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CUAP/ETA request N° 12.01/36

Common Understanding of Assessment procedure

for European Technical Approval according to
Article 9.2 of the Construction Products Directive

Fibre Reinforced Silica Aerogel Thermal Insulation

Internal EOTA working document resulting from procedure according to clause 3.2.3. of the Common Procedural Rules.

Endorsed by the Technical Board of EOTA.

Reference for the necessary consent of the relevant EOTA bodies on draft ETA according to clause 3.2.5 of the Common Procedural Rules.

To be applied in all cases in which the conditions of clause 3.2.4 of the Common Procedural Rules are met.

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1 SCOPE OF THE CUAP

1.1 Definition of the construction product

Fibre reinforced silica Aerogel thermal insulation products consist of a uniformly distributed blend of polyester (0 – 75% by weight of the product) and textile grade glass fibre (0 – 75% by weight of the product) reinforcement with embedded silica Aerogel. Products are delivered in board or blanket, with dimensions defined in the ETA.

The CUAP covers Fibre reinforced silica Aerogel thermal insulation products with variable percentage of each type of fibres (polyester and/or textile grade glass fibres). The fibres must always be present. This CUAP covers variety of products with different percentages of each type of fibres.

The product comprises no coating. It is produced from newly formed fibres, only (i.e. no recycled fibres are used). The product is opaque (it is neither translucent nor transparent). The fibres are isotropic oriented, i.e. the directions of the fibres are uniform and randomly distributed.

1.2 Intended use of the construction product

Thermal insulation sheets are intended to be used in walls, floors and ceilings as thermal insulation and also in partitions and intermediate floors as acoustic insulation. The insulation can be used in constructions where it is not exposed to wetting, weathering, heavy moisture transport, condensation or wind and where the product either is or is not exposed to compression loads.

1.3. Assumed working life of the construction product

The provisions and the verification and assessment methods included or referred to in this CUAP have been written based upon the assumed working life of 50 years of the product, provided that the product is subjected to appropriate installation, use and maintenance. These provisions are based upon the current state of the art and available knowledge and experience.

Assumed working life means that, when an assessment following the CUAP provisions is done, and when working life has elapsed, the real working life may be, in normal use conditions considerably longer without major degradation affecting the Essential Requirements¹.

The indications given as to the working life of the construction product cannot be interpreted as a guarantee given by the product manufacturer or his representative or the Approval body issuing the ETA, but are regarded only as means for choosing the appropriate products in relation to the expected economically reasonable working life of the works.

1.4 Terminology

1.4.1 Common terms relating to the Construction Products Directive

For the meaning of these terms see EOTA document "Common terms used in Guidelines for European technical approval" published in the EOTA website.

1.4.2 Specific terms used in this CUAP

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¹ The real working life of the product incorporated in a specific works depends on the environmental conditions to which that works is subjected and the particular conditions of the design, execution, use and maintenance of that works. Therefore, it cannot be excluded that there are cases in which the real working life of the product may also be shorter than the assumed working life.

1.5 Procedure in the case of a significant deviation from the CUAP

In cases in which this CUAP is intended to be used for another similar product and/or intended use but not complete or fully applicable in all aspects, the Approval body concerned shall prepare a draft supplement or modification to the CUAP for endorsement in EOTA TB. The procedure of Art. 9.2 of the CPD and section 3.2 of the Common procedural Rules will then be based on the supplemented or modified CUAP.

2 ASSESSMENT OF FITNESS FOR USE

2.1 Meaning of "fitness for use"

"Fitness for (the intended) use" of a construction product means that

the product has such characteristics that the *works* in which it is to be incorporated *can*, if properly designed and built,

1. *satisfy* the Essential Requirements when and where such works are subject to regulations containing such requirements (CPD Art. 2.1) and
2. *be fit* for their intended use, account being taken of economy, *and* in this connection *satisfy* the Essential Requirements for an economically reasonable working life, if normally maintained (see CPD Annex I, sentence 1 and 2).

2.2 Elements of the assessment of fitness for use

The assessment of the fitness of a construction product for its intended use includes:

- the identification of the characteristics of the product which are relevant to its fitness for intended use (in the following referred to as "regulatory characteristics");
- the establishment of methods for the verification and assessment of the regulatory product characteristics and the expression of the respective product performances;
- the identification of such regulatory characteristics to which the option "No Performance Determined" applies for the reason that in one or more Member States they are not relevant for the fulfilment of the requirements applicable to the works;
- the identification of such regulatory characteristics for which limit values (threshold values) have to be respected for technical reasons.

2.3 Relationship of requirements to the product characteristics and methods of verification and assessment

Table 1. Product characteristics and methods of verification and assessment

Nr	Product characteristic (where relevant with footnote*) (where relevant indicate respective ID clause)	Option "No Performance Determined"	Method of verification and assessment	Expression of product performance (value, class, NPD**, criterion, etc)	
(1)	(2)	(3)	(4)	(5)	
Essential Requirement 1: Mechanical resistance and stability					
1	Corrosion developing capacity on metal constructions	yes	2.4.1		
Essential Requirement 2: Safety in case of fire					
2	Reaction to fire	yes	2.4.2	Euroclass A1 - F	
Essential Requirement 3: Hygiene, health and environment					
3	Content and/or release of dangerous substances ¹⁾	yes	2.4.3	Statement by applicant	
4	Short term water absorption by partial immersion	yes	2.4.4	MDV	
5	Water vapour permeability	yes	2.4.5	MDV	
6	Air permeability	yes	2.4.6	MDV	
7	Susceptibility to mould growth	yes	2.4.7	According to test results	
Essential Requirement 4: Safety in use					
	Not relevant				
Essential Requirement 5: Protection against noise					
8	Dynamic stiffness and compressibility	yes	2.4.8	MDV	
9	Impact sound reduction	yes	2.4.9	MDV	
Essential Requirement 6: Energy economy and heat retention					
10	Thermal conductivity	no	2.4.10	MDV	
11	Geometry of the boards	no	2.4.11	MDV	
12	Dimensional stability	no	2.4.12	MDV	
13	Tensile strength parallel to faces	no	2.4.13	MDV	
General aspects relating to fitness for use *					
14	Compressive strength or stress at 10 % deformation	uses not exposed to compression loads	yes	2.4.14	MDV
		uses exposed to compression loads	no		
15	Deformation under specified compressive load and temperature conditions	yes	2.4.15	MDV	
16	Tensile strength perpendicular to faces	yes	2.4.16	MDV	
17	Compressive creep	yes	2.4.17	MDV	
18	Bending strength	yes	2.4.18	MDV	
19	Point load	yes	2.4.19	MDV	
<p>*) Aspects of durability and economy of the works (see CPD Annex 1, sentence 1 and 2) which are not dealt with under Essential Requirements 1 to 6. Such aspects are also referred to as "serviceability".</p> <p>¹⁾ The product/kit must be such that, when installed according to the appropriate provisions of the Member States, it allows for the satisfaction of the ER3 of the CPD as expressed by the national provisions of the Member States and in particular does not cause harmful emission of toxic gases, dangerous particles or radiation to the indoor environment nor contamination of the outdoor environment (air, soil or water).</p> <p>***) npd option regarding ER3: For meaning of npd option regarding ER3 see EOTA TR 034 "General Checklist for ETAGs/CUAPs/ETAs - Content and/or release of dangerous substances in products/kits"</p>					

2.3.1 Use categories

2.3.1.1 Use category: Indoor “IA”

Sub categories taking into account the intended use (release scenario):

- **Category IA2: Product with no direct contact with indoor air but possible impact on indoor air:**
Product which is either covered (e.g. by other products) but dangerous substances could be released into the indoor air due to diffusion or have to be considered in the case of maintenance and repair.
- **Category IA3: Product with no contact with indoor air and no impact on indoor air:**
Product which could contain dangerous substances but these substances could never be released into indoor air.

2.3.1.2 Use category: Outdoor “S/W”

Sub categories taking into account the intended use (release scenario):

- **Category S/W2: Product with no direct contact with soil, ground- and surface water:**
Product with no direct contact to soil/water but dangerous substances could be released into soil, ground- and surface water due to diffusion.
- **Category S/W3: Product with no contact to soil, ground- and surface water:**
Product which could contain dangerous substances but these substances could never be released into soil, ground- and surface water.

Note: Content restrictions have to be considered in any case.

2.4 Product characteristics which are relevant for the fitness for use

The declared value and the classification for each declared characteristic respectively shall be representative for the density and thickness range of the insulation product covered by the ETA. The samples shall be chosen accordingly. If necessary, the tests shall be performed on samples with different densities and thicknesses so that the worst case for each characteristic is covered.

2.4.1 Corrosion developing capacity

2.4.1.1 Methods of verification

The corrosion developing capacity on metal constructions is assessed on the basis of composition of the insulation product including possible additives.

If such evaluation is not feasible then the test in Annex A shall be carried out or NPD option is used.

2.4.1.2 Method of assessing and judging

Either the statement based on the composition or test results according to Annex A are given in the ETA or NPD option is used.

2.4.2 Reaction to fire

2.4.2.1 Method of verification

The “Fibre reinforced silica Aerogel« shall be tested, using the test method(s) relevant for the corresponding reaction to fire class, in order to be classified according to the EN 13501-1. The mounting and fixing provisions are presented in the Annex C of this CUAP. If no performance determined option is used the product falls in class F without testing.

2.4.2.2 Method of assessing and judging

The reaction to fire class is given in the ETA according to the standard EN 13501-1, or NPD option is used.

2.4.3 Content and/or release of dangerous substances

The applicant shall either

- submit the chemical constitution and composition of the Fibre reinforced silica Aerogel thermal insulation product – and the constituents of the product – to the Approval body which will observe strict rules of confidentiality

or

- submit a written declaration to the Approval body stating whether or not and in which concentration the Fibre reinforced silica Aerogel thermal insulation product – and the constituents of the product – contains substances which have to be classified as dangerous according to Directive 67/548/EEC and Regulation (EC) No 1272/2008 and/or listed in the “Indicative list on dangerous substances” of the EGDS – taking into account the installation conditions of the construction product and the release scenarios resulting from there.

Note: The information concerning the presence of dangerous substances listed in Council Directive 67/548/EEC and Regulation (EC) No 1272/2008 regulated at European level and/or listed in the "Indicative list on dangerous substances" of the EGDS and/or of other dangerous substances, shall be circulated as part of the evaluation report by the issuing Approval Body to the other Approval Bodies, under strict conditions of confidentiality. Information about other dangerous substances, not regulated at EU level or on the indicative list, shall also be circulated.

2.4.3.1 Methods of verification

The product and constituents of the product, and the related dangerous substances, which have to be considered will be verified by the following methods taking into account the installation conditions of the construction product and the release scenarios resulting from there.

All products under the scope of this CUAP can be classified into the group “factory made mineral wool boards” according to EOTA TR 034 (Edition July 2009).

For the Fibre reinforced silica Aerogel thermal insulation products the following methods are required:

“T+” or “T”

The use of substances which shall be labeled with “T+” or “T” in accordance with Directive 67/548/EEC and Regulation (EC) No 1272/2008 should be avoided; where the use of such substances cannot be avoided for technical reasons, a special assessment must take place.

“N”

The use of substances which shall be labeled with “N” in accordance with Directive 67/548/EEC and Regulation (EC) No 1272/2008 should be avoided; if the use of such substances cannot be avoided for technical reasons, a special assessment must take place.

Carcinogenic (T, R 45; T, R 49), mutagenic (T, R 46) and teratogenic (T, R 60; T, R 61) substances of categories 1 and 2

Carcinogenic (T, R 45; T, R 49), mutagenic (T, R 46) and teratogenic (T, R 60; T, R 61) substances of categories 1 and 2 in accordance with Directive 67/548/EEC and Regulation (EC) No 1272/2008 shall not be used.

Polybrominated diphenylether (PBDE)

Either:

The content of halogenated and brominated aromatic organophosphorous compounds shall be declared by the applicant.

Statement, that the flame retardant does not contain polybrominated diphenylether (PBDE).

or

According to the chemical composition of the product the Approval body has to declare that the product does not contain halogenated and brominated aromatic organophosphorous compounds.

Note: CEN TC 351 considers polybrominated diphenylethers and polyhalogenated dibenzodioxines and polyhalogenated dibenzofuranes contained therein (see “Indicative list on dangerous substances”). Therefore the verification is provisional, because harmonized European provisions do not exist. Future European provisions could request other verification methods.

Tetrabrombisphenol A (TBBPA)

The content of Tetrabrombisphenol A shall be declared by the applicant.

or

According to the chemical composition of the product the approval body has to prove, that no Tetrabrombisphenol A is used.

Note: In some Member States the content Tetrabrombisphenol A is restricted, e.g. proposed to be restricted in Norway (products (see TR034, Edition July 2009, list II) with more than 1%)

Hexabromcyclododecan (HBCDD)

The content of Hexabromcyclododecan shall be declared by the applicant.

or

According to the chemical composition of the product the Approval body has to prove, that no Hexabromcyclododecan is used.

Note: The content of Hexabromcyclododecan shall meet the respective regulations. In Norway products (see TR034, Edition July 2009, list II) with more than 0.1% Hexabromcyclododecan compounds are proposed prohibited.

VVOC, VOC and SVOC

Either:

The release of VOC and SVOC (individual VOC/SVOCs and the summission of VOC/SVOC) has to be determined according ISO 16000-ff.

or

Based on individually assessment by the Approval body there is no risk, that this substances will be set free by consideration of all possible release scenarios.

or

a statement has to be given, that: The release of VOC, VVOC and SVOC is not verified with this CUAP.

Note: CEN TC 351 considers VOC, VVOC and SVOC (see “Indicative list on dangerous substances”). Therefore the verification is provisional, because Harmonised European provisions do not exist. Future European provisions could request verification methods.

Formaldehyde

The formaldehyde release of “Fibre reinforced silica Aerogel” for use “IA2, IA3, S/W2 and S/W3” shall be determined according to the test standard “EN 717-1”, if raw materials containing formaldehyde are used in the production process.

Note 1: In some MS for some products the use of EN 717-1 is mandatory.

Note 2: If regulatory requirements exist in the country of production and destination the product shall fulfill the requirements of class E1 according to table “Classification criteria for the class E1 and E2 for the emission of formaldehyde.”

Man made mineral fibres/ceramic fibres: Carcinogenic fibres of EU category C1 and C2

Man made mineral fibres/ceramic fibres which are declared as carcinogenic of the EU category I and II (with exception of asbestos because asbestos is forbidden by European directive 76/769) shall not be used.

Note 1: If the applicant can show sufficiently, that there are no alternative products on the market available to achieve the technical behaviour of the material, the Approval body can decide to give an assessment of the products.

Note 2: CEN TC 351 considers Man-made vitreous (silicate) fibres with random orientation with alkaline oxide and alkali earth oxide and alkali earth oxide content greater than 18% by weight (see “Indicative list of dangerous substances”). Therefore the verification is provisional, because harmonized European provisions do not exist. Future European provisions could request other verification methods.

2.4.3.3 Method of assessing and judging

The product and constituents of the product, and the related dangerous substances which have to be considered, will be assessed by the following methods taking into account the installation conditions of the construction product and the release scenarios resulting from there.

For the Fibre reinforced silica Aerogel thermal insulation products the following methods are required:

“T+” or “T”

Based on the chemical composition of the product, the Approval body will confirm either:

- that no toxic or very toxic substances are used
- or
- that based on individual assessment by the Approval body there is no risk, that these substances will be released by consideration of all possible release scenarios
- or
- that these substance are authorised according EU Regulation 1907/2006 for the named intended use.

“N”

Based on the chemical composition of the product, the Approval body will confirm either:

- that no environmental hazardous substances are used
- or
- that based on individual assessment by the Approval body there is no risk, that these substances will be released by consideration of all possible release scenarios.
- or
- that these substances are authorised according EU Regulation 1907/2006 for the named intended use

Carcinogenic (T, R 45; T, R 49), mutagenic (T, R 46) and teratogenic (T, R 60; T, R 61) substances of categories 1 and 2

Based on chemical composition of the product, the Approval body will confirm either:

- that no carcinogenic, mutagenic and teratogenic substances of categories 1 and 2 are used
- or

- that based on an individual assessment by the Approval body there is no risk, that these substances will be released by consideration of all possible release scenarios
- or
- that these substances are authorised according EU Regulation 1907/2006 for the named intended use

Polybrominated diphenylether (PBDE)

Either:

The content of halogenated and brominated aromatic organophosphorous compounds shall be declared by the applicant.

A statement has to be given, that the flame retardant does contain polybrominated diphenylether (PBDE).

or

Statement of the Approval body, that due to the chemical composition the product does not contain halogenated and brominated aromatic organophosphorous compounds (including polybrominated diphenylether (PBDE)).

Tetrabrombisphenol A (TBBPA)

Either:

The content of Tetrabrombisphenol A shall be declared by the applicant.

or

According to the chemical composition of the product the Approval body has to proof, that no Tetrabrombisphenol A is used.

Note: In some Member States the content Tetrabrombisphenol A is restricted, e.g. proposed to be restricted in Norway (products (see TR034, Edition July 2009, list II) with more than 1%)

Hexabromcyclododecan (HBCDD)

Either:

The content of Hexabromcyclododecan shall be declared by the applicant.

or

According to the chemical composition of the product the Approval body has to proof, that no Hexabromcyclododecan is used.

Note: The content of Hexabromcyclododecan shall meet the respective regulations. In Norway products (see TR034, Edition July 2009, list II) with more than 0.1% Hexabromcyclododecan compounds are proposed prohibited

VVOC, VOC and SVOC

Based on chemical composition of the product, the Approval body will confirm either:

- The product does meet the requirements according to CEN TR
- or
- Based on an individual assessment by the Approval body there is no risk, that these substances will be set free by consideration of all possible release scenarios.
- or
- statement, that the release of dangerous substances to indoor air, is not verified with this CUAP.

Note1: In Germany the assessment of VOC/SVOC for floorings is obligatory according a national approval.

Formaldehyde

The formaldehyde release of “Fibre reinforced silica Aerogel” for use “IA2, IA3, S/W2 and S/W3” shall be determined according to the test standard EN 717-1, if raw materials containing formaldehyde are used in the production process.

Note 1: In some MS for some products the use of EN 717-1 is mandatory.

Note 2: If regulatory requirement exists in the country of production and destination the product shall fulfill the requirements of class E1 according to table “Classification criteria for the class E1 and E2 for the emission of formaldehyde.”

Man made mineral fibres/ceramic fibres: Carcinogenic fibres of EU category C1 and C2

Man made mineral fibres/ceramic fibres shall only be used, if they fulfill one of the conditions method I or method II. For Germany method I is mandatory.

Method I:

1. Proof that a suitable intraperitoneal test did not express signs of excessive carcinogenicity
2. The half life of intracheal instillation of a 2 mg fibre- suspension for fibres longer than 5µm, a diameter less than 3 µm and a relation of length to diameter greater than 3:1 (WHO-Fasern) do not exceed 40 days.
3. The “Kanzerogenitätsindex KI”, resulting from the difference between the sum of the mass contents (in %) of the oxides of sodium, potassium, boron, calcium, magnesium, barium and the double mass content (in %) of alumina results, is at least 40.

Method II:

The product has to meet the requirements given in comment Q and R of the Directive 97/69/EG.
Ceramic fibres: Ceramic fibres shall not be used.*

* If the applicant can show sufficiently, that there are no alternative products on the market available to achieve the technical behavior of insulation material, the Approval body can decide to give an approval for the product/kit anyway.

Declaration of the carcinogenic potential of the used fibres.

*Note: For dangerous substances falling under the scope of the CPD for which
- no assessment and verification methods are given in this ETA.*

or

- “npd” is declared

or

- the chosen verification and assessment method does not comply with the regulatory requirements of a particular Member State

there might be the necessity for an additional assessment at notational level.

2.4.4 Short term water absorption by partial immersion

2.4.4.1 Methods of verification

The short term water absorption by partial immersion is measured according to the standard EN 1609, method A.

2.4.4.2 Method of assessing and judging

The short term water absorption by partial immersion shall be given in the ETA.

2.4.5 Water vapour permeability

2.4.5.1 Methods of verification

Water vapour permeability is measured according to the standard EN 12086.

2.4.5.2 Method for assessing and judging

Results of the tests including μ -values are given in the ETA or NPD option is used.

2.4.6 Air permeability

2.4.6.1 Method of verification

The determination of the air permeability and air flow resistance is carried out according to the standard EN 29053.

2.4.6.2 Method for assessing and judging

Results of the tests are given in the ETA or NPD option is used.

2.4.7 Susceptibility to mould growth

2.4.7.1 Method of verification

The determination of the susceptibility to mould growth is tested according to the Annex B of this CUAP.

2.4.7.2 Method for assessing and judging

The results are given in the ETA or NPD option will be used.

2.4.8 Dynamic stiffness and compressibility

2.4.8.1 Method of verification

Dynamic stiffness is measured according to the standard, EN 29052-1 and compressibility according to the standard EN 12431. The compressibility shall be measured with maximum insulation thickness. When measuring the compressibility according to EN 12431 different thicknesses depending on loading are determined: the thickness d_L of the unloaded material, the thickness d_F before the loading and the thickness d_B after the loading. Compressibility is defined as the difference $d_L - d_B$.

2.4.8.2 Method for assessing and judging

The results are given in the ETA or NPD option is used.

2.4.9 Impact sound reduction

2.4.9.1 Method of verification

The impact sound reduction ΔL_w should be determined according to EN ISO 140-8 (category II) and EN ISO 717-2. The test shall be performed with the thinnest insulation layer covered by the ETA and with the floor covering representing the worst case for impact sound reduction (e. g. minimum mass per unit area of the floating screed). If need be, the tests shall be carried out with several build-ups.

The declared impact sound reduction ΔL_w shall be derived from the measured and weighted values ΔL_w by reduction of 2 dB to take possible influences of ageing of the insulation product into account.

The assessed heavyweight floor build-up shall be described in detail in the ETA. It shall be stated clearly to which heavyweight floor build-up the declared impact sound reduction applies. In particular the minimum mass per unit area of the screed shall be given in the ETA.

2.4.9.1 Method for assessing and judging

The results are given in the ETA or NPD option is used.

2.4.10 Thermal conductivity

2.4.10.1 Method of verification

The thermal conductivity shall be determined in accordance with the principles of method described in EN 12667 with simultaneous consideration of EN 13162:2009, clause 4.2.1.

At least 4 of these measurements shall be performed at an approved testing body.

The verification shall take into account the aging and the influence of the moisture content of the product as defined in Annex D.

Due to the lambda of Fibre reinforced silica aerogels being lower than entrapped air it is essential that the aerogel samples are in full contact with the test plates and no interstitial air is trapped in the system. This is achieved with an overpressure of 250 Pa on a single layer of aerogel blanket to ensure sample flatness.

2.4.10.2 Method for assessing and judging

The declared thermal conductivity is given in the ETA. If needed also moisture conversion coefficients and moisture contents at 23 °C/50 %RH and at 23 °C/80 %RH shall be given in the ETA.

2.4.11 Geometry

2.4.11.1 Method of verification

The dimensions of the products are measured according to the standards EN 822 (width and length), EN 823 (thickness), EN 824 (squareness), if applicable and EN 825 (flatness), if applicable. The loads in thickness measurements shall be according to the standard EN 13162 point 4.2.3.

2.4.11.2 Method for assessing and judging

The results are given in the ETA including the thickness tolerances.

2.4.12 Dimensional stability

2.4.12.1 Method of verification

Dimensional stability is measured according to the EN 1603 or EN 1604:

- at 23°C and 90% relative humidity or
- at 70°C or
- at 70°C and 90 % relative humidity.

2.4.12.2 Method for assessing and judging

The results in conjunction with the test condition for one or several test conditions are given in the ETA.

2.4.13 Tensile strength parallel to faces

2.4.13.1 Method of verification

Tensile strength parallel to faces is measured according to the standard EN 1608 in 2 perpendicular directions parallel to the surface of the blanket (or board).

2.4.13.2 Method for assessing and judging

The results are given in the ETA

2.4.14 Compressive stress at 10 % deformation

2.4.14.1 Method of verification

Compression strength is measured according to the standard EN 826.

2.4.14.2 Method for assessing and judging

The results are given in the ETA.

2.4.15 Deformation under specific compressive load and temperature conditions

2.4.15.1 Method of verification

Deformation is measured in 20 kPa and 80 °C according to the standard EN 1605.

2.4.15.2 Method for assessing and judging

The results are given in the ETA or NPD option is used

2.4.16 Tensile strength perpendicular to faces (delamination strength)

2.4.16.1 Method of verification

The tensile strength is measured according to the standard EN 1607 if and only if the thickness of a blanket (or board) is equal or longer than one half of the length of the fibres.

2.4.16.2 Method for assessing and judging

The results are given in the ETA or NPD option is used.

2.4.17 Compressive creep

2.4.17.1 Method of verification

Compressive creep is measured according to the standard EN 1606.

2.4.17.2 Method for assessing and judging

The results are given in the ETA or NPD option is used.

2.4.18 Bending strength

2.4.18.1 Method of verification

Bending strength is measured according to the standard EN 12089.

2.4.18.2 Method for assessing and judging

The results are given in the ETA or NPD option is used

2.4.19 Point load

2.4.19.1 Method of verification

Point load is measured according to the standard EN 12430.

2.4.19.2 Method for assessing and judging

The results are given in the ETA or NPD option is used.

3 EVALUATION AND ATTESTATION OF CONFORMITY AND CE-MARKING

3.1 System of attestation of conformity

According the decision of the European Commission 99/91/EC, the system of attestation of conformity given in the tables 2a or 2b shall be applied to the fibre reinforced silica Aerogel thermal insulation

Table 2a: System of attestation of conformity applicable to any intended use

Product(s)	Intended use(s)	Level(s) or class(es)	Attestation of conformity system(s)
Thermal insulation product	Any	-	3

Table 2b: System of attestation of conformity applicable to the product covered by this CUAP with respect to reaction to fire ⁽¹⁾

Product(s)	Intended use(s)	Level(s) or class(es) (<i>reaction to fire</i>)	Attestation of conformity system(s)
Thermal insulation	for uses subject to regulations on reaction to fire	A1*, A2*, B*, C* A1**, A2**, B**, C**, D, E, (A1 to E) ***, F	1 3 4
<p>System 1: See Directive 89/106/EEC Annex III.2.(i), without audit-testing of samples System 3: See Directive 89/106/EEC Annex III.2.(ii), Second possibility System 4: See Directive 89/106/EEC Annex III.2.(ii), Third possibility</p> <p>* 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) ** Products/materials not covered by footnote (*), is applied to this CUAP *** Products/materials that do not require to be tested for reaction to fire (eg. Products/materials of class A1 according to Commission Decision 96/603/EC, as amended)</p>			

⁽¹⁾ This CUAP covers the products falling AoC system 1, 3, or 4 as to reaction to fire.

AoC system 1:

Certification of the conformity of the product by a notified certification body on the basis of:

- (a) Tasks for the manufacturer:
 - (1) factory production control;
 - (2) further testing of samples taken at the factory by the manufacturer in accordance with a prescribed test plan;
- (b) Tasks for the notified body:
 - (3) initial type-testing of the product;
 - (4) initial inspection of factory and of factory production control;
 - (5) continuous surveillance, assessment and approval of factory production control.

AoC system 3:

Declaration of conformity of the product by the manufacturer on the basis of:

- (a) Tasks for the manufacturer:
 - factory production control;
- (b) Tasks for the notified body:
 - initial type-testing of the product.

AoC system 4:

Declaration of conformity of the product by the manufacturer on the basis of:

- Tasks for the manufacturer:
- initial type-testing of the product;
 - factory production control.

Note: In any case (also for systems 1+ and 1), the manufacturer has to make a declaration of conformity.

3.2 Tasks and responsibilities of the manufacturer and notified bodies

3.2.1 Tasks of the manufacturer

3.2.1.1 Factory production control (FPC)

The corner stones of the actions to be undertaken by the manufacturer of the product in the procedure of attestation of conformity are laid down in table 3.

Table 3: Control plan for the manufacturer; corner stones

Nr	Subject of control	Test method	Minimum frequency of control
Factory production control (FPC) [including testing of samples in accordance with a prescribed test plan]			
1	Thermal conductivity	EN 12667	Each batch or 1 per 24 h
2	Density	EN 1602	1 per 2 h
3	Geometry	EN 822, EN 823, EN 824, EN 825	Each batch or 1 per 2h Each batch or 1per 8 h
4	Water absorption	EN 1609	Twice a year <i>if declared</i>
5	Compressive stress	EN 826	1 per week or every fourth batch and density 1 per 2 hour <i>if declared</i>
6	Tensile strength parallel to faces	EN 1608	1 per 3 months or every fourth batch
7	Bending strength	EN 12089	1 per 3 months or every fourth batch <i>if declared</i>
8	Dynamic stiffness	EN 29052-1	1 per batch or week <i>if declared</i>
9	Compressibility	EN 12431	1 per batch or week <i>if declared</i>
10	Tensile strength perpendicular to faces	EN 1607	1 per 3 months or every fourth batch <i>if declared</i>
11	Air flow resistance	EN 29053	Once a year <i>if declared</i>
12	Reaction to fire	EN 13823 and EN ISO 11925-2 (B, C or D class) Manufacturer's method or EN 13820 EN ISO 11925-2 (E class)	1 per week or 1 per 2 years and indirect testing (loss on ignition) 1 per 4 h or batch and/or apparent density 1 per 2 h or batch <i>if declared and relevant</i> 1 per week or 1 per 2 years and indirect testing (density 1 per day) <i>if declared</i>

The manufacturer shall exercise permanent internal control of production. All the elements requirements and provisions adopted by the manufacturer shall be documented in a systematic manner including policies and procedures and records of test results. This production control system shall insure that the product is in conformity with the ETA.

Manufacturers having a FPC system which complies with EN ISO 9001 and addresses the requirements of an ETA are recognized as satisfying the FPC requirements of the CPD.

3.2.1.2 Initial type testing (ITT)

Approval tests will have been conducted by an Approval body or under its responsibility (which may include a proportion conducted by a laboratory or by the manufacturer witnessed by the Approval body) in accordance with section 2 of this CUAP. The Approval body will have assessed the results of these tests in accordance with section 2 of this CUAP, as part of ETA issuing procedure.

These tests shall be used for the purposes of initial type testing if they are done on samples coming from the current production process, so further testing is not necessary.

If new production line is started or new subcontractors used the new ITT is necessary.

3.2.2 Tasks of notified bodies

The corner stones of actions to be undertaken by the notified body in the attestation of conformity procedure are according to the table 4.

Approval tests will have been conducted by an ETA body or under its responsibility in accordance with section 2 of this CUAP. The ETA body will have assessed the results of these tests in accordance with section 2 of this CUAP, as part of ETA issuing procedure.

Table 4 Control plan for the notified body; corner stones

Subject of control	Control method	Frequency of control
AoC system 1		
Initial inspection of factory and factory production control (FPC)		
Inspection of the factory and factory production control as described in the control plan	Control of devices, results, and documentation of FPC	In connection of initial inspection of FPC and when relevant changes take place
Aoc system 1 and 3		
Initial type testing of the product		
Properties of the product	Methods mentioned in this CUAP chapter 2.4 which will be declared	Before issuing the ETA and when relevant changes take place in product or production
AoC system 1		
Continuous surveillance, judgement and assessment of factory production control (FPC)		
Inspection of the factory and factory production control as described in the control plan	Control of the documentation and results of FPC	Once a year

3.3 CE marking and accompanying information


According to Council Directive 93/68/EEC¹ the CE marking consists of the letters "CE" in the form laid down in the Directive, followed by the identification number of the notified certification body, where applicable. For products subject to Council Directive 89/106/EEC the identification number of the notified certification body shall be given for products to which systems 1+, 1 and/or 2+ of attestation of conformity apply.

The CE marking of the thermal insulation shall be accompanied by the following information:

- the name and address of the producer (legal entity responsible for the manufacturer),
- the last two digits of the year in which the CE marking was affixed,
- the number of the EC certificate of conformity in AoC 1,
- the number of the European technical approval,
- ... (indicate characteristics, performances, use categories, etc. of the product in accordance with the provisions of the ETAG/CUAP),

¹ Official Journal of the European Communities L 220 of 30.8.1993

Example of CE marking and accompanying information:

 1234
Any Company Street 1, City, Country 04 yy-CPD-0xxx
ETA-06/xxxx CUAP No xxx Polyester fibre thermal insulation with embedded silica aerogel -property 1 -property 2 etc

Letters "CE"

*Identification number of notified certification body
(when AoC 1 is applied)*

Name and address of the producer (legal entity responsible for the manufacture)

Two last digits of year of affixing CE marking

Number of EC certificate of conformity (when AoC 1 is applied)

ETA number

Type / intended use / relevant product characteristic(s) / declared values and/or classes in accordance with section 2. of the ETA

4 ASSUMPTIONS UNDER WHICH THE FITNESS FOR THE INTENDED USE IS ASSESSED

4.1 Manufacture of the product

Manufacturing of the Fibre reinforced silica Aerogel thermal insulation is based on the defined production method, use of defined raw materials and tolerances. If changes take place manufacturer is responsible to clarify if the change has influence on the properties of the product tested according to the provisions of this CUAP.

4.2 Packaging, transport, storage of the product

The insulation products are transported to the building site packaged into plastic foil. The products shall be stored in dry conditions before the installation.

4.3 Installation of the product in the works

The thermal insulation is installed on to the building according to the instructions of the manufacturer. The suitability of the insulation to the planned purpose shall be evaluated taking into account what has been said in chapter 1.2.

4.4 Use, maintenance, repair

The thermal insulation shall work adequately when the construction where it is installed according to the instructions of the manufacturer is maintained and repaired so that the provisions of use given in chapter 1.2 of this CUAP are fulfilled.

5 IDENTIFICATION OF THE CONSTRUCTION PRODUCT

5.1 Means of identification

The product which is the subject of the technical approval shall be identified according by:
(give all, some or one of the following methods and specify details as appropriate for the product concerned)

- testing of product characteristics as laid down in Table 5;
- fingerprinting;
- formulation;
- manufacturing process parameters;
- calculations, detailing, drawings.

Nr	Product characteristic (where relevant with footnote*)	Verification method: (clause ...)	Criteria for product identity: (clause ...)
1	Geometry	5.2.1	5.2.1
2	Density of the insulation	5.2.2	5.2.2
3	Composition of the fibres	5.2.3	5.2.3
4	Orientation of the fibres	5.2.4	5.2.4
5	Thermal conductivity	5.2.5	5.2.5
6	Length and diameter	5.2.6	5.2.6

* This characteristic is also relevant to the fitness for use (see 2.3, Table 1)

5.2 Product characteristics which are relevant for identification checking

5.2.1 Geometry

5.2.1.1 Method of verification

Measurements of the dimensions of the product and comparing them to the manufacturer's data sheet and drawings/dimensions given in the ETA.

5.2.1.2 Criteria for product identity

The element shall meet the given dimensions and tolerances as ready made before possible cutting (e.g. for edges) as given in the ETA.

5.2.2 Density of the insulation

5.2.2.1 Method of verification

The density is measured according to the EN 1602.

5.2.2.2 Criteria for product identity

Results are compared to the information given in the ETA.

5.2.3 Composition of the fibres

5.2.3.1 Method of verification

The IR analysis is performed.

5.2.3.2 Criteria for product identity

Results are compared to the results of IR analysis of the type tests.

5.2.4 Orientation of the fibres

5.2.4.1 Method of verification

The orientation of the fibres is expressed via tensile strength (parallel and perpendicular, if declared).

5.2.4.2 Criteria for product identity

Results are compared to the results of the type tests, given in the ETA.

5.2.5 Thermal conductivity

5.2.5.1 Method of verification

The measurement according to EN 12667 or EN 12939 is performed.

5.2.5.2 Criteria for product identity

Results are compared to the information, given in the ETA.

5.2.6 Length and diameter

5.2.6.1 Method of verification

The measurement of the length and the (equivalent) diameter of the fibres is performed according to the standard EN 14889-2, except:

a) the length should be measured with an accuracy of 1 mm.

b) the diameter (thickness) may also be measured with an alternative method (e.g. microscope, ...). with an accuracy of 1 μm .

5.2.6.2 Criteria for product identity

Results are compared to the results of the type tests, given in the ETA.

6 ETA APPROVAL

Format of ETAs issued on the basis of the CUAP are according to the Guidance to ETAG/CUAP writers.

References:

EN 140-8	Acoustics. Measurement of sound insulation in buildings and of building elements. Part 8: Laboratory measurements of the reduction of transmitted impact noise by floor coverings on a heavyweight standard floor (ISO 140-8:1997)
EN 717-2	Acoustics. Rating of sound insulation in buildings and of building elements. Part 2: Impact sound insulation (ISO 717-2:1996)
EN 822	Thermal insulating products for building applications. Determination of length and width
EN 823	Thermal insulating products for building applications. Determination of thickness
EN 824	Thermal insulating products for building applications. Determination of squareness
EN 825	Thermal insulating products for building applications. Determination of flatness
EN 826	Thermal insulating products for building applications. Determination of compression behaviour
EN 1602	Thermal insulating products for building applications. Determination of density
EN 1603	Thermal insulating products for building applications. Determination of dimensional stability under constant normal laboratory conditions (23 C/50 % relative humidity)
EN 1604	Thermal insulating products for building applications. Determination of dimensional stability under specified temperature and humidity conditions
EN 1605	Thermal insulating products for building applications. Determination of deformation under specified compressive load and temperature conditions
EN 1606	Thermal insulating products for building applications. Determination of compressive creep
EN 1607	Thermal insulating products for building applications. Determination of tensile strength perpendicular to faces
EN 1608	Thermal insulating products for building applications. Determination of tensile strength parallel to faces
EN 1609	Thermal insulating products for building applications. Determination of short term water absorption by partial immersion
EN ISO 10456	Building materials and products. Procedures for determining declared and design thermal values (ISO 10456:2007)
EN 12086	Thermal insulating products for building applications. Determination of water vapour transmission properties
EN 12089	Thermal insulating products for building applications. Determination of bending behaviour
EN 12430	Thermal insulating products for building applications. Determination of behaviour under point load
EN 12431	Thermal insulating products for building applications. Determination of thickness for floating floor insulating products
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 29052-1	Acoustics. Determination of dynamic stiffness. Part 1: Materials used under floating floors in dwellings
EN 29053	Acoustics. Materials for acoustical applications. Determination of air flow resistance (ISO 9053:1991)
EN 13501-1	Fire classification of construction products and building elements. Part 1: Classification using test data from reaction to fire tests
Annex A	Corrosion developing capacity - test method
Annex B	Susceptibility of the mould growth-test method
Annex C	Reaction to fire testing

ANNEX A

Determination of metal corrosion developing capacity

Note: *The determination method is taken from the British Standard BS 5803: Part 3: 1985 Appendix.*

Method of test for corrosivity

A.1 Principle

This test is intended to provide a basis for the acceptance or rejection of the level of corrosivity displayed by a fibrous insulation where water may cause chemical constituents to migrate to thin copper or zinc-coated elements adjacent to the insulation.

NOTE 1. This is an accelerated test and analytical laboratory hygiene is required at all stages.

NOTE 2. Material passing this test is deemed acceptable when installed adjacent to the thick-sectioned steel components (e.g. nails) which may be present in a loft. Thin-sectional steel components devoid of zinc coating or other protection are at risk in any humid loft environment irrespective of the nature of any insulation present.

A.2 Reagents and materials

- A.2.1 Four metal test coupons, two of copper foil of 99.9 % purity and two of zinc foil of 99.9 % purity, each 50 mm x 50 mm x 0.075 mm thick, judged free of tears, distortions, scratches, perforations, corrosion or other flaws when viewed under and over a 40 W coiled coll incandescent light bulb.
- A.2.2 Trichloroethylene, of analytical reagent quality.
NOTE3. Attention is drawn to the possible health risks when using this material.
- A.2.3 Sulphuric acid, (C) H₂SO₄ = 0.5 mol/l to 1 mol/l.
- A.2.4 Saturated ammonium acetate solution.

A.3 Apparatus

- A.3.1 Humidity chamber maintained at 40 ± 2 °C and 90 % RH.
- A.3.2 Four cylindrical glass crystallising dishes, well washed, nominally 90 mm in diameter and 50 mm deep.
- A.3.3 Rubber or PVC gloves.
- A.3.4 Stainless steel spatula.
- A.3.5 Tweezers

A.4 Procedure

Carry out the procedure as follows:

Wash each coupon successively in two glass dishes of the trichloroethylene to remove any grease or oil, and dry at room temperature. At this and all subsequent handling of the coupons, thin rubber or PVC gloves should be worn and tweezers used.

- (a) Take four 20 g samples of fibrous insulation and mix each with 150 ml of distilled or deionized water at room temperature in a clean glass beaker.
- (b) Transfer approximately half of one sample of the saturated fibrous insulation, using gloved hands and a clean stainless spatula, to one of the crystallising dishes and tamp level such that a layer of 10 mm to 15 mm thickness is formed. Place one of the metal coupons horizontally on this layer by introducing one end at a slight angle to the saturated material, progressively pressing the remainder of the coupon gently down and shaking the dish slightly, in such a way that all air bubbles are expelled from the underside of the coupon. If necessary, gently tamp the saturated layer and coupon level again.

Transfer the remainder of the sample of saturated fibrous insulation as before, together with any free liquor, to cover the first layer and coupon evenly. Remove carefully any air (silvery bubbles) still visible through the glass and then gently tamp the compact level.

Repeat the above procedure so that composite test assemblies are produced for all four metal coupons.

- (c) Transfer the four composite test assemblies without delay to the preconditioned humidity chamber.

The assemblies are not covered, but if the chamber is capable of dripping onto them, position a guard so as to prevent it.

- (d) Leave the test assemblies undisturbed in the humidity chamber for 336 ± 4 h (14 days), except for brief and occasional opening of the chamber for visual inspection or the introduction of other test assemblies. If, as a result of a visual inspection, it is found that a detectable drying of the surface of a composite test assembly has occurred, the minimum quantity of distilled or deionized water necessary to restore the original condition may be sprayed onto that surface, and a check made on the functioning of the chamber.
- (e) Upon completion of the test period, take the metal coupons from the assemblies and remove loose corrosion products by immersion for not longer than 30 s, as follows:
 - i. copper coupons in sulphuric acid at room temperature,
 - ii. zinc coupons in saturated ammonium acetate solution at room temperature.

Wash the coupons immediately under running water and dry without delay.

- (f) Immediately after cleaning, examine the metal coupons for perforation over the 40 W light bulb. Discount any notches or perforation within 3 mm of the edge of a coupon and note only those perforations within the remaining central zone.

ANNEX B

Determination of resistance to mould fungus

Resistance to mould fungus

Note: *The determination method is taken from the Austrian Standard ÖNORM B 6010, clause 3.22.*

B.1 Principle

A test specimen is exposed for a defined period time at a constant temperature to a high moisture climate.

After this period of time the test specimen is visually inspected for the presence of mould fungus.

B2 Apparatus

B.2.1 Desiccator, of sufficient size, that can contain a test specimen of 50 mm x 20 mm x 30 mm or for loose fill material a cage of wire according to B.2.2.

B.2.2 Cage made of stainless steel with an internal volume of approx. 0,05 liters for loose fill materials. Cage A, for large fibers, with a mesh size of 10 mm x 10 mm and a wire thickness of 0,4 mm. Cage B, for small fibers, with a mesh size 1 mm x 1 mm and a wire thickness of 0.25 mm.

B.3 Testing conditions

The exposure shall be performed at a constant temperature of (23 ± 2) °C.

Note: *This constant temperature is very necessary to avoid any condensation during the exposure period.*

B.4 Sample preparation for loose fill materials

The loose fill material shall be put in either cage A or cage B, depending to the fibre length.

Care shall be taken that density in the cage is the declared density.

B.5 Procedure

- The desiccator is filled at the bottom with water;
- The sample is then put in the desiccator, taking care that no part of the sample can come into contact with the water;
- The desiccator is then closed tightly and put in the temperature-conditioned room for a period of four weeks;
- After four weeks the desiccator is opened and the sample visually inspected on the presence of mould fungus according to EN ISO 846 clause 9.1.

B.6 Expression of results

The presence of mould fungus is expressed in classes of intensity of growth according to table 4 of EN ISO 846.

ANNEX C

Reaction to fire testing

C.1. General

The testing covers homogenous insulation materials either without any covering or coating or covered according to the application in practice. In the latter case the results are relevant only for that application.

C.2. Conditioning

All specimens are conditioned according to the provisions given in EN 13238 before the testing.

C.3. Testing according to EN ISO 1182 and EN ISO 1716

Test method is relevant for fire classes A1 and A2.

Each chemical composition has to be considered when testing. If there are several density classes at least lowest and highest density shall be tested.

The test results are valid for the tested product and following variations:

- same chemical composition
- of any thickness

C.4. Testing according to EN 13823

The test method is relevant for fire classes A, B, C and D and additional classification regarding smoke production and flaming droplets, s1, s2, d0, d1 and d2.

The specimens are fastened to the test apparatus as such or covered in a way which it will be attached in practice by using a similar method as is used in practice.

Several wall or floor substrates are possible to choose according to the EN 13238, e.g. timber, building boards.

The Corner specimen consist of two wings (495 +/- 5) mm x (1500 +/-5) mm and (1000 +/-5 mm) x (1000 +/-5 mm), respectively. If the thickness of the specimens is more than 200 mm, the thickness is reduced to 200 +/-10) mm.

The joints are used in applications where there are normally joints like when the product is used with building board.

The horizontal joint shall be done in the middle of the log wing at the height of 500 mm from the bottom edge of the sample and a vertical joint in the long wing at a distance of 200 mm from the corner line. The joints can be butt joints or grooved according to the application. The backing of the joints shall be done according to the application in question.

The backing shall be non ventilated.

The following parameters of the insulation and possible substrate shall be taken into account when conducting the SBI testing because the results will be valid:

- with the same chemical composition of the insulation
- with the same density
- the construction of possible end use solution
- tested thickness and all thicknesses between the tested thicknesses

C.5. Testing according to EN ISO 11925-2

The method is relevant for reaction to fire classes B, C, D and E.

Influence of the end use conditions can be considered as negligible when testing the specimens.

Each composition, the maximum and minimum thicknesses and the actual or maximum and minimum densities of the product shall be tested. When needed (different density or surface configuration) the test shall be conducted both to surface and to edge exposure.

ANNEX D

Determination of the declared thermal conductivity and the conversion factor to moisture content

D.1. Determination of the λ fractile value at 10°C, at dry conditions ($\lambda_{10,dry,90/90}$)

Tests and calculations of the thermal conductivity should be done in accordance with EN 13162:2008, clause 4.2.1 with possible additions on hygroscopic materials according to EN ISO 10456.

D.1.1. Measurement of the λ_{dry} at 10°C

D.1.1.1 Test specimens for the determination of the thermal conductivity λ at 10°C shall be conditioned to dryness after storage for at least 72 hours at (70 ± 2) °C in an oven ventilated with air taken at (23 ± 2) °C and (50 ± 5) % relative humidity.

D.1.1.2. The thermal conductivity of the test specimens conditioned according to above shall be measured according to EN 12667 or EN 12939 for thick products at a mean temperature of (10 ± 0.3) °C.

During the measurement, precaution shall be taken to avoid moisture absorption by the specimen. It is acceptable, for instance, to put the test specimen into a thin plastic bag.

D.1.2. Calculation of the λ fractile value at 10°C, at dry conditions ($\lambda_{10,dry,90/90}$)

The λ fractile at 10°C, at dry conditions ($\lambda_{10,dry,90/90}$) as a limit value representing at least 90% of the production with a confidence limit of 90% shall be calculated using the procedures as detailed in EN 13162 Annex A. It shall be noted that the λ_D shall be calculated in accordance with clause 3.

D.2. Determination of the moisture conversion factor ($f_{u,1}$)

For the determination of the moisture conversion factor $f_{u,1}$, two sets of measurements are needed.

D.2.1. Set 1

At least three measurements on dry specimens to determine $\lambda_{10,dry}$ and u_{dry} (moisture content mass by mass) are required.

Procedure Set 1

- Dry the three specimens following the procedure in 1.1.1.
- Determine for each test specimen the mass in dry conditions. Average the three values to determine the m_{dry} .
- The u_{dry} being the moisture content in dry conditions, is by definition set to 0.
- Determine for each test specimen the λ value at 10°C following the procedure in D.1.1.2. Average the three values to determine the $\lambda_{10,dry}$.

D.2.2. Set 2

At least three measurements on test specimens conditioned at (23 ± 2) °C and (50 ± 5) % relative humidity, to determine $\lambda_{10,(23,50)}$ and $u_{23,50}$ (moisture content mass by mass).

Procedure Set 2

- Condition the three test specimens at (23 ± 2) °C and (50 ± 5) % relative humidity following the procedures detailed in EN 13169 clause 5.2., step 2.
- Determine for each test specimen the mass at (23 ± 2) °C and (50 ± 5) % relative humidity. Average the three values to determine the mass at 23°C and 50% relative humidity as $m_{23,50}$.
- Calculate $u_{23,50}$ by the following formula (D.1)

$$u_{23,50} = \frac{m_{23,50} - m_{dry}}{m_{dry}},$$

where,

$m_{23,50}$ (Average) is the mass at 23°C and 50% relative humidity

m_{dry} (Average) is the mass according to clause D.2, Procedure Set 1

Determine for each test specimen the λ value in accordance with EN 12667 or EN 12939 for thick products at a mean temperature of (10 ± 0.3) °C. Average the three values to determine $\lambda_{10,(23,50)}$.

D.2.3. Calculation of the moisture conversion factor ($f_{u,1}$)

The moisture conversion factor $f_{u,1}$ shall be calculated by the formula (D.2), derived from ISO 10456, formula 4:

$$f_{u,1} = \frac{\ln \frac{\lambda_{10,(23,50)}}{\lambda_{10,dry}}}{u_{23,50} - u_{dry}}$$

where,

$\lambda_{10,(23,50)}$ (Average);

$\lambda_{10,dry}$ (Average) according to clause D.2.1, Procedure Set 1;

$u_{23,50}$ is determined according to formula (D.1);

u_{dry} is described in clause D.2.1, Procedure Set 1 and is defined to be 0.

D.3. Calculation of the declared thermal conductivity λ_D

The declared thermal conductivity λ_D shall be calculated using following formula (D.3):

$$\lambda_{10,(23,50)} = \lambda_{10,dry,90/90} \times e^{f_{u,1}(u_{23,50} - u_{dry})}$$

where,

$\lambda_{10,dry,90/90}$ is determined according to clause D.2.1;

$f_{u,1}$ is determined according to formula (D.2);

$u_{23,50}$ is determined according to formula (D.1);

u_{dry} is described in clause D.2.1, Procedure Set 1 and is defined to be 0.

The calculated value $\lambda_{10,(23,50)}$ shall be rounded upwards to the nearest 0.001W/mK and declared as $\lambda_{D(23,50)}$.

D.4. Determination of the conversion factor ($f_{u,2}$) to high moisture content

For the determination of the conversion factor to high moisture content $f_{u,2}$, two sets of measurements are needed.

D.4.1. Set 1

At least three measurements on test specimens conditioned at $(23 \pm 2)^\circ\text{C}$ and $(50 \pm 5)\%$ relative humidity, to determine $\lambda_{10,(23,50)}$ and $u_{23,50}$ (moisture content mass by mass).

Procedure Set 1

- Determine the $\lambda_{10,(23,50)}$ and $u_{23,50}$ in accordance with formula (D.3).

D.4.2. Set 2

At least three measurements on test specimens conditioned at $(23 \pm 2)^\circ\text{C}$ and $(80 \pm 5)\%$ relative humidity, to determine $\lambda_{10,(23,80)}$ and $u_{23,80}$ (moisture content mass by mass).

Procedure Set 2

- Condition the three test specimens at $(23 \pm 2)^\circ\text{C}$ and $(80 \pm 5)\%$ relative humidity following the procedures detailed in EN 13169 clause 5.2., step 2.
- Determine for each test specimen the mass at $(23 \pm 2)^\circ\text{C}$ and $(80 \pm 5)\%$ relative humidity. Average the three values to determine the mass at 23°C and 50% relative humidity as $m_{23,80}$.
- Calculate $u_{23,80}$ by the following formula (D.4)

$$u_{23,80} = \frac{m_{23,80} - m_{dry}}{m_{dry}},$$

where,

$m_{23,80}$ (Average) is the mass at 23°C and 80% relative humidity according to clause D.4.2

m_{dry} is the mass according to clause D.2, Procedure Set 1

Determine for each test specimen the λ value in accordance with EN 12667 or EN 12939 for thick products at a mean temperature of $(10 \pm 0.3)^\circ\text{C}$.

Average the three values to determine $\lambda_{10,(23,80)}$.

D.4.3. Calculation of the moisture conversion factor ($f_{u,2}$)

The conversion factor to high moisture content $f_{u,2}$ shall be calculated by the formula (D.5), derived from ISO 10456, formula 4:

$$f_{u,2} = \frac{\ln \frac{\lambda_{10,(23,80)}}{\lambda_{10,(23,50)}}}{u_{23,80} - u_{23,50}}$$

where,

$\lambda_{10,(23,80)}$ (Average);

$\lambda_{10,(23,50)}$ is determined according to formula (D.3);

$u_{23,80}$ is determined according to formula (D.4);

$u_{23,50}$ is determined according to formula (D.1).

Note 1: For the determination of the moisture conversion factor $f_{u,1}$ and the conversion factor to high moisture content $f_{u,2}$, the test specimens shall be taken from the same production run.

Note 2: Thermal conductivity may also be measured at mean temperatures other than 10°C , providing that the accuracy of the relationship between the temperature and thermal properties is well documented.