional classifications s1, s2, s3, d0, d1 and d2 regarding smoke production and flaming droplets. The specimens shall be prepared and tested in accordance with the provisions given in test standard EN 13823. All specimens shall be conditioned in accordance with provisions given in EN 13238 before testing.

The corner specimen consists of two wings, designated the short and long wings.
The specimens shall have the following dimensions:

a) short wing: 495 $\pm$ 5 mm (length) x 1500 $\pm$ 5 mm (height)
b) long wing: 1000 $\pm$ 5 mm (length) x 1500 $\pm$ 5 mm (height)

As masonry untis are not used without render or plaster finish in their end use application, they shall be tested without air gap directly in front of the backing board.

For polystyrene concrete masonry units with a width (b) greater than 200 mm, the width shall be reduced to 200 mm by cutting away the unexposed surface. Length (a) and height (c) of the polystyrene concrete masonry units shall be cut to fit the size of the test rig. The long wing of the specimen shall be made with staggered vertical joints. If the length (a) of the unit is less than or equal to 500 mm, the short wing shall be made from one piece. Otherwise, staggered vertical joints shall be made in the short wing as well.

The cut polystyrene concrete masonry units are simply stacked on top of each other dry without any adhesive.

A typical example of the test assembly is shown in Figure D.1 below.

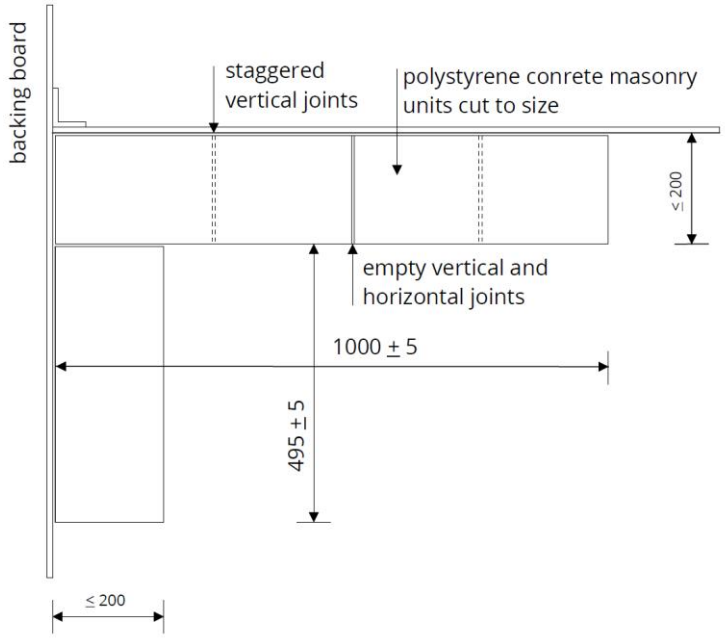


Figure D.1 Test rig configuration for polystyrene concrete masonry units

The assembly may be prepared away from the test chamber. The complete assembly can then be transported to the chamber.

The following parameters of the polystyrene concrete material shall be taken into account when conducting the SBI tests:

- each different product variations / part of a product family (as defined by a certain combination of raw materials and a certain type of production process)
- the greatest and lowest width (for product ranges including polystyrene concrete masonry units with a width less than 200 mm),
- the lowest density,
- the highest amount of polystyrene and additional organic componens and
- the lowest amount of flame retardant.

The test results are valid for the variation tested and all of the following variations of the product:

- with the same product variations / part of a product family (as defined by a certain combination of raw materials and a certain type of production process)
- with all widths between those tested (for product ranges including polystyrene concrete masonry units with a width less than 200 mm),
- with all other unit lengths and heights,
- with higher densities,
- with lower amounts of polystyrene and additional organic components and
- with higher amounts of the same type of flame retardant as the one which has been tested.

D.1.3 Testing in accordance with EN ISO 11925-2

This method is relevant for determining the reaction to fire classes B, C, D and E. The specimens shall be prepared and tested in accordance with the provisions given in test standard EN ISO 11925-2. All specimens shall be conditioned in accordance with provisions given in EN 13238 before testing. All tests shall be conducted on free-standing specimens without any substrate behind.

The following parameters shall be taken into account when preparing the specimens:

- each different product variations / part of a product family (as defined by a certain combination of raw materials and a certain type of production process)
- the greatest width (usually that means the greatest testable width of 60 mm)
- the lowest density,
- the highest amount of polystyrene and additional organic components and
- the lowest amount of flame retardant.

The test results are valid for the variation tested and all of the following variations of the product:
- with the same product variations / part of a product family (as defined by a certain combination of raw materials and a certain type of production process)
- with higher densities,
- with lower amounts of polystyrene and additional organic components,
- with higher amounts of the same type of flame retardant as the one which has been tested and
- of any width, if the maximum testable width of 60 mm was tested (if a width lower than 60 mm was used for testing, test results are valid for lower width).

D.2 Wall kits made from polystyrene concrete masonry units

D.2.1 Testing in accordance with EN ISO 1182 and EN ISO 1716

These methods are needed to determine classes A1 and A2. The specimens shall be prepared and tested in accordance with the provisions given in test standards EN ISO 1182 and EN ISO 1716. All specimens shall be conditioned in accordance with provisions given in EN 13238 before testing.
The wall kit is considered as a non-homogeneous product of which each substantial component applying for class A2 shall be tested separately in accordance with either EN ISO 1182 or EN ISO 1716. The non-substantial components of the kit shall be tested separately in accordance with EN ISO 1716 only.

Substantial components of the kit:
- polystyrene concrete masonry units
- PUR foam adhesive, if it has a mass/unit area $\geq$ 1,0 kg/m^2 or a thickness $\geq$ 1,0 mm
- glass fiber mesh reinforcement, if it is part of the kit and it has a mass/unit area $\geq$ 1,0 kg/m^2 or a thickness $\geq$ 1,0 mm
- thin gypsum plaster, if it is part of the kit and it has a mass/unit area $\geq$ 1,0 kg/m^2 or a thickness $\geq$ 1,0 mm
- thin render, if it is part of the kit and it has a mass/unit area $\geq$ 1,0 kg/m^2 or a thickness $\geq$ 1,0 mm

Non-substantial components of the kit:
- PUR foam adhesive, if it has a mass/unit area < 1,0 kg/m^2 and a thickness < 1,0 mm
- glass fiber mesh reinforcement, if it is part of the kit and it has a mass/unit area < 1,0 kg/m^2 and a thickness < 1,0 mm
- thin gypsum plaster, if it is part of the kit and it has a mass/unit area < 1,0 kg/m^2 and a thickness < 1,0 mm
- thin render, if it is part of the kit and it has a mass/unit area < 1,0 kg/m^2 and a thickness < 1,0 mm

D.2.1.1 Parameters to be taken into account when conducting the tests

Polystyrene concrete masonry units

See section D.1.1.

PUR foam adhesive

- each different composition
- the highest amount of organic content
- the lowest and the highest density
- the lowest amount of flame retardant (if any)

Glass fibre mesh reinforcement

- each different compostion
- the highest amount of organic content

Thin gypsum plaster, thin render

- each different composition
- the highest amount of organic content
- the lowest and the highest density
- the lowest amount of flame retardant (if any)

D.2.2 Testing in accordance with EN 13823 (SBI)

This method is relevant for determining classes A2, B, C and D as well as for the additional classifications s1, s2, s3, d0, d1 and d2 regarding smoke production and flaming droplets. The specimens shall be prepared and tested in accordance with the provisions given in test standard EN 13823. All specimens shall be conditioned in accordance with provisions given in EN 13238 before testing.

The corner specimen consists of two wings, designated the short and long wings.
The specimens shall have the following dimensions:

a) short wing: 495 ± 5 mm (length) x 1500 ± 5 mm (height)
b) long wing: 1000 ± 5 mm (length) x 1500 ± 5 mm (height)

As wall kits made from polystyrene concrete masonry units are free standing in their end use application, they shall be tested free standing at a distance of 40 mm from the backing board.

For polystyrene concrete masonry units with a width (b) greater than 160 mm, the width shall be reduced to 160 mm by cutting away the unexposed surface. Length (a) and height (c) of the polystyrene concrete masonry units shall be cut to fit the size of the test rig. The long wing of the specimen shall be made with staggered vertical joints. If the length (a) of the unit is less than or equal to 500 mm, the short wing shall be made from one piece. Otherwise, staggered vertical joints shall be made in the short wing as well.

The cut polystyrene concrete masonry units are stacked on top of each other and glued together with the PUR foam adhesive, that is part of the kit, in the horizontal and vertical joints.

If the glass fibre mesh and the internal plaster or external render are also parts of the kit, they shall be applied on the exposed surface. Tests with internal plaster and external render shall be carried out separately.

A typical example of the test assembly is shown in Figure D.2 below.

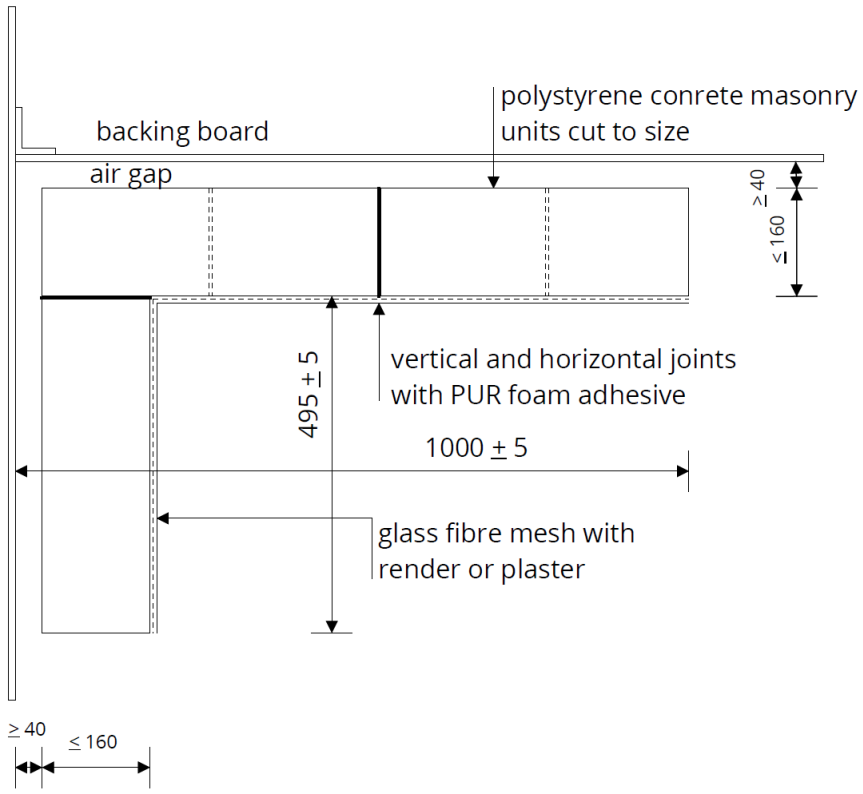


Figure D.2 Test rig configuration for the wall kit

The assembly may be prepared away from the test chamber. The complete assembly can then be transported to the chamber.

D.2.2.1 Parameters to be taken into account when conducting the tests

Polystyrene concrete masonry units

See section D.1.2.

PUR foam adhesive

- each different composition
- the highest amount of organic content or Q_{PCS} value per wall unit area (it can probably be achieved by choosing the smallest length and height of the polystyrene concrete masonry unit)
- the lowest amount of flame retardant (if any)

Glass fibre mesh reinforcement

- each different compostion
- the highest amount of organic content or Q_{PCS} value per wall unit area

Thin gypsum plaster, thin render

- each different compostion
- for a plaster or render coat having an organic content less than or equal to 5% (related to the mass in dried condition as used in the end use application), only the lowest thickness need to be used for preparing the test specimen
- for a plaster or render coat having an organic content higher than 5%, both the lowest and the highest thickness shall be used for preparing the test specimens
- regardless of the organic content, only the highest thickness of a plaster or render coat shall be tested on polystyerene concrete masonry units with a class of A1 or A2-s1, d0
- when the only difference in coatings is thickness and it is 0,5 mm or less, the coatings may be considered to be the same
- the lowest amount of the same type of flame retardants

D.2.3 Testing in accordance with EN ISO 11925-2

This method is relevant for determining the reaction to fire classes B, C, D and E. The specimens shall be prepared and tested in accordance with the provisions given in test standard EN ISO 11925-2. All specimens shall be conditioned in accordance with provisions given in EN 13238 before testing.
The specimens shall be representative of the whole kit and shall be tested as a multilayer product taking into consideration the rules of edge exposures as given in EN ISO 11925-2.

D.2.3.1 Parameters to be taken into account when conducting the tests

Polystyrene concrete masonry units

See section D.1.3.

PUR foam adhesive

See section D.2.2.1.

Glass fibre mesh reinforcement, thin gypsum plaster, thin render

See section D.2.2.1.

ANNEX E: DETERMINATION OF THE MASS-RELATED MOISTURE CONVERSION COEFFICIENT

E.1 Determination of the mass-related moisture conversion coefficient (f_u)

For the determination of the mass-related moisture conversion coefficient f_u, two sets of measurements are needed.

Set 1
At least three measurements on dry test specimens, to determine $\lambda_{10,dry}$ and u_{dry} (moisture content mass by mass).

Set 2
At least three measurements on test specimens conditioned at (23 ± 2) °C and (50 ± 5) % relative humidity, to determine $\lambda_{10,(23,50)}$ and $u_{23,50}$ (moisture content mass by mass).

E.2.1 Procedure

Set 1

E.2.1.1 Test specimens for the determination of the thermal conductivity $\lambda_{10,dry}$ shall be conditioned to dryness after storage for at least 72 hours at (65 ± 2) °C in an oven ventilated with air taken at (23 ± 2) °C and (50 ± 5) % relative humidity.

E.2.1.2 Determine for each test specimen the mass in dry condition. Average the values to determine the m_{dry}. The u_{dry}, being the moisture content in dry condition, is by definition set to 0.

E.2.1.3 The thermal conductivity of the test specimens conditioned according to E.2.1.1 shall be measured in accordance with EN 12667 at a mean temperature of (10 ± 0,3) °C.

During the measurement, precaution shall be taken to avoid moisture absorption by the specimen. It is acceptable, for instance, to put the test specimen into a thin plastic bag.

Average the values to determine the $\lambda_{10,dry}$.

Set 2

E.2.2.1 Condition the test specimens at (23 ± 2) °C and (50 ± 5) % relative humidity following the procedures detailed in EN 13171, clause 5.2, step 2.

E.2.2.2 Determine for each test specimen the mass at (23 ± 2) °C and (50 ± 5) % relative humidity. Average the values to determine the mass at 23°C and 50% relative humidity as $m_{23,50}$.

E.2.2.3 Calculate $u_{23,50}$ by the following formula:

$$u_{23,50} = \frac{m_{23,50} - m_{dry}}{m_{dry}}$$

where,
$m_{23,50}$ is the mass at 23°C and 50% relative humidity according to E.2.2.2
m_{dry} is the mass according to E.2.1.2

E.2.2.4 Determine for each test specimen conditioned according to E.2.2.1 the λ value in accordance with EN 12667 at a mean temperature of (10 ± 0,3) °C.

Average the values to determine $\lambda_{10,(23,50)}$.

Calculation of the mass-related moisture conversion coefficient (f_u)

E.2.2.5 The mass-related moisture conversion coefficient f_u shall be calculated by the following formula (derived from EN ISO 10456, formula 4):
where,

$$fu = \frac{ln\frac{\lambda_{10,(23,50)}}{\lambda_{10,dry}}}{u_{23,50} - u_{dry}}$$

$\lambda_{10,(23,50)}$ is determined according to E.2.2.4;
$\lambda_{10,dry}$ is determined according to E.2.1.3;
$u_{23,50}$ is determined according to E.2.2.3;
u_{dry} is determined according to E.2.1.2 and is defined to be 0.

ANNEX F: DETERMINATION OF THE BOND STRENGTH BETWEEN POLYSTYRENE CONCRETE MASONRY UNITS AND PUR FOAM ADHESIVE

F.1 Tools

- Substrate *(smooth concrete slab with a thickness of 40-80 mm, the water/cement ratio shall be of the order of 0,45 to 0,48, the tensile strength of the slab shall be at least 1,5 MPa, the moisture content of the slab prior to the test shall be a maximum of 3 % of the total mass.)*
- Polystyrene concrete *(dimensions*: 50 mm × 50 mm × 30-100 mm)*
- Spacers (any non-sticking material, used to ensure a consistent gap between the specimens of polystyrene concrete)
- Weights or clamps, if substrate material is not heavy enough to ensure stability of test sample
- Cutting knife
- Tie anchors to connect the polystyrene concrete to a testing machine (e.g. made of square metal plates)
- Calliper (accuracy ≤ 0,1 mm) for measuring sample surface area
- tensile testing machine

**Note: if the laboratory is equipped, one can also use a bigger polystyrene concrete plate (max. 120 mm x 200 mm x 30-100 mm) and cut test samples afterwards*

F.2 Preparation of test samples

The bottle/can is shaken at least 20 times before application. The first approximately 100 g of foam is discarded by spraying away.

After this, the foam is sprayed without interruption from a distance of approximately 10 mm onto the surface of the polystyrene concrete which shall be affixed to the substrate. The diameter of the beads shall be 20 to 30 mm without space between them. The foam shall be applied in longitudinal strips or in serpentine pattern (Figure F.1). It is very important that, while spraying the next bead(s), the foam is not sprayed into the already applied foam bead(s). The surface shall be fully covered with foam.

If not determined differently (see Clause F.5.2.2), the sample components shall be assembled together after 180±10 seconds from section finishing the foam application by firmly pressing the concrete slab onto the foam. If not determined differently (see Clause F.5.2.1) the foam thickness shall be (8 ± 1) mm. The foam has to be able to expand to the lateral sides.

If not determined differently (see Clause F.5.2) the samples are stored for at least 1 day (24 h) at the standard conditions. The required thickness is controlled by clamping the samples or using weights.

After one day curing, tie anchors may be affixed to the polystyrene concrete by using a suitable adhesive (see Figure F.6), the adhesive may need one day for curing.

Samples shall be cut to the specified dimensions (50 mm x 50 mm) after curing in case larger polystyrene concrete plates are used.

F.3 Figures on the bond strength – specimen preparation

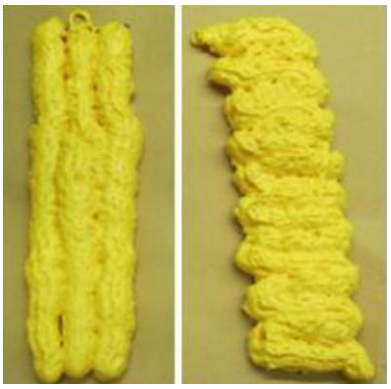


Figure F.1 Spray pattern

Figure F.2 Set-up with spacers (ex.1)

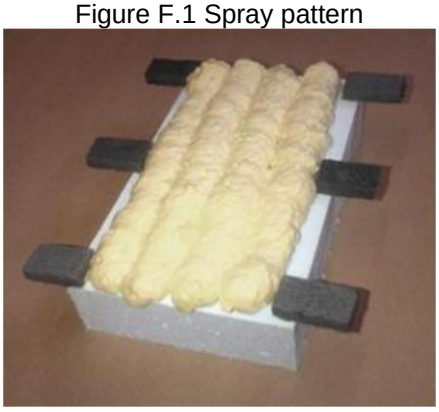


Figure F.3 Set-up with spacers (ex.2)

Figure F.4 Set-up with spacers (ex.3)

Figure F.5 Test sample during curing (48hrs)

Figure F.6 Tie anchors

Figure F.7 Cutting of the surplus

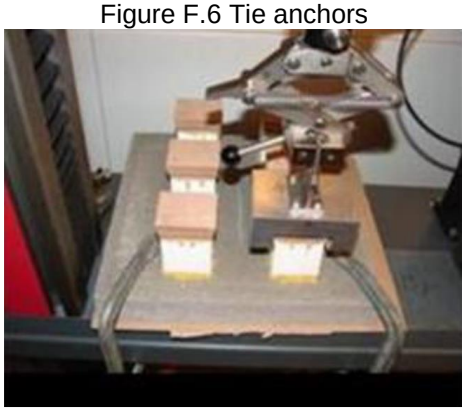


Figure F.8 Test set-up in test machine

F.4 Test procedure:

The surplus foam shall be carefully cut off (see Figure F.7).
The tensile test (pull-off test) is performed on at least five test samples at a tension speed of (10 ± 1) mm/min.

After testing the sample surface (s) shall be measured in mm², and the test results β_i are calculated by the formula

$$\beta_i = F_i/s_i$$

The test results (individual and mean values) are expressed in N/mm² (MPa) along with description of the failure mode. The way of application (straw/gun, application pattern) shall be given in the test report.

F.5 Test conditions

F.5.1 Standard application conditions

The tensile test is carried out at standard conditions (23 ± 2) °C / (50 ± 5) % RH with standard application conditions:
- Completion of test samples within 180±10 seconds
- Foam thickness: (8 ± 1) mm

F.5.2 Modification of application conditions

F.5.2.1 Modification of foam thickness

The tensile test is carried out at standard conditions (23 ± 2) °C / (50 ± 5) % RH with a foam thickness of (15 ± 1) mm by using appropriate spacers.

F.5.2.2 Modification of processing time (open time)

The tensile test is carried out at standard conditions (23 ± 2) °C / (50 ± 5) % RH with the standard foam thickness of (8 ± 1). The time between spraying the beads and completion of test samples shall be in accordance with the maximum open time specified by the manufacturer.

F.5.2.3 Modification of temperature

Two tensile tests are carried out with the standard foam thickness of (8 ± 1) mm. For preparation of test specimen, the following conditioning for substrate, polystyrene concrete, application, foam and curing is taken into account:

F.5.2.3.1 Low temperature: (5 ± 2) °C, no RH is required if not declared differently by the manufacturer

F.5.2.3.2 High temperature: (35 ± 2) °C, (30 ± 5) % RH if not declared differently by the manufacturer

The duration of storage must ensure the required temperature of all components.

After preparation and curing for 24 hours under the defined conditions, the samples are tested without delay at standard conditions (23 ± 2) °C / (50 ± 5) % RH.