EUROPEAN ASSESSMENT DOCUMENT

EAD 041561-00-1201

July 2020

# IN-SITU FORMED THERMAL INSULATION MADE OF MINERAL-BASED FOAM



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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

The construction product is an in-situ formed thermal insulation made of mineral-based foam.

The in-situ formed thermal insulation made of mineral-based foam (in the following referred to as thermal insulation) is made from several aqueous components (surfactant and additives / inorganic filler, organic binder and additives / curing agent) and pressurized air. The different components are mixed on site. The construction product does not contain fibres.

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 thermal insulation is intended to be built in in cavities of building elements (e. g., double-wall masonry) by specially trained companies. The cavities are completely filled by the foam.

The thermal insulation will not be built in between diffusion resistant layers.

The thermal insulation is intended to be used only in building elements which are in a proper state (no moisture penetration, free of damage and cracks).

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

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] 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 the working life referred to above.

# 2 ESSENTIAL CHARACTERISTICS AND RELEVANT ASSESSMENT METHODS AND CRITERIA

All undated references to standards or to EADs in this chapter are to be understood as references to the dated versions listed in chapter 4.

## 2.1 Essential characteristics of the product

Table 2.1 shows how the performance of the in-situ formed thermal insulation made of mineral-based foam is assessed in relation to the essential characteristics.

**Table 2.1 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 2: Safety in case of fire | | | |
| 1 | Reaction to fire | 2.2.1 | class |
| Basic Works Requirement 6: Energy economy and heat retention | | | |
| 2 | Thermal conductivity | 2.2.2 | level |
| 3 | Density | 2.2.3 | level |
| 4 | Long-term water absorption by partial immersion | 2.2.4 | level |
| 5 | Dimensional stability under constant normal laboratory conditions | 2.2.5 | level |
| 6 | Dimensional stability under specified temperature and humidity conditions of 70 °C / 90% relative humidity | 2.2.6 | level |
| 7 | Dimensional stability under specified temperature of -30 °C | 2.2.7 | level |
| 8 | Reactivity | 2.2.8 | description |

## 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.

The test specimens shall be chosen in such a way that the density range and the thickness range of the final product are covered. The minimum thickness of the test specimens shall be 50 mm unless other provisions result from the following clauses.

Depending on the used test method/test standard the test specimens are sawn out of a produced foam block (e. g., 400 mm x 400 mm x 200 mm), if no other provisions are stated in the following clauses.

### 2.2.1 Reaction to fire

The in-situ formed thermal insulation made of mineral-based foam shall be tested, using the test method(s) for the corresponding reaction to fire class according to EN 13501-1. The product shall be classified according to Commission Delegated Regulation (EU) 2016/364 in connection with EN 13501-1.

Provisions for choosing and preparation of the samples, mounting and fixing conditions of the test specimens as well as for the extended application of test results are given in Annex A.

### 2.2.2 Thermal conductivity

The thermal conductivity $\lambda_{10,(23,50)}$ is determined in accordance with EN 12667 or, for thick products, in accordance with EN 12939 (recommended: with guarded hot plate (two-plate) device). Measurements with at least 4 specimens are performed at a temperature of 10 °C. Before the test the samples shall be dried by storing the specimen (at least 200 mm x 200 mm) in a climate of 23 °C and 50% relative humidity to constant mass.

The thermal conductivity at 23 °C and 50% relative humidity $\lambda_{D(23,50)}$, representing at least 90% of the production with a confidence level of 90%, is determined on the basis of the measuring results ($\lambda_{10,(23,50)}$ ) in accordance with EN ISO 10456 (clause 5).

The thermal conductivity $\lambda_{D(23,50)}$ is given in the ETA.

The influence of humidity on the thermal conductivity is determined by storing at least 3 specimens out of the specimens (at least 4) which were already subjected to the measurements in a climate of 23 °C and 50% relative humidity, in a climate of 23 °C and 80% relative humidity followed by measurements in accordance with EN 12667.

For each climate the moisture content mass by mass ($u_{23,50}$ / $u_{23,80}$) is determined beside the thermal conductivity ($\lambda_{10,(23,50)}$ / $\lambda_{10,(23,80)}$).

The moisture conversion factor $F_m$ for the conversion of $\lambda_{23,50}$ to $\lambda_{23,80}$ is calculated according to EN ISO 10456 (clause 7.3) using the mean values of thermal conductivity of each climate and given in the ETA.

### 2.2.3 Density

The density is determined in accordance with EN 1602 with at least 5 specimens (at least 100 mm x 100 mm x 100 mm). Before the test the samples shall be dried by storing the specimen at 60 °C to constant mass.

The average density accompanied by variation coefficient is given in the ETA.

### 2.2.4 Long-term water absorption by partial immersion

The water absorption by long-term partial immersion is determined in accordance with EN 12087 (method 1A) or EN ISO 16535 [1] (method 1A) with at least 4 specimens (approx. 200 mm x 200 mm). Before testing the test specimens are stored for at least 6 hours at (23 ± 5) °C. The test shall be carried out at (23 ± 5) °C using water with a temperature of (23 ± 5) °C.

The long-term water absorption by partial immersion is given in the ETA using steps of 1 kg/m².

[1] Note: The a.m. test standard EN 12087 was replaced by EN ISO 16535 (including the same test methods, but with additional test conditions for the use in tropical countries).

### 2.2.5 Dimensional stability under constant normal laboratory conditions

The determination of the dimensional stability under constant normal laboratory conditions is carried out according to EN 1603 (method A) with at least 3 specimens (approx. 200 mm x 200 mm). Testing is performed after 28 days storage at (23 ± 2) °C and (50 ± 5) % relative humidity.

The mean values of the relative change in length $\Delta\varepsilon_l$, in width $\Delta\varepsilon_b$ and in thickness $\Delta\varepsilon_d$ are given in % in the ETA.

### 2.2.6 Dimensional stability under specified temperature and humidity conditions of 70 °C / 90% relative humidity

The determination of the dimensional stability under specified temperature and humidity conditions is carried out according to EN 1604 with at least 3 specimens (approx. 200 mm x 200 mm). Testing is performed after 28 days storage at (70 ± 2) °C and (90 ± 5) % relative humidity.

The mean values of the relative change in length $\Delta\varepsilon_l$, in width $\Delta\varepsilon_b$ an in thickness $\Delta\varepsilon_d$ are given in % in the ETA.

### 2.2.7 Dimensional stability under specified temperature of -30 °C

The determination of the dimensional stability under specified temperature is carried out according to EN 1604 with at least 3 specimens (approx. 200 mm x 200 mm). Testing shall be performed after 24 hours storage at (-30 ± 3) °C.

The maximum values of the relative change in length $\Delta\varepsilon_l$, in width $\Delta\varepsilon_b$ and in thickness $\Delta\varepsilon_d$ are given in % in the ETA.

### 2.2.8 Reactivity

The reactivity of the thermal insulation shall be tested in accordance with Annex B of this EAD.

The test result (reaction time in seconds) of the test samples is given in the ETA.

# 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 1999/91/EC, as amended by Commission Decision 2001/596/EC.

The system to be applied is 3 for any use except for uses subject to regulations on reaction to fire.

For uses subject to regulations on reaction to fire the applicable AVCP systems are 1, 3 or 4 depending on the conditions defined in the above-mentioned Decision (as amended).

## 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.

**Table 3.2 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 | Reaction to fire | 2.2.1 | according to control plan | according to control plan | twice per year ** |
| 2 | Thermal conductivity | 2.2.2 | according to control plan | 1 | every batch* |
| 3 | Density | 2.2.3 | according to control plan | 2.2.3 | every batch* |
| 4 | Long term water absorption by partial immersion | 2.2.4 | according to control plan | 2.2.4 | twice per year |
| 5 | Dimensional stability under constant normal laboratory conditions | 2.2.5 | according to control plan | 2.2.5 | twice per year |
| 6 | Dimensional stability under specified temperature and humidity conditions of 70°C / 90% relative humidity | 2.2.6 | according to control plan | 2.2.6 | twice per year |
| 7 | Dimensional stability under specified temperature of -30 °C | 2.2.7 | according to control plan | 2.2.7 | twice per year |
| 8 | Reactivity | 2.2.8 | according to control plan | 2.2.8 | every batch* |

* In case of discontinuous production these minimum frequencies should be adapted to an equivalent frequency.
** Test method according to EN 13823 shall apply once per two years at least.

## 3.3 Tasks of the notified body

The intervention of a notified body under AVCP system 1 for this product is only necessary if 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 limitation of the amount of organic content) and the reaction to fire performance class of the product is A1, A2, B or C.

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 thermal insulation product are laid down in Table 3.3.

**Table 3.3 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 | Reaction to fire:<br>- Presence of suitable test equipment<br>- Presence of trained personnel<br>- Presence of an appropriate quality assurance system and necessary stipulations<br>taking especially account of a clearly identifiable stage in the production process results in an improvement of the reaction to fire classification | Verification of the complete FPC, to be implemented by the manufacturer | Control plan | - | When starting the production or after modification of the production process |
| **Continuous surveillance, assessment and evaluation of factory production control** | | | | | |
| 2 | Reaction to fire<br>- Inspection of factory, of the production of the product and of the facilities for factory production control<br>- Evaluation of the documents concerning the factory production control<br>- Issuing a report of surveillance<br>taking especially account of a clearly identifiable stage in the production process results in an improvement of the reaction to fire classification | Verification of the controls carried out by the manufacturer on the raw materials, on the process and on the product as indicated in Table3.2 | Control plan | - | Annually |

# 4 REFERENCE DOCUMENTS

EN 1602:2013 Thermal insulating products for building applications - Determination of the apparent density

EN 1603:2013 Thermal insulating products for building applications – Determination of dimensional stability under constant normal laboratory conditions (23 °C/ 50 % relative humidity)

EN 1604:2013 Thermal insulating products for building applications - Determination of dimensional stability under specified temperature and humidity conditions

EN 12087:2013 Thermal insulating products for building applications - Determination of long-term water absorption by immersion

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 12939:2000 Thermal performance of building materials and products - Determination of thermal resistance by means of guarded hot plate and heat flow meter methods - Thick products of high and medium thermal resistance

EN 13238:2010 Reaction to fire tests for building products - Conditioning procedures and general rules for selection of substrates

EN 13501-1:2018 Fire classification of construction products and building elements – Part 1: Classification using data from reaction to fire tests

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 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 10456:2007 + AC:2009 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 building products subjected to direct impingement of flame - Part 2: Single-flame source test

EN ISO 16535:2019 Thermal insulating products for building applications - Determination of long-term water absorption by immersion

# ANNEX A - PROVISIONS FOR PREPARATION AND MOUNTING AND FIXING CONDITIONS OF THE TEST SPECIMENS AS WELL AS THE EXTENDED APPLICATIONS OF THE TEST RESULTS OF THE RELEVANT REACTION TO FIRE TESTS

## A.1 Preparation of specimens and conditioning

For the preparation of specimens the mineral based foam shall be foamed onto an appropriate standard substrate acc. to EN 13238 (calcium-silicate board is recommended, but the use of a wood-based standard substrate is also possible) or into a frame made of a standard substrate board acc. to EN 13238. After hardening the mineral foam blocks shall be cut to the required size acc. to the relevant test standards.

Conditioning of the prepared test specimens shall be conducted in accordance with the provisions of the respective test standards and EN 13238.

## A.2 Product and installation parameters

The tables A.1 and A.2 give the parameters that have to be taken into account when determining the reaction to fire performance of the mineral based foam.

Table A.1: Product parameters

| Product Parameters | EN ISO 1182 (class A1 and A2) | EN ISO 1716 (class A1 and A2) | EN 13823 (class A1 to D) | EN ISO 11925-2 (class B to E) |
|---|---|---|---|---|
| Variations of a product family[1] | X | X | X | X |
| Thickness | - | - | X | X |
| Density | X | - | X | X |
| Organic content / amount of flame retardants | X | X | X | X |

[1] As defined by a certain combination of raw materials and a certain type of production process

Table A.2: Installation parameters

| Parameter | EN 13823 (class A1 to D) | EN ISO 11925-2 (class B to E) |
|---|---|---|
| Exposure to thermal attack | X | X |
| Substrate | X | X |
| Air gaps / Cavities | X | - |
| Joints/edges | X | X |
| Size and specimen positioning | X | - |
| Product orientation and geometry | - | - |
| Fixing of test specimen | X | X |

## A.3 EN ISO 1182 and EN ISO 1716

These test methods are relevant for reaction to fire classes A1 and/or A2.
The tests shall be performed taking into account the product parameters as given in table A.1 but without consideration of the end-use conditions of the mineral foam.

## A.4 EN 13238 (SBI test)

This test method is relevant for reaction to fire classes A2 to D acc. to EN 13501-1 and in certain cases for class A1 too.

**Test specimens – preparation and dimension of the test rig and the specimens**

For preparing the test specimens the product parameters and installation parameters stated in tables A.1 and A.2 as well as the rules for the application of the test results given in table A.3 and the following provisions shall be taken into account.

The test rig consists of a right-angle corner with a long wing (1.0 m width) and a short wing (0.5 m width), each 1.5 m height. The dimensions of the specimens shall be:

| | **Assembly dimensions [mm – nominally]** | |
|---|---|---|
| | **Length** | **Height** |
| **Short wing** | 500 | 1500 |
| **Long wing** | 1000 + t | 1500 |
| Where t = thickness of the panels | | |

On the long wing of each test specimen at least one vertical and one horizontal joint shall be considered as prescribed in the test standard (200 mm for away from the inner corner of the test specimen and 500 mm above the floor of the specimen trolley). Execution of the joints shall be executed as butt joints.

The hardened mineral based foam shall be cut to pieces from the blocks prepared acc. to clause A.1 and with such size that at least the joints prescribed before are ensured (a size of 500 mm x 400 mm x "t" is recommended as standard dimension). Due to the uneven surface of the hardened foam (as result of the foaming process), the visible surface shall be smoothed by an appropriate tool (e. g., a metal saw) to obtain the specimen thickness required for testing.

The entire test specimens (including the substrate) shall be directly positioned in front of the SBI backing board.

**Substrate and fixing**

For testing purposes the test specimens shall be mounted onto an appropriate standard substrate acc. to EN 13238 representing the possible substrates in end use applications.
Due to the porous and brittle nature of the hardened mineral based foam, the foam pieces shall be glued onto the substrate by using a non-combustible adhesive having no influence on the test results of the foam (a sodium-silicate based adhesive with a PCS value equal or lower than 0 MJ/kg shall be used). The maximum coverage of the adhesive shall be of about 600 to 650 g/m².
Additionally, each piece of the hardened foam shall be secured on the substrate with one metal screw and washer of 30 mm diameter in the middle of the surface of each piece.

**Air gap and ventilation**

Due to the intended end-use application of the mineral based foam no air gap and its ventilation have to be taken into account when preparing the test samples.

**Number of test specimens**

At least one test with any of the identified specimen configurations (based on the aforementioned provisions) shall be performed and two further tests with the most onerous specimen configuration as basis for the classification.

**A.5 EN ISO 11925-2 (Small ignition source test)**

This test method is relevant for reaction to fire classes B to E acc. to EN 13501-1.

**Test specimens – preparation and dimension of the specimens**

For preparing the test specimens the product parameters and installation parameters stated in tables A.1 and A.2 as well as the rules for the application of the test results given in table A.3 and the following provisions shall be taken into account.

The dimension of the specimens shall be as prescribed in the test standard – 90 mm x 250 x.mm x "t" – without any joints:

The hardened mineral based foam shall be cut to pieces from the blocks prepared acc. to clause A.1 and with dimensions as prescribed before. Due to the uneven surface of the hardened foam (as result of the foaming process), the visible surface shall be smoothed by an appropriate tool (e. g., a metal saw) to obtain the specimen thickness required for testing.

**Substrate and fixing**

For testing purposes the test specimens shall be mounted onto an appropriate standard substrate acc. to EN 13238 representing the possible substrates in end use applications.
Due to the porous and brittle nature of the hardened mineral based foam, the foam pieces shall be glued onto the substrate by using a non-combustible adhesive having no influence on the test results of the foam (a sodium-silicate based adhesive with a PCS value equal or lower than 0 MJ/kg shall be used). The maximum coverage of the adhesive shall be of about 600 to 650 g/m².
Additionally, the hardened foam pieces shall be secured on the substrate with one screw and washer of 30 mm diameter in the middle of the specimen surface.

**Types of flame exposure and number of test specimens**

The test specimens shall be tested with edge exposure as well as with surface exposure. At least two tests with any of the identified specimen configurations (based on the aforementioned provisions) shall be performed and four further tests with the most onerous specimen configuration as basis for the classification.

## A.6 Extended application of test results

Tables A.3 describes the applicability of the test results with regard to those parameters of tables A.1 and A.2 that were taken into account within the reaction to fire tests of the mineral based foam.

Table A.3: Validity of test results with regard to product parameters and installation

| Parameters | EN ISO 1182 | EN ISO 1716 | EN 13823 (SBI) | EN ISO 11925-2 |
|---|---|---|---|---|
| Variations of a defined product family [1] | for all variations of a defined product family covered by the parameters below | | | |
| Thickness | not relevant | not relevant | - as tested or<br>- range between highest and lowest thickness tested<br>- any higher thickness, if 200 mm thick specimens were tested. | - as tested or<br>- range between highest and lowest thickness tested<br>- any higher thickness, if 60 mm thick specimens were tested. |
| Density | - for the tested density ± 10 %<br>or<br>- for the range between highest and lowest density tested | not relevant | - for the tested density ± 10 %<br>or<br>- for the range between highest and lowest density tested | |
| Amount of organic content and flame retardants | - for the tested composition with equal or lower organic content only<br>and<br>- with equal or higher amount of the same type of flame retardants. | | | |
| Type of exposure | See EN ISO 1182 and EN ISO 1716 respectively | | See EN 13823 | see EN ISO 11925-2 – for all covered exposures, if tested with edge and surface exposure |
| Substrate | | | See EN 13238 | |

<table>
<tr><td colspan="5">Table A.3: Validity of test results with regard to product parameters and installation</td></tr>
<tr><td>Parameters</td><td colspan="2">EN ISO 1182</td><td colspan="2">EN ISO 1716</td><td>EN 13823 (SBI)</td><td>EN ISO 11925-2</td></tr>
<tr><td>Air gaps / Cavities</td><td colspan="3" rowspan="5">Not relevant – these tests are independent from any installation parameters in the end-use application</td><td colspan="2">Without air gaps or cavities behind the insulation foam</td></tr>
<tr><td>Joints/edges</td><td colspan="2">Without joints or butt joints<br>With or without edge protection</td></tr>
<tr><td>Specimen positioning</td><td colspan="2">For all product sizes</td></tr>
<tr><td>Product orientation and geometry</td><td colspan="2">Not relevant due to the type of the manufacturing an application of the foam</td></tr>
<tr><td>Fixing of test specimen</td><td colspan="2">For applications<br>- without any types of fixing,<br>- with metal mechanical fixing devices and/or<br>- with non-combustible adhesives (PCS ≤ 0 MJ/kg)</td></tr>
<tr><td colspan="7">[1] As defined by a certain combination of raw materials and a certain type of production process</td></tr>
</table>

# ANNEX B - TEST METHOD FOR THE REACTIVITY OF THE THERMAL INSULATION

The reactivity of the thermal insulation made of mineral-based foam shall be tested as follows with at least 3 test specimens (conical sample with approx. 300 mm diameter and a height of approx. 200 mm).

The components of the foam shall be mixed according to the manufacturers instruction and the result of the reaction process of these mixed components is the hardened foam.

The reactivity of the thermal insulation made of mineral-based foam is determined with a suitable stopwatch measuring the reaction time of the foam from the start of the foaming (starting point) until a hardened foam has been developed (end point).

After mixing the components of the foam the foam-mass shall be reacted within 60 seconds to produce a solid and homogeneous foam material.

The test shall be carried out within 60 seconds after mixing the components of the foam with a suitable spatula by splitting the foam sample. The end point is considered as reached if the hardened foam material breaks with flat and smooth fracture surface of the cut areas inside of the tested specimen. No further foaming or backflow (flow of liquid components of the foam) shall be observed.

The test result (reaction time in seconds) of the test samples is given in the ETA.