EUROPEAN ASSESSMENT DOCUMENT

EAD 040394-00-1201

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FACTORY MADE CELLULAR GLASS LOOSE FILL

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

The construction product is a cellular glass loose fill material that consists of factory made particles of cellular foamed glass, with typical size 10/60 mm (nominal sizes d/D) and is manufactured from glass powder. The type of glass powder can be new or recycled material. The organic content of the construction products is less than 1,0 %.

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

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 cellular glass loose fill is intended to be used as load bearing and thermal insulation layer underneath building foundations or floor slabs in areas with in-ground frost subjected to ground damp and non-standing seepage water.

The load bearing function is limited to predominantly static loads. Under load-bearing structures the cellular glass loose fill material is compacted to obtain optimal load bearing capacity, though without excessive crushing.

In particular the following applications are covered:

a) Load bearing and thermal insulation underneath foundation slabs
b) Horizontal thermal insulation/frost protection layer in areas with in-ground frost (also in road construction),as lightweight fill and as water capillary barrier (non-load bearing application)

The cellular glass loose fill is not used under concentrated loads.

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 thermal insulation product for the intended use of 50 years when installed in the works (provided that the thermal insulation product is subject to appropriate installation. 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[1].

1 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.

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 Actual degree of compaction

The degree of compaction is defined as the density before compaction divided by the density after compaction. The actual degree of compaction for testing should correspond to the degree of compaction for the intended use. A common degree of compaction of cellular glass loose fill is. 1.3 to 1.

2 ESSENTIAL CHARACTERISTICS AND RELEVANT ASSESSMENT METHODS AND CRITERIA

2.1 Essential characteristics of the product

Table 1 shows how the performance of thermal insulation 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
Basic Works Requirement 1: Mechanical resistance and stability			
1	Oedometer modulus	See clause 2.2.1	Level
2	Compressive stress at 10 % deformation[2]	See clause 2.2.2	Level
3	Crushing resistance	See clause 2.2.3	Level
4	Creep strain	See clause 2.2.4	Level
5	Behaviour under cyclic load	See clause 2.2.5	Level
6	Loose bulk density[2]	See clause 2.2.6	Level / tolerances
7	Installation-specific density[2]	See clause 2.2.7	Level / tolerances
8	Shear parameter	See clause 2.2.8	Level
Basic Works Requirement 2: Safety in case of fire			
9	Reaction to fire	See clause 2.2.9	Class
Basic Works Requirement 3: Hygiene, health and the environment			
10	Content, emission and/ or release of dangerous substances	See clause 2.2.10	Description
Basic Works Requirement 6: Energy economy and heat retention			
11	Thermal conductivity	See clause 2.2.11	Level
12	Water absorption by total immersion	See clause 2.2.12	Level

2 Also relevant for BWR 6: Energy economy and heat retention

No	Essential characteristic	Assessment method	Type of expression of product performance
13	Freeze/ thaw resistance	See clause 2.2.13	Level
14	Particle size distribution	See clause 2.2.14	Level / tolerances
15	Capillary water suction height	See clause 2.2.15	Level

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

The level/ class/ description to be stated for each characteristic have to be representative for the range of density, particle size distribution and thicknesses at built-in state. The test specimens shall be chosen accordingly (number of test specimens, thickness and density of test specimens). If necessary, the tests shall be performed on samples with minimum and maximum loose bulk density and particle size distributions, so that the worst case for each characteristic can be given.

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 Oedometer modulus

The oedometer modulus (compression stiffness) is determined in accordance with ISO 17892-5 and the modifications described in Annex A.1 (giant oedometer test procedure). The test procedure is also similar to a standard drained oedometer test as described in EN 1997-2, but modified to suit a material with large particle size and low crushing resistance.

Specimen

Test specimens are taken from the same production lots as the specimens that were used for the compressive test according to EN 826 (see section 2.2.2). At least three test specimens each should be taken from three different lots. The test is performed on test specimens with the actual degree of compaction.

After compaction the test specimen is subjected to a series of incrementally increasing static loads (load stage), while the corresponding vertical deformation is recorded versus time.

The following values for each tested lot are stated in the ETA:

- The initial thickness reduction X_0
- For each load stage:
  - mean value of total deformation, X_{total} and of the related thickness reduction, X_{load},
  - oedometer modulus, calculated according to ISO 17892-5; Annex B.3

Note :
For the use under in-ground frost conditions, the oedometer test or the test of compressive stress at 10 % deformation (see 2.2.2) can be performed on dry as well as on specimens on which water absorption and freeze/ thaw change were tested (see 2.2.12 and 2.2.13.1).

2.2.2 Compressive stress at 10 % deformation

2.2.2.1 Compressive stress or compressive strength

The compressive stress at 10 % deformation is determined in accordance with EN 826. The test (test frame of e.g. 200 mm x 200 mm x 170 mm) is performed on at least five test specimens each should be taken from three different lots with the actual degree of compaction:

a) Dry material (five test specimens)
b) After water absorption test by total immersion in chapter 2.2.12 (two test specimens)
c) After the freezing and thawing test in chapter 2.2.13.1 (dry/wet test specimen)

The compressive strength at 10 % deformation or compressive stress is given for the cases a), b) and c) in the ETA.

2.2.2.2 Characteristic value of compressive stress or compressive strength

The characteristic value of stress at 10% deformation is defined on basis of statistical analysis of the measured results of compressive stress at 10 % deformation (see 2.2.2.1). The statistical analysis is carried out in accordance with EN 1990, clause 4.2 for the 5 %- quantile value for a one-sided confidence level of 75 % under unknown or known variance using EN 12491. For the first 35 test results the variance of the normal population should be considered as unknown. The characteristic value of compressive stress, $\sigma_{0,05}$, is given in the ETA together with the number of sample measurements (n), the sample mean value (σ_{mean}) and the standard deviation (s_σ).

2.2.3 Crushing resistance

The crushing resistance is determined on basis of the test described in EN 13055, Annex C with the following modifications: Testing of the crushing resistance is performed on test specimens with an aggregate size not less than 10 mm and not greater than 22 mm (eventually prepared by crushing). The test is performed on minimum three test specimens.

The crushing resistance, expressed in kPa, is determined as the average calculated from minimum three test specimens. The crushing resistance is given in the ETA for the actual degrees of compaction.

Note 1:
Determination of the crushing resistance is only needed when used under load bearing conditions.
Note 2:
There is no simple relationship between the crushing resistance of lightweight aggregates and the properties in practical use. The test results should be considered as an internal production control.

2.2.4 Creep strains

The creep behaviour is tested in a giant oedometer apparatus as described in 2.2.1/Annex A.1. The test specimen is compacted to the actual degree of compaction. After compaction the test specimen is subjected to a series of incrementally increasing static loads (load stages) until a creep test load stage between e.g. 200 and 300 kPa is reached.

The recommended creep test load stage is 30 % of the average value of compressive stress at 10 % deformation or the compressive strength (see section 2.2.2). The creep test load stage is sustained until no increase in vertical deformation take place or the strain rate is almost negligible. Generally a test period of 3-4 weeks may be sufficient. For extreme loads a longer test period may be required.

The test specimens are taken from the same production lots as the specimens that were used for the compressive test according to EN 826 (see section 2.2.2). The test is performed on minimum two test specimens.

The following values for each load stage are stated in the ETA:

- The initial thickness reduction X_0
- For each load stage: mean value of total deformation, X_{total} and of the related thickness reduction, X_{load}
- For the creep test load stage: test time, mean creep deformation after test time X_{ct}

2.2.5 Behaviour under cyclic loading

Determination of the behaviour under cyclic loading is performed by using the giant oedometer test procedure described in in 2.2.1/Annex A.1 with monoaxial cyclic load changes of e.g. 50 kPa and 200 kPa. The test is performed with a minimum of 1000 load changes on minimum three compacted test specimens. The test specimens are taken from the same production lots as the specimens that were used for the compressive test according to EN 826 (see section 2.2.2).

The following mean values of deformation after 100, 500 and 1000 load changes are given in the ETA:

- The initial thickness reduction X_0
- For each of these numbers of load changes: mean value of total deformation, X_{total} and of the related thickness reduction, X_{load}

Note:
Declaration of behaviour under cyclic load is only needed when used under pavement layers subjected to moving loads.

2.2.6 Loose bulk density

Loose bulk density is to be determined in accordance with EN 1097-3. At least five test specimens each should be taken from three different production lots. The test specimens are taken from the same production lots as the specimens that were used for the compressive test according to EN 826 (see section 2.2.2).

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

Additionally the determination of aggregate density is performed according to EN 1097-6 and given in the ETA.

Note:
Density for lightweight fill applications depends on water absorption, compaction and crushing during spreading (see 2.2.7).

2.2.7 Installation-specific density

Installation-specific densities are determined based on EN 1097-3. The minimum number of test specimen to get one test result is three.

The following installation-specific densities are determined:

1) Dry density with the actual degree of compaction of the specimens used for the determination of compressive stress (see chapter 2.2.2).
2) Densities in wet state, with the actual degree of compaction. Water content as obtained after testing of water absorption in accordance with EN 12087 (see chapter 2.2.12).
3) Densities at maximum water absorption. Water content as obtained after testing of water absorption in accordance with EN 12087 and resistance against freezing and thawing in accordance with EN 12091 (see chapter 2.2.13.1).

Installation-specific densities (bullet 1) to 3)) are determined as the average of minimum three test specimens. Installation-specific densities of the product are given in the ETA.

2.2.8 Shear parameter

The shear test is performed in accordance with the guidelines in DIN 18137-3.

The test procedure is modified in Annex A.2 (Test method for determination of shear parameters) to suit a material with large particle size and lower crushing resistance.

The test is performed on minimum 5 compacted (with the actual degree of compaction) test specimens, each under a different vertical stress load, to determine the effects upon shear resistance and displacement.

For each vertical stress load the measured rates of deformation and the measured shear displacement along with the corresponding nominal shear stress is given in the ETA. The shear parameters friction angle φ' and the cohesion c are estimated according to DIN 18137-3 and given in the ETA.

2.2.9 Reaction to fire

The product is classified according to EN 13501 without testing as class A1 product in accordance with commission decision 96/603/EC as amended by decision 2000/605/EC.

The class A1 is given in the ETA.

Note:
All references given in EN 13501-1 to older EC decisions regarding reaction to fire classification should be read as given to the new Delegated Act 2016/364 issued by the EC. The test result is given in the ETA (according to EN 13501-1).

2.2.10 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 (in accordance with EOTA TR 034) 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 scenario for this product and intended use with respect to dangerous substances is

S/W 1: Product with direct contact to soil, ground- and surface water.

The requirements in the application of factory made cellular glass loose fill manufactured from glass powder based on recycled material are considered with respect to environmental compatibility.

The following parameters are analysed in the solid material:

The concentration of arsenic, lead, cadmium, chromium (total), copper, nickel, mercury, zinc, after digestion of glass powder according to EN 13657 (aqua regia digestion). The parameters are analysed with an appropriate standardised test method according to Table 2. Measured values for each parameter of the solid material analysis of the glass powder are expressed in mg/kg and stated in the ETA.

Leaching tests of the glass powder made of recycled glass (every single supplier) are conducted according to EN 12457-4. The following parameters are analysed in the eluate:

The concentration of arsenic, lead, cadmium, chromium (total), copper, nickel, mercury, zinc is analysed. The parameters are analysed with an appropriate standardised test method according to Table 2. Measured values for each parameter of the analysis of the elution test of the glass powder are expressed in µg/L and stated in the ETA.

Table 2 Relevant parameters for analysis and appropriate standardised test methods

No	Parameter	Test method
1	Arsenic (As)	EN ISO 11969 or EN ISO 11885

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	Lead (Pb)	EN ISO 11885
3	Cadmium (Cd)	EN ISO 5961 or EN ISO 11885
4	Chromium (total) (Cr)	EN 1233 or EN ISO 11885
5	Copper (Cu)	EN ISO 11885
6	Nickel (Ni)	EN ISO 11885
7	Mercury (Hg)	EN 1483
8	Zinc (Zn)	EN ISO 11885

2.2.11 Thermal conductivity

The thermal conductivity of dry material is measured in accordance with EN 12667 and/or EN 12664 at a mean temperature of 10±0,3 °C under the following conditions:

Specimen

Test specimen with dimensions not less than 500 mm x 500 mm x 100 mm are to be used. The test specimens are compacted with actual degree of compaction. The test specimens are dried at 110±5 °C to constant mass.

The thermal conductivity is determined on basis of minimum three test results in accordance with EN ISO 10456.

The thermal conductivity $\lambda_{90/90}$, is calculated on basis of the EN 13167, Annex A representing at least 90 % of the production, determined with a confidence level of 90 %.The thermal conductivity λ_D, is rounded upwards to the nearest 0,005 W/(m·K).

The thermal conductivity λ_D is given in the ETA.

Moisture correction factor

The determination of the moisture correction factor, F_m, is performed on wet specimen under the following conditions:

Condition 1: The test specimens are exposed for long term water absorption by total immersion in accordance with EN 12087 (see chapter 2.2.12).

Condition 2: The test specimens are exposed for long term water absorption by total immersion in accordance with EN 12087 and afterwards for freeze-thaw cycles in accordance with the guidelines in EN 12091 (see chapter 2.2.13.1).

The thermal conductivity of dry material is measured in accordance with EN 12667 and/ or EN 12664 at a mean temperature of 10±0,3 °C.

The moisture correction factor, F_m, for calculation of the thermal conductivity for wet material is determined on basis of the average from minimum two measurements on dry material and two measurements on wet material and given in the ETA.

Note:
As a minimum the correction factor for the cellular glass loose fill with moisture content obtained after water absorption by total immersion according to EN 12087 is determined and given in the ETA.

2.2.12 Water absorption by total immersion

Long term water absorption by total immersion is determined in accordance with EN 12087, method 2A (total immersion).

The test is performed with the following modifications:

- The volume of the test specimen is at least 10 ℓ. The specimen can be placed in a cage (e.g. cage of heat-resistant plastic material with dimensions 500 mm x 500 mm x 100-200 mm) or in a cylinder, wrapped up in a cloth or mesh with a mesh width of approximately 2 mm.

- The minimum number of test specimen to get one test result is three.
- The water absorption should preferably be measured after 1 min, 14 days, 28 days and at the end of the test period.
- To determine the long term water absorption behaviour, the test in accordance with EN 12087 should be performed over a period at least one year unless the values of water content differ less than 3 % over test duration of 3 weeks.

Furthermore 5 particles taken from different lots are also exposed to total immersion accordance with EN 12087 over a period of 28 days. The water content and mass loss should be determined for each particle.

The water absorption is determined as the average value calculated from minimum three test specimens. The water absorption of the product is given in the ETA.

Note 1:
Testing over a period in accordance with EN 12087 is sufficient for production control.

Note 2:
For load bearing applications the test is performed on test specimens with the actual degree of compaction.

2.2.13 Resistance to freezing and thawing

2.2.13.1 Building applications

The resistance to freezing and thawing is tested in accordance with the guidelines in EN 12091 as follows:

The compacted specimens and 5 particles are first exposed for long term water absorption by total immersion (see chapter 2.2.12) in accordance with EN 12087 over a period of 28 days and then two of these three compacted specimens and the 5 particles are subjected to 25 freeze-thaw cycles.

Each freeze-thaw cycle consist of a 9 hour frost exposure at minus 20 °C followed by 15 hours of thawing in a water bath at about 20 °C.

The water absorption is determined after completion of the freeze-thaw cycles and the used aggregates are examined for any changes such as crack formation and/or loss in mass.

The determination of compressive stress at 10 % deformation described in 2.2.2 is performed on both dried and wet compacted specimen after these freeze-thaw cycles. The minimum number of test specimen to get one test result is three in dry conditions (test specimens shall be dried at 105 °C until constant mass) and three in wet conditions. The test is performed on test specimens (test frame of 200 mm x 200 mm x 100-200 mm) with the actual degree of compaction.

The water absorption during freeze-thaw cycles calculated as mean value of minimum two test specimens is determined and given in the ETA. The changes in compressive behaviour of both wet and dry specimens are determined and given in the ETA (see chapter 2.2.2).

Note 1:
Determination of resistance to freezing and thawing is only needed when the product is used under in-ground frost conditions.

Note 2:
For load bearing applications the test is performed on test specimens with the actual degree of compaction.

Note 3:
For internal production control the change in compressive behaviour can be determined on basis of testing of crushing resistance in accordance with 2.2.3 or by testing of compressive stress at 10% deformation in accordance with 2.2.2.

2.2.13.2 Traffic areas

For the use of cellular glass in the field of permanent way of traffic loads, the resistance to freezing and thawing in accordance with EN 13055 is determined. The minimum number of test specimen to get one test result is three. The minimum amount of material in one test specimen is 2000 ml.

The percentage loss in mass because of disintegration is determined. Visual observations of crack formations are described.
The percentage loss in mass because of disintegration is given as the mean value of minimum three test specimens in the ETA.

Note 1:
Determination of resistance to freezing and thawing is only needed when the product is used under in-ground frost conditions.

Note 2:
Depending on the applications planned it could be necessary to perform the test on compacted specimens.

Note 3:
If the determination of resistance to freezing and thawing is performed according to chapter 2.2.13.1 the results can be used instead.

2.2.14 Particle size distribution

Particle size distribution is determined in accordance with EN 933-1, applying sieve sizes according to EN 933-2.

The test is to be performed with the following modifications:

To avoid grinding, the sieving will be done carefully (preferably by hand), using no longer time than strictly necessary. The amount of material should be approximately 20 ℓ.

The particle size distribution of the product is given in the ETA, classification according to the following:

1) Grading given as typical particle size d/D (nominal sizes)
2) Cleanliness given as G85/15 (Maximum 15 % oversize and 15 % undersize)

2.2.15 Capillary water suction height

The water suction height is determined according to EN 1097-10 with the following modifications: The diameter and height of the test specimen is at least five times the maximum particle size, but not less than 300 mm. Before testing, the specimen is compacted with the actual degree of compaction.

The minimum number of test specimen to get one test result is three. The water suction height is determined as the mean level calculated from three test results.

To determine the long term capillary suction behaviour, the test in accordance with EN 1097-10 should be performed over a period at least one year. If the values of water suction differ less than 3 % after measurements over a shorter period the test can be stopped earlier.

The capillary water suction height is determined as the mean value calculated from minimum three test specimens. The capillary water suction height of the product is given in the ETA.

Note:
Testing over a period in accordance with EN 1097-10 is sufficient for production control.

3 ASSESSMENT AND VERIFICATION OF CONSTANCY OF PERFORMANCE

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

For the products with regard to structural bearings covered by this EAD the applicable European legal act is: Decision 95/467/EC

The systems are for any use except for uses subject to regulations on reaction to fire:

System 1 (for structural use, where requirements on individual bearings are critical) or 3 (non-structural use, 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
Factory production control (FPC) [**including testing of samples taken at the factory in accordance with a prescribed test plan**]					
1	Loose bulk density	EN 1097-3	Acc. to control plan	3	1 per day
2	Compressive stress at 10 % deformation	See clause 2.2.2	Acc. to control plan	3	1 per day[4]
3	Crushing resistance	See clause 2.2.3	Acc. to control plan	3	1 per month
4	Particle size distribution	See clause 2.2.15	Acc. to control plan	1	1 per 3 month
5	Thermal conductivity, dry	See clause 2.2.11	Acc. to control plan	1	1 per 3 month
6	Water absorption by total immersion	See clause 2.2.12	Acc. to control plan	1	2 per year
7	Compressive stress at 10 % deformation (after water absorption test by total immersion)	See clause 2.2.2	Acc. to control plan	1	2 per year

4 If the test results show little variation the frequency can be reduced to once per week.

No	Subject/type of control	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control
8	Thermal conductivity on wet material (Condition 1)	See clause 2.2.11	Acc. to control plan	1	1 per year
9	Freeze/thaw resistance	See clause 2.2.13	Acc. to control plan	2	1 per year
10	Oedometer modulus	See clause 2.2.1	Acc. to control plan	2	1 per 5 years
11	Creep strain	See clause 2.2.4	Acc. to control plan	2	1 per 5 years
12	Shear parameter	See clause 2.2.8	Acc. to control plan	5	1 per 5 years
13	Content, emission and release of dangerous substances	See clause 2.2.10	Acc. to control plan	1	4 per year

3.3 Tasks of the notified body

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.

The intervention of the notified body is only necessary in case of a structural use of the bearings (where requirements on individual bearings are critical), or in so far as the conditions for the applicability of system1 related to reaction to fire as defined in Decision 95/467/EC are fulfilled.

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
Initial inspection of the manufacturing plant and of factory production control *(for system 1 only)*					
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 – personnel and equipment – the suitability of the factory production control established by the manufacturer – full implementation of the prescribed test plan	-	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: – Presence of suitable test equipment – Presence of trained personnel – Presence of an appropriate quality assurance system and the necessary stipulations	Clauses 2.2.1 to 2.2.8	Control Plan	-	When starting the production
Continuous surveillance, assessment and evaluation of factory production control *(for system 1 only)*					
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: – Inspection of factory, of the production of the product and of the facilities for factory production control – Evaluation of the documents concerning factory production control Issuing a report of surveillance	Clauses 2.2.1 to 2.2.7	Control Plan	-	

* *Only relevant for products in buildings and civil engineering works where requirements on individual bearings are 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.*

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.

DIN 18137-3	Soil, investigation and testing: Part 3: Direct shear test.
EN 826	Thermal insulating products for building applications - Determination of compression behaviour
EN 933-1	Test for geometrical properties of aggregates-Part 1: Determination of particle size distribution; Sieving method
EN 933-2	Test for geometrical properties of aggregates-Part 2: Determination of particle size distribution; Test sieves, nominal size of apertures
EN 1097-3	Tests for mechanical and physical properties of aggregates-Part 3: Determination of loose bulk density and voids.
EN 1097-6	Tests for mechanical and physical properties of aggregates — Part 6: Determination of particle density and water absorption
EN 1097-10	Tests for mechanical and physical properties of aggregates-Part 10: Determination of water suction height.
EN 13286-7	Unbound and hydraulically bound mixtures-Test methods-Part 7: Cyclic load tri-axial test for unbound mixtures.
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 insulation products for building applications-Determination of long term water absorption by immersion
EN 12091	Thermal insulation products for building applications-Determination of freeze-thaw resistance
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 13055	Lightweight products: Lightweight aggregates
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 15715	Thermal insulation products – Instructions for mounting and fixing for reaction to fire testing – Factory made products
ISO 17892-5	Geotechnical investigation and testing - Laboratory testing of soil –Part 5: Incremental loading oedometer test
ISO 12491	Statistical methods for quality control of building materials and components
EN 1997-2	EUROCODE 7-Geotechnical design-Part 2: Ground investigation and testing
EOTA TR 034	General BWR 3 - Checklist for EADs / ETAs – Content and/or release of dangerous substances in construction products/kits

ANNEX A

1. Giant Oedometer test for testing on cellular glass loose fill

The test specimen is subjected to a series of increasing static loads, while vertical deformation is recorded versus time.

The procedure should be based on the CEN-document EN 1997-2 "Geotechnical design – Part 2: Design assisted by laboratory testing", with the following modifications:

The test specimen is prepared in a cylindrical steel container. The minimum dimensions of the container/specimen depend on the maximum size of the particles tested. Minimum height (and diameter) is approximately 10 times the maximum grain size of the material. The diameter should be approximately equal to or larger than the height of the specimen. The friction against the walls in the container should be minimized (e.g. by using grease and plastic film).

The cellular glass particles shall be filled into the cylinder in 5 - 6 layers of approx. equal thickness, followed by compaction with the actual degree of compaction.

Vertical static load increments are applied at certain time intervals. The load is increased stepwise from approximately 20 kPa. The load increment may be increased for increasing load stages. The following load stages may be used: 20 – 40 – 60 – 80 – 100 – 125 – 150 – 200 – 250 – 300 – 400 – 500 kPa. During each load stage the deformation of the specimen is recorded versus time.

The oedometer modulus is defined as the change in effective stress divided by the change in strain.

The oedometer modulus is calculated for each load stage and plotted against a stress load corresponding to the average of the stress at the previous and present load stages.

The load duration on the load stage shall be larger than 20 min for higher loads than approx. 60 kPa. The maximum load should be at least 500 kPa. The stop criteria (or time interval) for each load stage is defined in the ETA. For factory production control time intervals of 20 min are sufficient for all load stages up to 200 kPa, and the sufficient maximum load stage is 300 kPa.

2. Large shear frame test for testing on cellular glass loose fill

The interaction device with a floating upper frame shall have inlay frame dimensions of approximately 500 x 500 x 200 mm. The normal stress loads are applied over a pressure pad. Using hydraulic jacks the lower frame shall be moved horizontally and the required shearing strength depending on the displacement path shall be recorded.

The test specimen is to be installed with the actual degree of compaction.

The compacted test specimen are subjected to a series of vertical stress loads, while the shear strength is recorded relating to time.

The shear testing shall be performed with 5 vertical stress loads (e.g. 25, 50, 100, 200 and 250 kN/m²).

In advance of the shearing process the samples are to be consolidated by the according load stress until the subsidence is lower than 0,1 mm per minute. The consolidation shall be carried out with a minimum stressing time of 30 minutes.

The displacement rate during the subsequent shearing process shall be 1,0 mm per minute.

The following parameters are to be determined for every vertical stress load (σ') per test:

- Peak shearing strength τ_f [kN/m²]
- Consolidation subsidence [mm]
- Displacement path/distance [mm] at the highest reached shearing strength
- Diagram with shear strength and displacement path/distance.

The parameters friction angle φ' as well as the cohesion c' can be derived from a regression line approximating the peak shear strength:

$$\tau_f = \sigma' \cdot \tan \varphi' + c'$$

Note: The cohesion thus determined is caused by particle break and particle interlocking at the shear plane.