



## EUROPEAN ASSESSMENT DOCUMENT

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# CELLULAR GLASS BOARDS AS LOAD BEARING LAYER AND THERMAL INSULATION OUTSIDE THE WATERPROOFING

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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).

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## 1 SCOPE OF THE EAD

### 1.1 Description of the construction product

The factory-made products are of foamed cellular glass with a closed cell structure. Cellular glass boards can be assembled together by bonding. These composite boards can have a bitumen coating on both faces. Cellular glass boards are manufactured with straight edges.

The cellular glass boards are not fully covered by the following harmonised technical specification: EN 13167.

The deviations from the standards are:

- The products have to fulfil specific requirements and properties concerning the load bearing function concerning e.g. compressive strength and shear behavior as well as compressive creep (see intended use a) according to clause 1.2.1 / BWR 1 according to Table 1). The load bearing function is limited to predominantly static loads.

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 use(s) of the construction product

#### 1.2.1. Intended use(s)

The boards with plane surfaces can be combined as exterior thermal insulation (also in case of groundwater) and load bearing layer underneath floor slabs. The boards are laid uniformly on the substrate to which they are applied.

#### 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 insulation boards for the intended use of 50 years when installed in the works (provided that the thermal insulation boards are subject to appropriate installation (see 1.1)) 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.

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.

### **1.3. Specific terms used in this EAD (if necessary in addition to the definitions in CPR, Art 2)**

#### **1.3.1. Composite board**

Single-layer boards are assembled together by edge bonding as composite boards. These composite boards can have a bitumen coating on both faces.

#### **1.3.2. Double-layer installation**

Single-layer boards or composite boards are to be used for double-layer installation underneath floor / foundation slabs.

#### **1.3.3. Single-layer boards**

Single-layer boards are boards without bonding. These boards can have a bitumen coating on both faces.

#### **1.3.4. Edge modules**

Edge modules are preformed elements of cellular glass as an outer closure of horizontal thermal insulation. They are manufactured using the identical chemical composition as the single boards.

## 2. ESSENTIAL CHARACTERISTICS AND RELEVANT ASSESSMENT METHODS AND CRITERIA

### 2.1. Essential characteristics of the product

Table 1 shows how the performance of the product is assessed in relation to the essential characteristics.

**Table 1 Essential characteristics of the product 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
<b>Basic Works Requirement 1: Mechanical resistance and stability</b>			
1	Compressive strength	See clause 2.2.1	Level
2	Characteristic value of compressive strength	See clause 2.2.2	Level
3	Compressive creep	See clause 2.2.3	Level
4	Behaviour under compressive load (large-sized specimen, double-layer installation)	See clause 2.2.4	Level
5	Shear strength	See clause 2.2.5	Level
6	Behaviour under shear load (large-sized specimen, double-layer installation)	See clause 2.2.6	Level
7	Density	See clause 2.2.7	Level
<b>Basic Works Requirement 2: Safety in case of fire</b>			
8	Reaction to fire	See clause 2.2.8	Class
<b>Basic Works Requirement 6: Energy economy and heat retention</b>			
9	Thermal resistance / Thermal conductivity	See clause 2.2.9	Level
10	Water absorption	See clause 2.2.10	Level
11	Water vapour transmission	See clause 2.2.11	Level
12	Geometrical properties	See clause 2.2.12	Level
13	Dimensional stability under specified conditions	See clause 2.2.13	Level

No	Essential characteristic	Assessment method	Type of expression of product performance
14	Tensile strength perpendicular to faces	See clause 2.2.14	Level
15	Bending strength	See clause 2.2.15	Level
16	Point load	See clause 2.2.16	Level

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

For sampling, conditioning and testing (dimensions of the test specimens, minimum number of measurements, specific conditions), EN 13167 shall apply, unless otherwise is specified in the following. - The test specimens shall be chosen to cover the intended product parameter (thickness and density range). If the tests are carried out on specimens with minimum and maximum total thickness the results can be applied for the thicknesses in between, unless otherwise is stated in the following.

The test specimens shall be chosen accordingly (number of test specimens, thickness and density of test specimens). The tests are carried out at least on specimens with minimum and maximum total thickness covered by the ETA, unless otherwise is stated in the following.

The test conditions of the characteristics take the following products for installation into account

- Single-layer or composite boards for single-layer installation
- Single-layer or composite boards for double-layer installation

This EAD contains provisions on how to declare certain performance characteristics. These provisions only apply if the manufacturer wishes to declare a performance for the relevant product characteristic.

### 2.2.1. Compressive strength

Compressive strength of single-layer boards or composite boards is determined after conditioning according to EN 826, Annex A in accordance with EN 13167. The thickness of the test specimens should be equal to the total thickness of the product. At least 5 specimens each should be taken from 3 different charges. The load-deformation curve should be recorded. Each measured value may not be more than 10% lower than the given level.

Compressive strength,  $\sigma_m$ , is given in the ETA using levels with steps of 10 kPa.

### 2.2.2. Characteristic value of compressive strength

The characteristic value of compressive strength is defined on basis of statistical analysis of the measured results of compressive strength (see 2.2.1).

The statistical analysis is carried out in accordance with EN 1990, clause 4.2 for the 5%-fractile value for a one-sided confidence level of 75 % under unknown or known variance using ISO 12491. For the first 35 test results the variance of the normal population should be considered as unknown.

The characteristic value of compressive strength,  $\sigma_{0,05}$ , is given in the ETA together with the number of sample measurements ( $n$ ), the sample mean value ( $\sigma_{\text{mean}}$ ) and the standard deviation ( $\sigma_{\sigma}$ ).

### 2.2.3. Compressive Creep

The long-term creep behavior under compressive load of single-layer boards or composite panel is performed according to EN 1606 deviating from EN 13167 as follows.

#### Load steps

If the Findley parameters are required the creep test should be carried out minimum at three different compression load steps in order to estimate the parameters of Findley approach as a function of the applied compression stress. The recommended load steps are 20 %, 30 %, and 40 % of the mean value of the compressive strength (see section 2.2.1).

When the Findley parameters are not required as a function of stress, three specimens (preferably from three different charges) are tested.

#### Specimen

The specimens for the determination of the creep behavior are taken from the same sample, like the specimens that were used for the compressive test according to EN 826.

The thickness of the test specimens should be equal to the total thickness of the product. It is recommended to test minimum three specimens under each of the three selected compression load steps. These specimens are extracted from three different boards where each board preferably comes from a different charge. Thereby, the potential variation in creep response of the same product between the different charges as well as the variation between the different specimens within the same charge could be taken into account by evaluating the creep behavior.

#### Test time

For the intended use of 50 years the test time (extrapolation time of 50 years) is 20 months (608 days).

The following values for each load step,  $\sigma_c$ , are stated in the ETA:

- The initial thickness reduction  $X_0$
- The creep deformation after test time  $X_{ct}$
- The creep deformation extrapolated to 50 years,  $X_{ct50}$
- The total thickness reduction extrapolated to 50 years,  $X_{t50}$

### 2.2.4. Behaviour under compressive load (large-sized specimen, double-layer installation)

Density, board thickness and flatness deviation of the boards are documented. 5 specimens each of the largest two-layer thickness are tested.

The testing of compressive strength accordance with EN 826 is performed on large-sized specimens (minimum five specimens each preferably from three different charges). The relative dimensions between the thickness and the length of the test specimen should be kept equal to a ratio of 1:4. It is worth mentioning here that the dimension of the test specimen parallel to the shear loading direction is referred to as the length of the specimen. Specimen of composite boards should include a bonding ply.

The mean value of compressive strength ( $\sigma_{large}$ ) is given in the ETA.

### 2.2.5. Shear strength

The shear strength of single-layer boards or composite boards is determined in accordance with EN 12090 and EN 13167. The thickness of the test specimen should be the total thickness of the product.

The shear strength,  $\tau$  is given in the ETA according to EN 13167.

### 2.2.6. Behaviour under shear load (large-sized specimen)

The testing of shear strength accordance with DIN EN 12090 is performed on large-sized specimens (minimum five specimens each from three different charges) with dimensions of 600 mm x 450 mm x total thickness. Specimen of composite boards should include a bonding ply.

The mean value of compressive strength ( $T_{large}$ ) is given in the ETA.



### **2.2.7. Density**

Density is determined in accordance with EN 1602 at minimum 5 test specimens with delivery dimensions. Composite boards should be tested without coating.

The density range of the products covered by the ETA is given in the ETA.

### **2.2.8. Reaction to fire**

Reaction to fire classification is performed according to EN 13167, clause 4.2.6. The reaction to fire class is given in the ETA.

### **2.2.9. Thermal resistance and thermal conductivity**

The thermal conductivity at 10 °C is determined according to EN 12667 or EN 12939 in accordance with EN 13167 and given in the ETA in levels with steps of 0.001 W/(m·K).

### **2.2.10. Water absorption**

#### 2.2.10.1. Short term water absorption by partial immersion

Short term water absorption by partial immersion of single-layer boards and composite boards is determined according to EN 1609.

The short water absorption by partial immersion is given in the ETA using the level according to EN 13167.

#### 2.2.10.2. Long term water absorption by partial immersion

Long term water absorption by partial immersion of single-layer boards and composite boards is determined according to EN 12087 (method 1A).

The water absorption by partial immersion is given in the ETA using the level according to EN 13167.

### **2.2.11. Water vapour transmission**

The water vapour transmission properties are determined according to EN 12086 (test condition A) in accordance with EN 13167.

The water vapour diffusion resistance factor  $\mu$  is given in the ETA.

### **2.2.12. Geometrical properties**

#### 2.2.12.1. Thickness

The thickness is determined according to EN 823 in accordance with EN 13167 at 5 test specimens with delivery dimensions. The thickness is given in the ETA considering the tolerances according to EN 13167.

#### 2.2.12.2. Length, width,

The length and width are determined according to EN 822 in accordance with EN 13167 at 5 test specimens with delivery dimensions. Length and width are given in the ETA considering the tolerances according to EN 13167.

#### 2.2.12.3. Squareness

The squareness on length and width is determined according to EN 824 in accordance with EN 13167 at 5 test specimens with delivery dimensions. The squareness is given in the ETA considering the tolerances according to EN 13167.

#### 2.2.12.4. Flatness

The flatness is determined according to EN 825 in accordance with EN 13167. The flatness at 5 test specimens with delivery dimensions is given in the ETA considering the tolerances according to EN 13167.

#### 2.2.13. Dimensional stability under specified conditions

Dimensional stability under specific temperature and humidity conditions is determined according to EN 1604 in accordance with EN 13167 at a temperature of 70°C and a relative humidity of 90% (DS(70,90)) and given in the ETA using the level according to EN 13167.

In addition dimensional stability at a temperature of - 30°C can be determined according to EN 1604. The relative changes in length and width and the relative reduction in thickness are given in the ETA.

#### 2.2.14. Tensile strength perpendicular to faces

The tensile strength perpendicular to faces is determined according to EN 1607 in accordance with EN 13167.

The tensile strength perpendicular to faces is given in the ETA using levels according to EN 13167.

#### 2.2.15. Bending strength

Bending strength is determined according to EN 12089 in accordance with EN 13167 and is given in the ETA using levels according to EN 13167.

#### 2.2.16. Point load

Deformation under point load is determined according to EN 12430 in accordance with EN 13167 and is given in the ETA using levels according to EN 13167.

### 3. ASSESSMENT AND VERIFICATION OF CONSTANCY OF PERFORMANCE

#### 3.1. System(s) of assessment and verification of constancy of performance to be applied

The applicable European legal act is: Decision 95/467/EC (structural bearings)

The system is:

System 1 (where requirements on individual bearings are critical) or

System 3 (where requirements on individual bearings are not critical)

‘Critical’ in the sense that those requirements may, in case of failure of the bearing, put the works or parts thereof in states beyond those regarded as serviceability and ultimate limit states.

#### 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.

**Table 3 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
<b>Factory production control (FPC)</b> [including testing of samples taken at the factory in accordance with a prescribed test plan]					
1	Compressive strength	EN 13167	Acc. to control plan	3	see EN 13167
2	Characteristic value of compressive strength	See clause 2.2.2	Acc. to control plan		twice per year
3	Density	See clause 2.2.7	Acc. to control plan	3	once per day
4	Shear strength	See clause 2.2.5	Acc. to control plan	2	once per year
5	Reaction to fire	See EN 13167	Acc. to control plan		see EN 13167
6	Thermal resistance / Thermal conductivity	See clause 2.2.9	Acc. to control plan	1	see EN 13167
7	Water absorption	See clause 2.2.10	Acc. to control plan	3	once per year
8	Water vapour transmission	See clause 2.2.11	Acc. to control plan	1	See EN 13167

No	Subject/type of control	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control
9	Geometrical properties	See clause 2.2.12	Acc. to control plan		See EN 13167
10	Dimensional stability under specified conditions	See clause 2.2.13	Acc. to control plan	2	twice per year
11	Tensile strength perpendicular to faces	See clause 2.2.14	Acc. to control plan	2	twice per year
12	Bending strength	See clause 2.2.15	Acc. to control plan	2	twice per year
13	Point load	See clause 2.2.16	Acc. to control plan	2	twice per year

### 3.3. Tasks of the notified body

The intervention of the notified body is only necessary in so far as system 1 is applicable.

The cornerstones of the actions to be undertaken by the notified body of the product in the procedure of assessment and verification of constancy of performance are laid down in Table 4.

**Table 4 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
<b>Initial inspection of the manufacturing plant and of factory production control</b> <i>(for system 1 only)</i>					
1	The notified body shall verify the ability of the manufacturer for a continuous and orderly manufacturing of the product according to the European Technical Assessment. In particular the following items shall be appropriately considered <ul style="list-style-type: none"> <li>– personnel and equipment</li> <li>– the suitability of the factory production control established by the manufacturer</li> <li>– full implementation of the prescribed test plan</li> </ul>	-	Control Plan	-	When starting the production

No	Subject/type of control	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control
2	Basic Works Requirement 1 - Mechanical resistance and stability: <ul style="list-style-type: none"> <li>- Presence of suitable test equipment</li> <li>- Presence of trained personnel</li> <li>- Presence of an appropriate quality assurance system and the necessary stipulations</li> </ul>	Clauses 2.2.1 to 2.2.7	Control Plan	-	When starting the production
3	Basic Works Requirement 2* -: Safety in case of fire: <ul style="list-style-type: none"> <li>- Presence of suitable test equipment</li> <li>- Presence of trained personnel</li> <li>- Presence of an appropriate quality assurance system and the necessary stipulations</li> </ul>	Clause 2.2.8	Control Plan	-	
<b>Continuous surveillance, assessment and evaluation of factory production control</b> <i>(for system 1 only)</i>					
4	It shall be verified that the system of factory production control and the specified manufacturing process are maintained taking into account of the control plan.				Annually
5	Basic Works Requirement 1 - Mechanical resistance and stability: <ul style="list-style-type: none"> <li>- Inspection of factory, of the production of the product and of the facilities for factory production control</li> <li>- Evaluation of the documents concerning factory production control</li> <li>- Issuing a report of surveillance</li> </ul>	Clauses 2.2.1 to 2.2.7	Control Plan	-	
6	Basic Works Requirement 2* - Safety in case of fire: <ul style="list-style-type: none"> <li>- Inspection of factory, of the production of the product and of the facilities for factory production control</li> <li>- Evaluation of the documents concerning factory production control</li> <li>- Issuing a report of surveillance</li> </ul>	Clause 2.2.8	Control Plan	-	

\*Only relevant for products of class C and higher

#### 4. REFERENCE DOCUMENTS

As far as no edition date is given in the list of standards thereafter, the standard in its current version at the time of issuing the European Technical Assessment is of relevance.

EN 822	Thermal insulating products for building applications - Determination of length and width
EN 823	Thermal insulating products for building applications - Determination of thickness
EN 824	Thermal insulating products for building applications - Determination of squareness
EN 825	Thermal insulating products for building applications - Determination of flatness
EN 826	Thermal insulating products for building applications - Determination of compression behaviour
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 1605	Thermal insulating products for building applications - Determination of deformation under specified compressive load and temperature conditions
EN 1606	Thermal insulating products for building applications - Determination of compressive creep
EN 1607	Thermal insulating products for building applications - Determination of tensile strength perpendicular to faces
EN 1609	Thermal insulating products for building applications - Determination of short term water absorption by partial immersion
EN 1990	Eurocode: Basis of structural design
EN ISO 10456	Building materials and products - Hygrothermal properties-Tabulated design values and procedures for determining declared and design thermal values
EN 12086	Thermal insulation products for building applications-Determination of water vapour transmission properties
EN 12087	Thermal insulating products for building applications-Determination of long term water absorption by immersion
EN 12089	Thermal insulating products for building applications - Determination of bending behaviour
EN 12090	Thermal insulating products for building applications - Determination of shear behaviour
EN 12430	Thermal insulating products for building applications - Determination of behaviour under point load
EN 12664	Thermal performance of building materials and products-Determination of thermal resistance by means of guarded hot plate and heat flow meter methods-Dry and moist products of medium and low thermal resistance

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 13501-1	Fire classification of construction products and building elements-Part 1: Classification using test data from reaction to fire tests
EN 13167	Thermal insulation products for buildings - Factory made cellular glass (CG) products - Specification
EN ISO 11925-2	Reaction to fire tests - Ignitability of products subjected to direct impingement of flame - Part 2: Single-flame source test
ISO 12491	Statistical methods for quality control of building materials and components
ISO 16269-6	Statistical interpretation of data – Part 6: Determination of statistical tolerance intervals