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European Assessment Document for

Aggregate concrete masonry units with specific moisture conversion factor F_M



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1 SCOPE OF THE EAD

1.1 Description of the construction product

The EAD covers aggregate concrete masonry units with specific moisture conversion factor F_m (in the following referred to as aggregate concrete masonry units). The aggregate concrete masonry units are of category I according to EN 771-3¹, Clause 3.1.19. The aggregate concrete masonry units are made of cement according to EN 197-1, lightweight aggregates according to EN 13055-1 or a combination of lightweight aggregates according to EN 13055-1 and aggregates according to EN 12620 and, if necessary, admixtures.

Due to the use of lightweight aggregates, the aggregate concrete masonry units subject to this EAD have a lower density and higher thermal insulation properties, but more porosity, than the aggregate concrete masonry units with only dense aggregates.

The aggregate concrete masonry units contain a mass and volume fraction of $\leq 1,0$ % of homogeneously distributed organic materials.

The product is not fully covered by the following harmonised technical specification EN 771-3:

- In addition to EN 771-3 this EAD gives the possibility to declare the following essential characteristic: Specific moisture conversion factor F_m .
- This EAD gives the possibility to declare the gross dry density and net dry density based on the assessment methods included in EN 771-3 but as (independent) essential characteristics as these characteristics are related to the intended use covered by this EAD (see Clause 1.2.1).
- Due the nature (high porosity) of the aggregate concrete masonry units the exposure to external climatic conditions is excluded from the intended use (see Clause 1.2.1). Therefore, the "durability against freeze/thaw" is not relevant for the products subject to this EAD.
- In addition to bullet point above (exclusion of external climatic conditions) and due to the low content of organic materials ($\leq 1,0$ %), the "content and/or emission of dangerous substances" is not relevant for the product subject to this EAD, neither regarding the environmental nor hygiene and health points of views.

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 intended uses are various types of load bearing and non-load bearing applications in all forms of internal and external walling including single leaf, cavity, partitions, retaining, basement and general use below ground level, including walling for fire protection, thermal insulation, sound insulation and the fabric of chimneys (excluding chimney flue units) according to EN 771-3.

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.

In deviation from EN 771-3, Clauses 3.1.3 and 3.1.4, and based on the nature of the aggregate concrete masonry units (high porosity) the aggregate concrete masonry units subject to this EAD are not intended to be exposed to external climatic conditions. Thus, in case of external walls, the aggregate concrete masonry units are intended to be used only in walls that are provided with a complete protection against water penetration on the face exposed to weathering.

The specific moisture conversion factors F_m can be used for calculation of thermal insulation.

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 aggregate concrete masonry units for the intended use of 50 years when installed in the works (provided that the aggregate concrete masonry units 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 works².

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

1.3.1 Absorption moisture content mass by mass $u_{m,80}$

A quotient of the mass of vapourable water and the mass of dry aggregate concrete masonry units at the temperature of 23 °C and 80 % relative humidity (r. h.).

1.3.2 Specific moisture conversion factor F_m

A product specific factor, derived from tests (see Clause 2.2.1 of this EAD), that represents the effect of moisture content at the conditions under which the aggregate concrete masonry units are intended to be used on their thermal conductivity in comparison with the dry state. (F_m is used for determining the thermal properties (calculation of thermal insulation) of the aggregate concrete masonry units on the basis of $\lambda_{10,dry,mat}$, see EN 1745).

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.

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 aggregate concrete masonry units is assessed in relation to the essential characteristics.

Table 2.1.1 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 | Dimensions | EN 771-3, Clause 5.2.1 | Level |
| 2 | Dimensional tolerances | EN 771-3, Clause 5.2.2 | Level, Class |
| 3 | Configuration | EN 771-3, Clause 5.3 | Description |
| 4 | Compressive strength | EN 771-3, Clause 5.5.1 | Level |
| 5 | Dimensional stability | EN 771-3, Clause 5.9 | Level |
| 6 | Shear bonds strength | EN 771-3, Clause 5.12 | Level |
| 7 | Flexural bond strength | EN 771-3, Clause 5.13 | Level |
| Basic Works Requirement 2: Safety in case of fire | | | |
| 8 | Reaction to fire | EN 771-3, Clause 5.11 | Class |
| Basic Works Requirement 3: Hygiene, health and the environment | | | |
| 9 | Water absorption | EN 771-3, Clause 5.8 | Level |
| 10 | Water vapour permeability | EN 771-3, Clause 5.10 | Level |
| Basic Works Requirement 5: Protection against noise | | | |
| 11 | Direct airborne sound insulation | EN 771-3, Clause 5.4.1 EN 771-3, Clause 5.2 EN 771-3, Clause 5.3.1 | Description |
| Basic Works Requirement 6: Energy economy and heat retention | | | |
| 12 | Thermal resistance | EN 771-3, Clause 5.6 | Level |
| 13 | Gross dry density | EN 771-3, Clause 5.4.1 and EN 771-3, Clause 5.4.3 | Level |
| 14 | Net dry density | EN 771-3, Clause 5.4.2 and EN 771-3, Clause 5.4.3 | Level |
| 15 | Specific moisture conversion factor F_m | 2.2.1 | Level |

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.

All assessment methods which are given in Table 2.1.1 as direct reference to the relevant clauses of EN 771-3 (for the Essential Characteristics No 1 – 14) shall be used in connection with the other related clauses of EN 771-3, mainly in connection with Annex A "Sampling for determination of product type and for independent testing of consignments". The relevant test methods (test standards) and the number of specimens given in its Table A.1 "Number of units required for a test" shall be used.

2.2.1 Specific moisture conversion factor F_m

The specific moisture conversion factor F_m shall be assessed as follows:

2.2.1.1 Determination of density of test specimens

As F_m is related to the porosity and, therefore, to the density of the material, the net dry density of the specimens of aggregate concrete masonry units which are used in the following tests shall be determined in accordance with EN 772-13, Clause 7.2.2, and recorded, see also Clause 2.2.1.5.

2.2.1.2 Determination of absorption moisture content

The absorption moisture content mass by mass at a temperature of 23°C and a relative humidity (r. h.) of 80 % $u_{m,80}$ shall be determined based on EN ISO 12571 using the climatic chamber method (in deviation from EN ISO 12571, Clause 4.1, only one test environment shall be applied (23°C, 80% r. h.), no sorption curve shall be drawn).

The following equation shall be used to calculate $u_{m,80}$ for each test specimen with an accuracy of one digit after the decimal point:

$$u_{m,80}[\%] = \frac{m_{80} - m_0}{m_0} \times 100$$

were

m_{80} is mass in kg of test specimen with equilibrium moisture content with the test environment of 23°C, 80% r. h.;

m_0 is mass in kg of dried test specimen.

The number of specimens is at least 3.

Then, the mean value of the test results $u_{m,80,mean}$ shall be calculated and rounded up to the first position after decimal point.

2.2.1.3 Determination of thermal conductivity in dry state/after moisture absorption

The following thermal conductivity measurements shall be taken in accordance with EN 12664 on specimens of the aggregate concrete masonry units:

- at least 3 measurements of thermal conductivity of the material $\lambda_{10,dry,mat}$ at an average temperature of 10°C in dry state,
- at least 3 measurements of thermal conductivity of the material $\lambda_{um,80}$ on specimens with equilibrium moisture content according to Clause 2.2.1.2 (23°C, 80% r. h.).

2.2.1.4 Calculation of moisture conversion factor

- Firstly, the effect of each 1% increase of moisture content on the thermal conductivity of material $\Delta\lambda_{1\%u}$ shall be calculated for each test specimen using the following equation:

$$\Delta\lambda_{1\%u} [\%/(1\%u)] = \frac{\frac{\lambda_{u_{m,80}} - \lambda_{10,dry,mat}}{\lambda_{10,dry,mat}} \times 100}{u_{m,80}}$$

- The mean value $\Delta\lambda_{1\%u,mean}$ shall be calculated and rounded up to the first position after decimal point.
- Then the specific moisture conversion factor F_m shall be calculated using the following equation and shall be rounded up to the second position after the decimal point:

$$F_m [-] = 1 + \frac{\Delta\lambda_{1\%u,mean} \times u_{m,80,mean}}{100}$$

2.2.1.5 Expression of performance

The specific moisture conversion factor F_m with the related specific range of net dry density shall be given in the ETA. The specific range of net dry density is the result of the highest value + 5 % and the lowest value - 5 % of the net dry densities of the specimens tested.

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 covered by this EAD the applicable European legal act is Commission Decision 97/740/EC, as amended by Commission Decision 2001/596/EC.

The system is 2 +.

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.

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] | | | | | |
| 1 | The controls in accordance with EN 771-3, Annex D, Table D.1 — Checking of finished products | EN 771-3, Annex D, Table D.1 | Control plan | EN 771-3, Annex D, Table D.1 | EN 771-3, Annex D, Table D.1 |
| 2 | Incoming Material | Visual or delivery note | Control plan | - | each delivery |
| 3 | Adsorption moisture content mass by mass <i>U_{m,80}</i> | 2.2.1 | Control plan | 3 | once a year |
| 4 | thermal conductivity $\lambda_{10,dry,mat}$ | EN 12664 | confidence level of 90% as mentioned in 3.4.1 | 1 | once a year |

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 aggregate concrete masonry 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 | | | | | |
| 1 | The Notified Body will ascertain that the factory production control with the staff and equipment are suitable to ensure a continuous and orderly manufacturing of the aggregate concrete masonry units | Verification of the complete FPC, to be implemented by the manufacturer | Control plan | - | When starting the production process or when starting a new production line |
| Continuous surveillance, assessment and evaluation of factory production control | | | | | |
| 2 | The Notified Body will ascertain that the system of factory production control and the specified manufacturing process are maintained taking account of the control plan | Verification of the controls carried out by the manufacturer on the raw materials, on the process and on the product as indicated in Table 3.2.1 | Control plan | - | Twice a year |

3.4 Special methods of control and testing used for the assessment and verification of constancy of performance

3.4.1 Statistical evaluation

With the results of the measurements $\lambda_{10,dry,mat}$ of the specimens regarding to Clause 2.2.1.3 a statistical evaluation (linear regression) of $\lambda_{10,dry,mat}$ shall be made as a function of the net dry density of the aggregate masonry units, regarding the determined range of net dry density.

Additionally, to the linear regression, a confidence level of 90% (mean value) shall be determined.

An example of a graphic presentation of a statistical evaluation is shown in Annex A, Figure A.1.

4 REFERENCE DOCUMENTS

| | |
|-------------------------|--|
| EN 197-1:2011 | Cement – Part 1: Composition, specifications and conform criteria for common cements |
| EN 771-3:2011+A1:2015 | Specification for masonry units – Part 3: Aggregate concrete masonry units (Dense and lightweight aggregates) |
| 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 772-16:2011 | Methods of test for masonry units — Part 16: Determination of dimensions |
| EN 772-20:2000+A1:2005 | Methods of test for masonry units — Part 20: Determination of flatness of faces of masonry units |
| 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 1745:2020 | Masonry and masonry products - Methods for determining thermal properties |
| EN ISO 12571:2021 | Hygrothermal performance of building materials and products — Determination of hygroscopic sorption properties (ISO 12571:2021) |
| EN 12620:2002+A1:2008 | Aggregates for concrete |
| EN 12664:2001 | 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 with medium and low thermal resistance |
| EN 13055-1:2002+AC:2004 | Lightweight aggregates |

ANNEX A

ANNEX A: EXAMPLE OF GRAPHIC PRESENTATION OF THE STATISTICAL EVALUATION

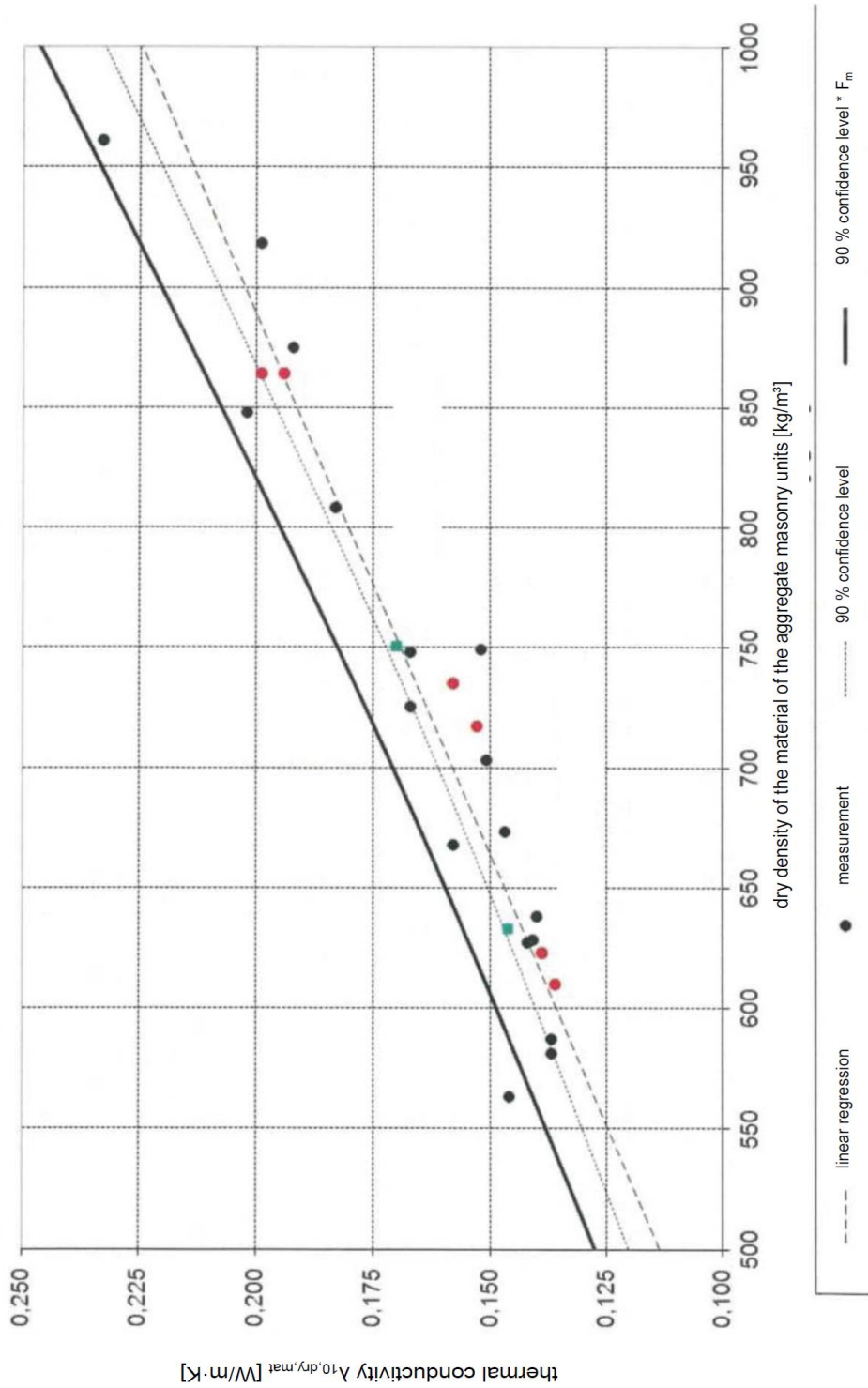


Figure A.1