



EUROPEAN ASSESSMENT DOCUMENT

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THERMAL INSULATION BOARD MADE OF PRESSED RIGID POLYURETHANE FOAM

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1 SCOPE OF THE EAD

1.1 Description of the construction product

The factory-made thermal insulation boards are made of pressed rigid polyurethane (PU) foam material with a very high compressive strength. They are in the following referred to as "thermal insulation boards".

The thermal insulation boards are available in a range of thicknesses and board sizes and have got smooth, level and rigid surfaces without additional layers.

The thermal insulation boards are composed of milled PU-residues bonded using a binding agent and compressed to form boards. Cutting and milling residues from production, which can include layers (e.g. aluminium foil) without impurities are used.

The product is not fully covered by the following harmonised technical specification: EN 13165¹.

The thermal insulation boards deviate from EN 13165 because of the following reasons.

- The thermal insulation boards have, different from the products covered by EN 13165 (c.f. EN 13615, clause 3), not a substantially closed cell structure.
- Consequently, the boards do not include a blowing agent so that an ageing effect concerning thermal conductivity due to changes in the cell gas composition with time does not occur (see Annex C of EN 13165). However, an influence of humidity on the thermal conductivity exists.
- The density, the bending strength and the shear strength are not covered by Annex ZA of EN 13165 but can be necessary in case of fixing the thermal insulation boards directly on a wall or ceiling.

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 polyurethane (PU) thermal insulation boards are intended to be used as thermal insulation in buildings and construction applications, including floors, walls and roofs where they are protected from mechanical damage, weathering, precipitation and moisture, for construction elements with no contact to water and soil.

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 board for the intended use 25 years when installed in the works, provided that the thermal insulation board is subject to appropriate installation

¹ All undated references to standards or to EADs in this document are to be understood as references to the dated versions listed in clause 4.

(see clause 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.

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 1 shows how the performance of the thermal insulation board 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 2: Safety in case of fire			
1	Reaction to fire	2.2.1	Class
Basic Works Requirement 4: Safety and accessibility in use			
2	Bending strength	2.2.14	Level
3	Shear strength	2.2.15	Level
Basic Works Requirement 6: Energy economy and heat retention			
4	Thermal conductivity	2.2.2	Level
5	Compressive strength	2.2.3	Level
6	Short-term water absorption	2.2.4	Level
7	Hygroscopic sorption properties	2.2.5	Level
8	Water vapour diffusion resistance	2.2.6	Level
9	Dimensional stability under specified temperature and humidity	2.2.7	Level
10	Tensile strength perpendicular to faces	2.2.8	Level
11	Density	2.2.9	Level
12	Thickness	2.2.10	Level
13	Length and width	2.2.11	Level
14	Squareness	2.2.12	Level
15	Flatness	2.2.13	Level
16	Deformation under specified compressive load and temperature conditions	2.2.16	Level
17	Compressive creep	2.2.17	Level
18	Flatness after one-sided wetting	2.2.18	Level
19	Long-term water absorption	2.2.19	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.

For sampling, conditioning and testing (dimensions of the test specimens, minimum number of measurements, specific conditions) EN 13165 shall apply, unless otherwise is specified in the following.

2.2.1 Reaction to fire

The thermal insulation product shall be tested using the procedures/test method(s) relevant 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.

The instructions for mounting and fixing according to EN 15715 (tables A16 and A17) using the product specific details for polyurethane (PU)-boards are used for reaction to fire testing.

The reaction to fire class is given in the ETA.

2.2.2 Thermal conductivity

The thermal conductivity at a temperature of 10 °C shall be determined in accordance with EN 12667 or EN 12939 for thick products in accordance with EN 13165, clause 5.3.2 but without aging according to Annex C of EN 13165. At least 4 measurements shall be performed (test specimens 500 mm x 500 mm).

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 in accordance with EN 13165, Annex A, and stated in the ETA.

The influence of humidity on the thermal conductivity is determined by storing the specimens in a climate of 23 °C and 80 % relative humidity followed by measurements with at least 3 specimens in accordance with EN 12667 or EN 12939 for thick products.

The thermal conductivity ($\lambda_{10,(23,80)}$) and the moisture content mass by mass ($u_{23,50} / u_{23,80}$) are determined.

During the measurement, precaution is taken to avoid moisture absorption by the specimens.

The mass-related moisture conversion coefficient f_u is calculated by the following formula (derived from EN ISO 10456, formula 4) by using the average for λ and u :

$$f_u = \frac{\ln \frac{\lambda_{10,(23,80)}}{\lambda_{10,(23,50)}}}{u_{23,80} - u_{23,50}}$$

The moisture conversion factor F_m is calculated according to EN ISO 10456, formula 4.

The mass-related moisture conversion coefficient f_u for the conversion of $\lambda_{23,50}$ to $\lambda_{23,80}$ as well as the moisture content mass by mass (m/m) at 23 °C and 50 % relative humidity and 23 °C and 80 % relative humidity are given in the ETA.

The moisture conversion factor F_m for the conversion of $\lambda_{23,50}$ to $\lambda_{23,80}$ is given in the ETA.

2.2.3 Compressive strength

The compressive strength is determined, in line with the provisions of EN 13165, in accordance with EN 826 with at least 3 test specimens (size at least 50 x 50 mm and not more than 100 x 100 mm).

The compressive strength is given in the ETA in levels using steps as given in EN 13165.

2.2.4 Short-term water absorption

The short-term water absorption by partial immersion is determined in accordance with EN 1609, method B.

The short-term water absorption is given in the ETA.

2.2.5 Hygroscopic sorption properties

The hygroscopic sorption properties are determined in accordance with EN ISO 12571 (climatic chamber method).

The moisture content u at 23 °C and 80% relative humidity (desorption) is given in the ETA.

2.2.6 Water vapour diffusion resistance

The water vapour diffusion resistance factor is determined, in line with the provisions of EN 13165, in accordance with EN 12086 (climatic condition A).

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

2.2.7 Dimensional stability under specified temperature and humidity

Dimensional stability under specified temperature and humidity conditions, in line with the provisions of EN 13165, is determined in accordance with EN 1604.

The tests shall be carried out under the test conditions according to EN 13165, clause 4.3.2.

The relative changes in length, width and thickness are given in the ETA in accordance with EN 13165, clause 4.3.2.

2.2.8 Tensile strength perpendicular to faces

The tensile strength perpendicular to faces is determined, in line with the provisions of EN 13165, in accordance with EN 1607 with at least 3 test specimens (size at least 50 mm x 50 mm and not more than 100 mm x 100 mm).

The tensile strength perpendicular to faces is given in the ETA in accordance with EN 13165, Table 9. Above 150 kPa, the tensile strength can be given in levels with steps of 50 kPa.

2.2.9 Density

The density is determined in accordance with EN 1602.

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

2.2.10 Thickness

The thickness d is determined, in line with the provisions of EN 13165, in accordance with EN 823 with at least 3 test specimens.

The thickness and the possible tolerances are given in the ETA considering the maximum tolerances given in EN 13165, clause 4.2.3.

2.2.11 Length and width

The length l and width b of the insulation board is determined, in line with the provisions of EN 13165, in accordance with EN 822 with at least 3 test specimens.

The length, width and the possible tolerances are given in the ETA considering the maximum tolerances given in EN 13165, clause 4.2.2.

2.2.12 Squareness

The squareness is determined, in line with the provisions of EN 13165, in accordance with EN 824 with at least 3 test specimens.

The deviation from squareness on length and width, S_b , is given in the ETA and shall, in accordance with EN 13165, clause 4.2.4, not exceed 5 mm/m.

2.2.13 Flatness

The flatness is determined, in line with the provisions of EN 13165, in accordance with EN 825 with at least 3 test specimens.

The deviation from flatness, S_{max} , is given in the ETA and shall not exceed the level given in EN 13165, clause 4.2.5.

2.2.14 Bending strength

The bending strength is determined, in line with the provisions of EN 13165, Annex E.2, in accordance with EN 12089 (method B).

The bending strength is given in the ETA.

2.2.15 Shear strength

The shear strength is determined, in line with the provisions of EN 13165, Annex E, in accordance with EN 12090. A single test piece shall be used.

The shear strength is given in the ETA.

2.2.16 Deformation under specified compressive load and temperature conditions

The deformation under specified compressive load and temperature conditions is determined, in line with the provisions of EN 13165, in accordance with EN 1605.

The used test conditions and the relative change in thickness are given in the ETA using levels given in EN 13165.

2.2.17 Compressive creep

The compressive creep and the total thickness reduction are determined after at least 122 days of testing at a defined compressive stress (given in steps of at least 1 kPa) and the results extrapolated 30 times (corresponding to ten years) to obtain the defined levels, in line with the provisions of EN 13165, in accordance with EN 1606. The test is performed with the load step of $\sigma_c = 0,15 \times \sigma_m$ or $\sigma_c = 0,15 \times \sigma_{10}$ according to EN 1606, clause 7.2.

The compressive creep and the total thickness reduction are given in the ETA in levels, with steps of 0,5 %, at the defined stress.

2.2.18 Flatness after one-sided wetting

Change in deviation from flatness after one-sided wetting is determined from measurements of flatness made in accordance with EN 825 before and after conditioning the product in accordance with EN 13165 (clause 5.3.3). Both sides of the product are tested.

The change in deviation from flatness for each side shall not exceed the level given in EN 13165.

2.2.19 Long-term water absorption

Long-term water absorption by partial and/or total immersion is determined, in line with the provisions of EN 13165, in accordance with EN 12087. Method 1A is used for partial immersion, method 2A for total immersion.

The long-term water absorption and the used test conditions are 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 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, or 3, or 4 depending on the conditions defined in the above mentioned Commission Decision 1999/91/EC, as amended by Commission Decision 2001/596/EC.

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 2.

Table 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	1	EN 13165, Table B.2
2	Thermal conductivity	2.2.2	According to control plan	1	EN 13165, Table B.1
3	Compressive strength	2.2.3	According to control plan	4	EN 13165, Table B.1
4	Short-term water absorption	2.2.4	According to control plan	4	EN 13165, Table B.1
5	Hygroscopic sorption properties	2.2.5	According to control plan	3	twice per year
6	Water vapour diffusion resistance	2.2.6	According to control plan	4	EN 13165, Table B.1
7	Dimensional stability under specified temperature and humidity	2.2.7	According to control plan	4	EN 13165, Table B.1
8	Tensile strength perpendicular to faces	2.2.8	According to control plan	4	EN 13165, Table B.1
9	Density	2.2.9	According to control plan	3	EN 13165, Table E.1
10	Thickness	2.2.10	According to control plan	4	EN 13165, Table B.1

No	Subject/type of control	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control
11	Length and width	2.2.11	According to control plan	4	EN 13165, Table B.1
12	Squareness	2.2.12	According to control plan	4	EN 13165, Table B.1
13	Flatness	2.2.13	According to control plan	4	EN 13165, Table B.1
14	Bending strength	2.2.14	According to control plan	3	twice per year
15	Shear strength	2.2.15	According to control plan	3	twice per year
16	Deformation under specified compressive load and temperature conditions	2.2.16	According to control plan	4	EN 13165, Table B.1
17	Compressive creep	2.2.17	According to control plan	4	EN 13165, Table B.1
18	Flatness after one-sided wetting	2.2.18	According to control plan	4	EN 13165, Table B.1
19	Long-term water absorption	2.2.19	According to control plan	4	EN 13165, Table B.1

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 3.

The intervention of the notified body under AVCP system 1 is only necessary for reaction to fire for products/materials for which a clearly identifiable stage in the production process results in an improvement of the reaction to fire classification (e.g. an addition of fire retardants or a limiting of organic material).

Table 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	<p>Initial inspection of the manufacturing plant and of factory production control carried out by the manufacturer regarding the constancy of performance related to reaction to fire** and taking into account a limiting of organic material and/or the addition of fire retardants</p> <p>In particular the following items shall be appropriately considered:</p> <ul style="list-style-type: none"> - Presence of suitable test equipment - Presence of trained personal - Presence of an appropriate quality assurance system and necessary stipulations 	-	According to control plan	-	When starting the production
Continuous surveillance, assessment and evaluation of factory production control					
2	<p>Continuous surveillance, assessment and evaluation of the factory production control carried out by the manufacturer regarding the constancy of performance related to reaction to fire** and taking into account a limiting of organic material and/or the addition of fire retardants</p> <p>In particular the following should be dealt with:</p> <ul style="list-style-type: none"> - Inspection of factory, of the production of the product and of the facilities for factory production control - Evaluation of the documents concerning the factory production control - Issuing a report of surveillance 	-	According to control plan	-	Annually

** Only relevant for products of class C and higher

4 REFERENCE DOCUMENTS

EN 822:2013	Thermal insulating products for building applications – Determination of length and width
EN 823:2013	Thermal insulating products for building applications – Determination of thickness
EN 824:2013	Thermal insulating products for building applications – Determination of squareness
EN 825:2013	Thermal insulating products for building applications – Determination of flatness
EN 826:2013	Thermal insulating products for building applications - Determination of compression behaviour
EN 1602:2013	Thermal insulating products for building applications – Determination of the apparent density
EN 1604:2013	Thermal insulating products for building applications – Determination of dimensional stability under specified temperature and humidity conditions
EN 1605:2013	Thermal insulating products for building applications – Determination of deformation under specified compressive load and temperature conditions
EN 1606:2013	Thermal insulating products for building applications – Determination of compressive creep
EN 1607:2013	Thermal insulating products for building applications – Determination of tensile strength perpendicular to faces
EN 1609:2013	Thermal insulating products for building applications – Determination of short-term water absorption by partial immersion
EN 12086:2013	Thermal insulating products for building applications - Determination of water vapour transmission properties
EN 12087:2013	Thermal insulating products for building applications – Determination of long-term water absorption by immersion
EN 12089:2013	Thermal insulating products for building applications – Determination of bending behaviour
EN 12090:2013	Thermal insulating products for building applications – Determination of shear behaviour
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 13165:2012+A2:2016	Thermal insulation products for buildings - Factory made rigid polyurethane foam (PU) products - Specification
EN 13501-1:2007+A1:2009	Fire classification of construction products and building elements – Part 1: Classification using test data from reaction to fire tests
EN 15715:2009	Thermal insulation products - Instructions for mounting and fixing for reaction to fire testing - Factory made products
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 12571:2013	Hygrothermal performance of building materials and products – Determination of hygroscopic sorption properties