EUROPEAN ASSESSMENT DOCUMENT

EAD 040369-01-1201

February 2021

INSULATION MADE OF LOOSE-FILL OR COMPOUND GRANULATED EXPANDED CORK OR LOOSE-FILL GRANULATED NATURAL CORK AND RUBBER

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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) 305/2011 as a basis for the preparation and issuing of European Technical Assessments (ETA).

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1 SCOPE OF THE EAD

1.1 Description of the construction product

The product is an insulation material composed by granulated expanded cork, with or without a binding agent, or a mixture of granules from recycling of natural cork and rubber waste, without a binding agent, referred to hereafter as “insulation product“.

The granulated expanded cork is obtained by grinding and/or milling manufactured insulation cork boards.

The granulated natural cork is obtained by grinding and/or milling all kinds of cork industry derivatives, the less noble sub-layers of the cork industry that are commonly waste, used corks, and end-of-life cork linings removed from homes and other applications.

Regarding rubber, granules are obtained from tire recycling with a rubber polymer base.

The insulation product can be delivered as a loose-fill granulated expanded cork, as a dry mixture of granulated expanded cork and binding agent (or as separate components) or as a mixture of granulated natural cork and rubber. It can be applied for wall and roof insulation (as a loose-fill) or for floor insulation (compound or loose-fill inside cavities).

The final product which forms the insulation layer after installation is hereinafter referred to as insulation product.

The insulation product is not covered by a harmonised European standard (hEN)[1]. Product according to this EAD is not fully covered by EAD 040369-00-1201[2] due to changes in the scope: inclusion of natural cork and rubber granules and also due to deviations identified next.

In comparison to the 040369-00-1201, in this EAD the following clauses and annexes have been changed or added: Title of EAD, section 1.1, section 1.3, section 2.2.3, Annex B and Annex E.

Additionally, normative references have been updated and text has been improved.

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 insulation 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 insulation layer formed by the insulation product serves the following intended use:

- Thermal and/or acoustic insulation of walls, roofs and floors.

The assessment of insulation product only applies if the product is protected from precipitation, wetting or weathering in built-in state and during transport, storage and installation and if it will not be used for construction elements with contact to water and soil or in constructions with a risk that the critical moisture content will be exceeded.

[1] hEN 14064-1 covers inorganic fibres, not organic granules. hEN does not consider some relevant essential characteristics, namely acoustical properties, dangerous substances (PaH and VOCs), biological resistance and corrosion developing capacity.

[2] All undated references to standards or to EADs in this document are to be understood as references to the dated versions listed in chapter 4

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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 insulation product for the intended use of 50 years when installed in the works (provided that insulation product is subject to appropriate installation (see 1.1)). These provisions are based upon the current state of the art and the available knowledge and experience.

When assessing the insulation 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[3].

The indications given as to the working life of the construction product cannot be interpreted as a guarantee neither given by the product manufacturer or his representative nor by EOTA when drafting this EAD nor by the Technical Assessment Body issuing an ETA based on this EAD, but are regarded only as a means for expressing the expected economically reasonable working life of the product.

1.3 Specific terms used in this EAD

1.3.1 Cork

Protective layer of the cork oak tree (*Quercus suber* L.) which may be periodically removed from its trunk and branches to provide the raw material for cork products.

1.3.2 Granulated natural cork

Fragments of natural cork obtained by grinding and/or milling raw or manufactured cork.

1.3.3 Insulation cork board

Pre-formed product made from ground granulated cork expanded and bonded exclusively with its own natural binder exuded from cork cell walls by heating under pressure.

1.3.4 Granulated expanded cork

Fragments of expanded cork obtained by grinding and/or milling manufactured insulation cork boards.

1.3.5 Loose-fill

Any of several insulation materials in the form of fragments or that can be blown, injected or placed by hand.

1.3.6 Granulated expanded cork compound

Mixture of granulated expanded cork with a binding agent and eventually with additional fine aggregates.

1.3.7 Rubber

Polymer of isoprene, an organic material, sometimes with traces of other materials such as proteins, resins and inorganic materials.

1.3.8 Granulated rubber

Recycled rubber produced from end-of-life automotive and truck scrap tires.

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3 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.

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2 ESSENTIAL CHARACTERISTICS AND RELEVANT ASSESSMENT METHODS AND CRITERIA

2.1 Essential characteristics of the insulation product

Table 2.1.1 shows how the performance of the insulation product is assessed in relation to the essential characteristics.

Table 2.1.1 Essential characteristics of the insulation 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 insulation product performance
Basic Works Requirement 2: Safety in case of fire			
1	Reaction to fire	2.2.1	Class
2	Propensity to undergo continuous smouldering	2.2.2	Description
Basic Works Requirement 3: Hygiene, health and the environment			
3	Content, emission and/or release of dangerous substances	2.2.3	Description
4	Biological resistance	2.2.4	Level
5	Water vapour transmission	2.2.5	Level
Basic Works Requirement 4: Safety and accessibility in use			
6	Compressive stress/ strength[1]	2.2.6	Level
7	Deformation under specified load and temperature[1]	2.2.7	Level
8	Point load[1]	2.2.8	Level
9	Corrosion developing capacity	2.2.9	Description
Basic Works Requirement 5: Protection against noise			
10	Impact sound reduction[2]	2.2.10	Level
11	Airborne sound insulation	2.2.11	Level
12	Sound absorption	2.2.12	Level
13	Dynamic stiffness[1]	2.2.13	Level
14	Airflow resistance	2.2.14	Level
15	Compressibility[1]	2.2.15	Level
Basic Works Requirement 6: Energy economy and heat retention			
16	Thermal conductivity /resistance	2.2.16	Level
17	Moisture absorption	2.2.17	Level
18	Loose bulk density	2.2.18	Level
19	Settlement[3]	2.2.19	Level
20	Water absorption	2.2.20	Level
21	Particle size distribution[3]	2.2.21	Description

[1] In case of compound product
[2] In case of floor application
[3] In case of loose-fill product

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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.

2.2.1 Reaction to fire

The insulation product shall be tested according to the method(s) referred to in EN 13501-1 and relevant for the corresponding reaction to fire class. The product shall be classified in connection to the Commission Delegated Regulation (EU) No. 2016/364.

Detailed instructions for mounting and fixing are set in Annex A.

2.2.2 Propensity to undergo continuous smouldering

The performance of the product’s propensity to undergo continuous smouldering combustion shall be tested and assessed in accordance with EN 16733.

The conditions and parameters which shall be taken into account within the test as well as the rules for the application of the test results are specified in Annex B.

In accordance with EN 16733, clause 11, the ETA shall specify the following information, depending on the out-come of the assessment:

− “The product does not show propensity to undergo continuous smouldering”;

− “The product shows propensity to undergo continuous smouldering”; or

− "Assessment of the propensity to undergo continuous smouldering is not possible".

2.2.3 Content, emission and/or release of dangerous substances

The performance of the insulation product related to the emissions and/or release and, where appropriate, the content of dangerous substances will be assessed on the basis of the information provided by manufacturer[4] after identifying the release scenarios taking into account the intended use of the product and the Member States where the manufacturer intends his product to be made available on the market.

4 The manufacturer may be asked to provide to the TAB the REACH related information which he must accompany the DoP with (cf. Article 6(5) of Regulation (EU) No 305/2011).

The manufacturer is **not** obliged:
- to provide the chemical constitution and composition of the product (or of constituents of the product) to the TAB, or
- to provide a written declaration to the TAB stating whether the product (or constituents of the product) contain(s) substances which are classified as dangerous according to Directive 67/548/EEC and Regulation (EC) No 1272/2008 and listed in the "Indicative list on dangerous substances" of the SGDS.

Any information provided by the manufacturer regarding the chemical composition of the products may not be distributed to EOTA or to TABs.

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The identified intended release scenarios[5] for this insulation product and intended use with respect to dangerous substances are:

IA2: Product with indirect contact to indoor air (e.g., covered products) but possible impact on indoor air

IA3: Product with no contact to indoor air

S/W3: Product with no contact to soil, ground- and surface water

2.2.3.1 VOC and SVOC

The release of VOC and SVOC (individual VOC/SVOCs and the sum emission of VOC/SVOC) has to be determined according to the relevant parts of EN ISO 16000 and according to EN 16516.

2.2.3.2 Biocides (others than wood preservatives): active substances

Only such active substances shall be applied which are approved according to Commission Directive 98/8/EC of the European Parliament and of the Council (the BPR - (EU) No. 528/2012- will apply EU-wide from 1st September 2013). As long as Annex I of Directive 98/8/EC is under development, only such biocides shall be applied which are notified for the applicable product type (Commission Decision 1451/2007 as amended).

2.2.3.3 Formaldehyde

The formaldehyde release of loose-fill or compound for use in the intended release scenario IA2, shall be determined according to the test standard EN ISO 16000-9 in combination with EN ISO 16000-3 and EN ISO 16000-11.

2.2.3.4 PAH and B[a]P

For the intended use covered by the release scenarios IA2, IA3, S/W2 and S/W3, the specific organic compounds polyaromatic hydrocarbons (PAH) and Benzo(a)pyrene (B[a]P) are to be determined in accordance with ISO 18287 (GC-MS) or ISO 13877 (HPLC).

The preparation of the test specimen is performed in accordance with the manufacturer's product installation instructions or (in absence of such instructions) the usual practice of rubber granules. The specimen with maximum thickness shall be used.

Once the test specimen has been produced, as described above, it should immediately be placed in the emission test chamber. This time is considered the starting time of the emission test.

The test results have to be reported for the relevant parameters (e.g., chamber size, temperature and relative humidity, air exchange rate, loading factor, size of test specimen, conditioning, production date, arrival date, test period, test result) after 3 and 28 days testing.

The relevant test results shall be expressed in mg/kg and stated in the ETA.

2.2.3.5 Nitrosamines

For the intended use covered by the release scenarios IA2, IA3, S/W2 and S/W3, the content of nitrosamines, where applicable, is to be determined in accordance with the method established by DIK, published in "Kautschuk Gummi Kunststoffe, Nr. 6/91, Methods for the determination of n-nitrosamines in the air vulcanization steams" by DIK (Deutsches Institut für Kautschuktechnologie e.V.).

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[5] Scenario **IA2** is applicable for products which are covered with other products but nevertheless could release dangerous substances to indoor air (e.g., products covered with porous/unsealed coverings incapable of avoiding migration, such as gypsum panels).

Scenario **IA3** is applicable for products which are completely covered with tight products capable of avoiding any kind of migration of dangerous substances to indoor air.

Scenario **S/W2** is applicable for products which can be leached by rain (e.g., external claddings) and could release dangerous substances which can have an impact on soil and water.

Scenarios **S/W3** is applicable for products which are completely covered with tight products capable of avoiding any kind of migration of dangerous substances to soil or water.

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The preparation of the test specimen is performed in accordance with the manufacturer's product installation instructions or (in absence of such instructions) the usual practice of rubber granules. The specimen with maximum thickness shall be used.

Once the test specimen has been produced, as described above, it should immediately be placed in the emission test chamber. This time is considered the starting time of the emission test.

The test results have to be reported for the relevant parameters (e.g., chamber size, temperature and relative humidity, air exchange rate, loading factor, size of test specimen, conditioning, production date, arrival date, test period, test result) after 3 and 28 days testing.

The relevant test results shall be expressed in $\mu g/m^3$ and stated in the ETA.

2.2.4 Biological resistance

The determination of the growth of mould fungus shall be carried out according to Annex C.

The growth of mould fungus shall be expressed according to Table 4 of EN ISO 846.

2.2.5 Water vapour transmission

Water vapour transmission (water vapour diffusion resistance factor μ) shall be carried out according to EN 12086, test condition A, dry state.

The samples shall be stored in accordance with EN 12086, clause 6.3.

In the case of loose-fill product, a suitable specimen holder (*e.g.,* metal cylinder with height equal to testing thickness and diameter equal or greater than height) may be used. The tested thickness shall be stated in the ETA.

The insulation product shall completely fill up the specimen holder and the surface shall be levelled off without compacting the sample.

The bottom surface of the specimen holder shall be a steel mesh which shall be compatible with (retain) the minimum nominal particle size of the insulation and made with a wire thickness of 0.25 mm.

The water vapour diffusion resistance factor(s) (μ) shall be given in the ETA.

2.2.6 Compressive stress/strength

Compressive stress/strength shall be evaluated only for compound product. The compressive stress at 10 % deformation, or the compressive strength, shall be determined according to EN 826 with at least 5 test samples of 50 mm x 50 mm, for thickness below 50 mm. For larger thicknesses the width of the test specimen shall be not less than its thickness and square. At least minimum and maximum insulation product thickness shall be tested.

The minimum value for each tested thickness shall be stated in the ETA.

2.2.7 Deformation under specified load and temperature

The determination of the deformation under specified compressive load and temperature conditions shall be carried out only for compound product according to EN 1605 with at least 3 test samples, for test condition 1, of 50 mm x 50 mm, for thickness below 50 mm. For larger thicknesses the width of the test specimen shall be not less than its thickness and square.

The maximum change of the relative deformation in % for the step: 20 kPa for (48 ± 1) h at (80 ± 1) ºC, shall be stated in the ETA.

2.2.8 Point load

The behaviour of insulation product under point load shall be determined only for compound product according to EN 12430 with 3 test samples of 300 mm x 300 mm.

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The assessed thickness, the compressive force and the deformation at the critical point, if relevant, the point load at a deformation of 5 mm, and the force-deformation curve shall be presented in the ETA.

2.2.9 Corrosion developing capacity

The corrosion developing capacity on metal construction shall be assessed according to Annex D.

Either the statement based on composition or the existence or not of notches or perforations within the central zone (3 mm off the edge of a coupon) shall be stated in the ETA.

2.2.10 Impact sound reduction

The impact sound reduction, ΔL, depends on the specific end-use floor built up solution, including, namely, the thermal/acoustic insulation layer or filled cavities, the type of structural elements and the floor finishing, including any additional acoustic layers.

The determination of the impact sound reduction shall be performed according to EN ISO 10140-3. The test arrangement is the *full-size test opening* referred to in clause 4.3.1 of EN ISO 10140-5.

The test sample shall reproduce the specific complete end-use constructive solution and the result is valid only for the tested solution.

The assessed build-up shall be described in detail in the ETA.

The corresponding weighted impact sound reduction ΔL_w shall be calculated and rated according to EN ISO 717-2.

The weighted impact sound reduction ΔL_w (if need be, for different build-ups) shall be stated in the ETA

2.2.11 Airborne sound insulation

The airborne sound insulation, R, depends on the specific end-use floor, wall or ceiling built up solution, including, namely, the thermal/acoustic insulation layer or filled cavities, the type of structural elements and the floor or ceiling finishes, including any additional acoustic layers.

The determination of the airborne sound insulation shall be performed according to EN ISO 10140-2. The test arrangement is the *full-size test opening* referred to in clause 6.2 of EN ISO 10140-2.

The test sample shall reproduce the specific complete end-use constructive solution and the result is valid only for the tested solution(s).

The assessed build-up shall be described in detail in the ETA.

The corresponding weighted airborne sound insulation R_w shall be calculated and rated according to EN ISO 717-1.

2.2.12 Sound absorption

The determination of the sound absorption coefficient shall be performed according to EN ISO 354, using mounting specifications of Type A for the loose fill product and Type I for the compound.

The assessed test thicknesses shall be described in detail in the ETA.

The sound characteristics shall be calculated according to EN ISO 11654, using the values for the sound absorption coefficient α_p, at the frequencies 125 Hz, 250 Hz, 500 Hz, 1000 Hz, 2000 Hz and 4000 Hz, and the single number value for the weighted sound absorption coefficient α_w.

The obtained values for α_p and α_w shall be rounded to the nearest 0.05 (α_p larger than 1 shall be expressed as $\alpha_p = 1$).

The values for α_p and α_w shall be expressed in levels with steps of 0.05.

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2.2.13 Dynamic stiffness

The determination of dynamic stiffness shall be carried out according to EN 29052-1 only for compound product. At least minimum and maximum insulation product thickness shall be tested. The mean value of dynamic stiffness for different insulation product and different thickness shall be expressed in the ETA in levels using steps of 1 MN/m³.

2.2.14 Airflow resistance

The determination of the specific airflow resistance shall be carried out according to EN ISO 9053-1.

The specific airflow resistance, R_s, shall be expressed in levels using steps of 1 kPa.s/m.

2.2.15 Compressibility

The determination of thickness d_L and d_B shall be carried out only for compound product according to EN 12431, with maximum insulation product thickness and a pause of 120 s before measuring d_B.

The compressibility c is defined as follows:

$c = d_L – d_B$

The nominal values d_L and the maximum value of the compressibility c shall be stated in the ETA.

2.2.16 Thermal conductivity/resistance

The determination of the thermal conductivity of insulation product, at a temperature of 10 °C, shall be determined according to EN 12667 or EN 12664 for compound products.

At least 4 measurements shall be performed under dry conditions.

When testing loose-fill materials, the thickness of the specimen shall be at least 10 times the mean dimension of the granules of loose-fill material and preferably with a minimum thickness of 50 mm.

The insulation product samples shall be tested in a square rigid frame (e.g., cellular plastic), made of a low conductivity material covered by a plastic film (e.g., plastic foil), large enough to provide a test specimen corresponding to test dimensions.

Compound products shall be moulded to obtain samples with the intended testing dimensions. The surface of the test specimen shall be made plane by appropriate means, so that close contact between the specimen and apparatus or interpose sheets can be effected.

The thermal conductivity at a temperature of 10 °C at dry conditions ($\lambda_{10,dry,90/90}$) representing at least 90% of the production with a confidence level of 90% shall be determined according to Annex E, clause E.1.

Moisture related conversion coefficients, mass by mass, $f_{u,1}$ and $f_{u,2}$ and equilibrium moisture contents (expressed in kg/kg) $u_{23,50}$ and $u_{23,80}$ shall be given in the ETA.

The moisture conversion coefficient ($f_{u,1}$) and the equilibrium moisture content $u_{23,50}$ shall be determined in accordance with Annex E, clause E.2.

The moisture conversion coefficient ($f_{u,2}$) to high humidity and the equilibrium moisture content $u_{23,80}$ shall be determined in accordance with Annex E, clause E.3.

Mass related moisture conversion factors F_{m1} and F_{m2} shall be given in the ETA.

The moisture conversion factor F_{m1} for conversion of $\lambda_{10,dry}$ to $\lambda_{10,(23,50)}$ and the moisture conversion factor F_{m2} for conversion of $\lambda_{10,(23,50)}$ to $\lambda_{10,(23,80)}$ shall be calculated according to EN ISO 10456 clause 7.3, equation 4.

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2.2.17 Moisture absorption

The moisture absorption shall be determined according to EN ISO 12571, desiccator method.

The maximum moisture absorption at 23ºC and 50% relative humidity and at 23ºC and 80% relative humidity shall be stated in the ETA.

2.2.18 Loose bulk density

The determination of the loose bulk density shall be carried out according to EN 1097-3.

The value of the loose bulk density (upper and lower limit) shall be stated in the ETA.

2.2.19 Settlement

The settlement depends on the density of the insulation product, the thickness and the application. Therefore, the settlement shall be assessed for different nominal densities, at different thicknesses covering the intended use conditions. Per settlement, the following characteristics shall be determined:

- the settlement S
- the bulk density ρ
- the settled density ρ_s

In the cases of roofs (e.g., ventilated attics) and floors, the determination of the settlement characteristics of loose-fill product under cyclical temperature and humidity conditions (S_{cyc}) shall be carried out in accordance with EN 15101-1, Annex B, method B.1. Deviating from EN 15101-1, the insulation product is manually or mechanically laid into the specimen box, or in accordance with the manufacturer's recommendations for installation. A thickness of 300 mm shall be tested.

Three test specimens shall be used. The density of the specimens shall approximately correspond to the minimum density covering in the ETA.

The settlement under cyclical temperature and humidity conditions, S_{cyc}, shall be given in the ETA using the classes (SH) according to EN 15101-1, clause, 4.2.2.2, Table 1.

In the case of walls, the determination of the settlement characteristics of loose-fill product shall be carried out in accordance with EN 15101-1, Annex B, method B.2. Deviating from EN 15101-1, the insulation product is manually or mechanically laid into the specimen box. After filling the box the vibration sequences, as specified in EN 15101-1/B.2.4.2, are applied until no further settlement is observed. Then the value S_d [%] is calculated and presented in the ETA.

A minimum thickness of 100 mm and a maximum of 240 mm shall be tested.

The settlement S_d (in %) and the settled density ρ (in kg/m^3) shall be stated in the ETA, as well as the tested depth used for the application in walls. The ETA shall include a note that the nominal thickness for calculating the thermal resistance shall be determined from settled thickness.

2.2.20 Water absorption

The determination of short term water absorption by partial immersion shall be carried out according to EN ISO 29767, section, 7.2.1 method A (drainage).

The specimen side length shall be 200 mm and a thickness of at least 100 mm. In the case of loose-fill product, an appropriate specimen holder (mesh box) shall be used. The mesh size shall ensure that the smallest particles are retained.

The water absorption in kg/m^2 shall be stated in the ETA.

2.2.21 Particle size distribution

The determination of the dimensions of the particle size distribution of the loose-fill insulation product shall be carried out in accordance with EN 933-1 and prepared without washing.

The particle size distribution shall be stated in the ETA.

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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 insulation products covered by this EAD the applicable European legal act is: Decision 1999/91/EC as amended by 2001/596/EC.

The applicable AVCP 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 regarding reaction to fire are 1, or 3, or 4 depending on the conditions defined in the said Decision.

3.2 Tasks of the manufacturer

The cornerstones of the actions to be undertaken by the manufacturer of the insulation product in the process of assessment and verification of constancy of performance are laid down in Table 3.2.1.

Table 3.2.1 Control plan for the manufacturer; cornerstones

No	Subject/type of control	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control [a]
Factory production control (FPC) [including testing of samples taken at the factory in accordance with a prescribed test plan]					
Loose-fill product					
1	Raw and base materials	According to manufacturer´s specifications	Control Plan	Control Plan	Each batch
2	Reaction to fire	2.2.1	Control plan	1 (EN ISO 1182) 1 (EN 13823) 1 (EN ISO 11925-2)	Once a year
3	Continuous smouldering combustion	2.2.2	Control plan	1	Once a year
4	Biological resistance	2.2.4	Control plan	4	Once a year
5	Water vapour transmission	2.2.5	Control plan	5	Once a year
6	Corrosion developing capacity	2.2.9	Control plan	4	Once a year
7	Airborne sound insulation	2.2.11	Control plan	1	Once a year
8	Sound absorption	2.2.12	Control plan	1	Once a year
9	Airflow resistance	2.2.14	Control plan	3	Once a year
10	Thermal conductivity/resistance	2.2.16	Control plan	1	Once a month or bulk density twice a week
11	Moisture absorption	2.2.17	Control plan	3	Quarterly

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No	Subject/type of control	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control [a]
12	Loose bulk density	2.2.18	Control plan	3	Twice a week
13	Settlement	2.2.19	Control plan	3	2 per year
14	Water absorption	2.2.20	Control plan	4	Quarterly
15	Particle size distribution	2.2.21	Control plan	1	Once per week
Compound product					
16	Raw and base materials	According to manufacturer´s specifications	Control Plan	Control Plan	Each batch
17	Reaction to fire	2.2.1	Control plan	1 (EN ISO 1182) 1 (EN 13823) 1 (EN ISO 11925-2)	Once a year
18	Continuous smouldering combustion	2.2.2	Control plan	1	Once a year
19	Biological resistance	2.2.4	Control plan	4	Once a year
20	Water vapour transmission	2.2.5	Control plan	5	Once a year
21	Compressive stress/strength	2.2.6	Control plan	5	Once a week
22	Deformation under specified load and temperature	2.2.7	Control plan	3	Once a year
23	Point load	2.2.8	Control plan	3	1 per 5 years
24	Corrosion developing capacity	2.2.9	Control plan	4	Once a year
25	Impact sound reduction	2.2.10	Control plan	1	Once a year
26	Airborne sound insulation	2.2.11	Control plan	1	Once a year
27	Sound absorption	2.2.12	Control plan	1	Once a year
28	Dynamic stiffness	2.2.13	Control plan	3	Once a year
29	Airflow resistance	2.2.14	Control plan	3	Once a year
30	Compressibility	2.2.15	Control plan	3	Once a week
31	Thermal conductivity/resistance	2.2.16	Control plan	1	Once a month or bulk density twice a week
32	Moisture absorption	2.2.17	Control plan	3	Quarterly
33	Loose bulk density	2.2.18	Control plan	3	Twice a week
34	Water absorption	2.2.20	Control plan	4	Quarterly

[a] In case of discontinuous production these minimum frequencies should be adapted to an equivalent frequency.

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3.3 Tasks of the notified body

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).

In this case the cornerstones of the tasks to be undertaken by the notified body under AVCP system 1 are laid down in Table 3.3.1.

Table 3.3.1 Control plan for the notified body; cornerstones

No	Subject/type of control	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control
Initial inspection of the manufacturing plant and of factory production control carried out by the manufacturer regarding the constancy of performance related to reaction to fire *(for system 1 only)*					
1	Initial inspection of the manufacturing plant, of the production of the insulation product and of the facilities for factory production control	See Table 3.2.1	According to control plan	According to control plan	When starting the production or a new line
2	Assessment of the technical conditions in the factory, including the assessment of the factory production control system	See Table 3.2.1	According to control plan	According to control plan	Once a year
Continuous surveillance, assessment and evaluation of factory production control carried out by the manufacturer regarding the constancy of performance related to reaction to fire (for system 1 only)					
3	Subsequent continuous surveillance of factory production control	See Table 3.2.1	According to control plan	According to control plan	Once a year

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Reference documents

EAD 040369-00-1201:01-2016	*Insulation made of loose-fill or compound granulated expanded cork*
EN 826:2013	*Thermal insulating products for building applications - Determination of compression behaviour*
EN 933-1:2012	*Tests for geometrical properties of aggregates – Part 1: Determination of particle size distribution – Sieving method*
EN 1097-3:1998	*Tests for mechanical and physical properties of aggregates – Part 3: Determination of loose bulk density and voids*
EN 1605:2013	*Thermal insulating products for building applications - Determination of deformation under specified compressive load and temperature conditions*
EN 12430:2013	*Thermal insulating products for building applications - Determination of behaviour under point load*
EN 12431:2013	*Thermal insulating products for building applications - Determination of thickness for floating floor insulating products*
EN 12086:2013	*Thermal insulating products for building applications – Determination of water vapour transmission properties*
EN 12664:2001	*Thermal performance of building materials and products. Determination of thermal resistance by means of guarded hot plate and heat flow meter methods. Dry and moist products of medium and low thermal resistance*
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 12939:2001	*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 13823:2020	*Reaction to fire tests for building products – Building products excluding floorings exposed to the thermal attack by a single burning item*
EN 15101-1:2013 +A1:2019	*Thermal insulation products for buildings – In-situ formed loose-fill cellulose (LFCI) products – Part 1: Specification for the products before installation*
EN 16516:2017	*Construction products – Assessment of release of dangerous substances – Determination of emissions into indoor air*
EN 16733:2016	*Reaction to fire tests for building products – Determination of a building product's propensity to undergo continuous smouldering*
EN 29052-1:1992	*Acoustics - Determination of dynamic stiffness - Part 1: Materials used under floating floors in dwellings*
EN ISO 354:2003	*Acoustics – Measurement of sound absorption in a reverberation room*
EN ISO 717-1:2013	*Acoustics – Rating of sound insulation in buildings and of building elements – Part 1: Airborne sound insulation*
EN ISO 717-2:2013	*Acoustics – Rating of sound insulation in buildings and of building elements – Part 2: Impact sound insulation*
EN ISO 846:2019	*Plastics – Evaluation of the action of microorganisms*
EN ISO 9053-1:2018	*Acoustics - Determination of airflow resistance - Part 1: Static airflow method (ISO 9053-1:2018)*

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EN ISO 1182:2020	*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 10140-2:2010	*Acoustics – Laboratory measurement of sound insulation of building elements – Part 2: Measurement of airborne sound insulation*
EN ISO 10140-3:2010	*Acoustics – Laboratory measurement of sound insulation of building elements – Part 3: Measurement of impact sound insulation*
EN ISO 10140-5:2010	*Acoustics – Laboratory measurement of sound insulation of building elements – Part 5: Requirements for test facilities and equipment*
EN ISO 10456:2007	*Building materials and products – Hygrothermal properties – Tabulated design values and procedures for determining declared and design thermal values*
EN ISO 11654:1997	*Acoustics – Sound absorbers for use in buildings – Rating of sound absorption*
EN ISO 11925-2:2020	*Reaction to fire tests – Ignitability of products subjected to direct impingement of flame – Part 2: Single-flame source test*
EN ISO 12571:2013	*Hygrothermal performance of building materials and products – Determination of hygroscopic sorption properties*
EN ISO 29767:2019	*Thermal insulating products for building applications - Determination of short-term water absorption by partial immersion (ISO 29767:2019)*
EN ISO 16000-3:2006	*Indoor air – Part 3: Determination of formaldehyde and other carbonyl compounds in indoor air and test chamber air – Active sampling method*
EN ISO 16000-9:2006	*Indoor air – Part 9: Determination of the emission of volatile organic compounds from building products and furnishing – Emission test chamber method*
EN ISO 16000-11:2006	*Indoor air – Part 11: Determination of the emission of volatile organic compounds from building products and furnishing – Sampling, storage of samples and preparation of test specimens*
ISO 9053:1991	*Acoustics – Materials for acoustical applications – Determination of airflow resistance*
ISO 13877:1998	*Soil quality – Determination of polynuclear aromatic hydrocarbons – Method using high -performance liquid chromatography*
ISO 18287:2006	*Soil quality – Determination of polycyclic aromatic hydrocarbons (PAH) – Gas chromatographic method with mass spectrometric detection (GC-MS)*
ISO/DIS 18393-1:2012	*Thermal insulation products – Determination of ageing by settlement – Part 1: Blown loose-fill insulation for ventilated attics*
DIK, Nr. 6/91	*Kautschuk Gummi Kunststoffe. “Methods for the determination of n-nitrosamines in the air vulcanization steams”*

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ANNEX A: REACTION TO FIRE

A.1 Conditioning

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

A.2 Testing according to EN ISO 1182 and EN ISO 1716

These methods are needed to determine classes A1 and A2 according to EN 13501-1. If required, the specimens shall be prepared and tested according to the provisions given in the test standards EN ISO 1182 and EN ISO 1716.

Each different chemical composition has to be considered when testing. In case of products with the same composition but different densities and different amounts of organic components, the variation with the lowest density and the highest amount of organic components, if applicable, shall be tested.

If the product contains flame retardant, the variation with the lowest amount of the flame retardant shall be tested.

The test result is valid for that variation tested and all variation of the products:

- with the same chemical composition,
- with higher densities,
- of any thickness,
- with lower amounts of organic components, if applicable, and
- with higher amounts of the same type of flame retardant as the one which has been tested, if applicable.

A.3 Testing according to EN 13823 (SBI)

A.3.1 Loose-fill product

The mounting and fixing of loose-fill product shall be made using boxes made of a galvanized steel frame (built up with steel angles 25 mm x 25 mm x 3 mm) and galvanized steel mesh.

The mesh size shall be 4 mm x 4 mm, which may be reduced in order to retain smaller size particles. and wire thickness of 0.5 mm. To avoid moulding of the cages, a reinforcement by a second mesh layer with a mesh size of 50 mm x 50 mm and wire thickness of 2 mm shall be used.

The general substrate to be used to test the product is calcium silicate board (according to EN 13238) and is to be formed by the SBI backing board.

The thickness of the product giving the worst test result shall be determined. If the worst test is not known minimum and maximum thickness shall be tested.

The test results are valid for:

- higher densities,
- all thickness between those evaluated in the tests,
- greater thicknesses if test results are obtained on 180 mm thick test specimens,
- higher amounts of the same type of flame retardant as the one which has been tested, if applicable.

A.3.2 Compound product

The end-use applications have to be taken into account when testing compound products according to EN 13823. For testing the insulation product, two different basic types of substrates are considered in end-use applications – structures made of mineral material (e. g. concrete, ceramic) and structures made of beams with timber or wood based panels.

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According to EN 13238 (clause 5.3) the standard substrate made of fibre cement boards (A2-s1,d0) represents mineral end-use substrates classes A1 and A2-s1,d0. The standard substrate made of not fire retardant treated wood particle boards (D-s2,d0) represents end-use substrates of wood and also end-use substrates of class A1 and A2-s1,d0 (according to EN 13238, clause 5.2.3). If other substrates are considered in the end-use application, other substrates exactly representing the substrate of the end-use application shall be used for testing. The results are only valid for the tested specific end-use application. Since the reaction to fire performance of the insulation product shall be evaluated, all tests shall be conducted without any covering (e.g., surface finishing boards, screeds) to the compound product.

The following test configuration shall be used:

1. The samples (compound product + substrate) will be produced in the dimensions of the SBI test specimens.
2. Due to the kind of production – casting of the insulation material on site without joints – no joints shall be considered when preparing the long wing of the SBI specimens.
3. Both the short and the long wing of each sample shall be mounted together on the SBI trolley after conditioning.
4. The samples shall be fixed on the substrate only mechanically by screws with a diameter of 6 mm (see Figure A1 and A2).
5. The correct length of the screws shall be derived from Figure A3.
6. Before fixing the sample, pilot holes with a diameter of 4 mm shall be drilled into the substrate according to Figure A1 and A2.

Instead of fixing the insulation product on the substrate using screws the whole sample can be mounted in a steel frame made of U-profiles covering the lateral edges and the top edge of the sample.

The following parameters of the compound product shall be taken into account when conducting the SBI tests:

- each different composition (proportion of cork, type of rubber granulate, type and amount of binder, etc.),
- the greatest and lowest thickness,
- the lowest density,
- the highest amount of expanded cork and additional organic components and
- the lowest amount of flame retardant.

The test results are valid for the variation tested and any variations of the product:

- with the same chemical composition,
- with higher densities,
- all thickness between those evaluated in the tests,
- with lower amounts of expanded cork and additional organic components, if applicable and
- with higher amounts of the same type of flame retardant as the one which has been tested, if applicable.

Test results of samples with a thickness of 200 mm (that means an insulation thickness of about 190 mm) are also valid for greater thickness.

Test results on the standard particleboard substrate or on other standard substrates are valid for those end-use substrates for which the standard substrate is representative according to the rules given in EN 13238.

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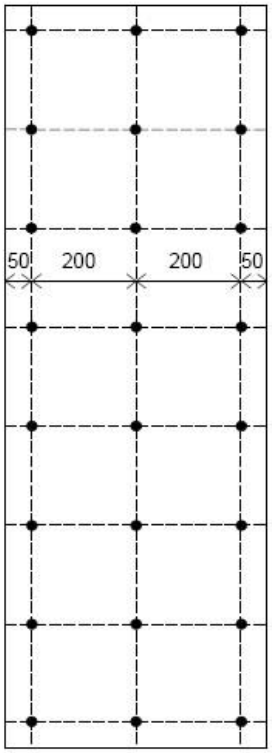

Figure A1

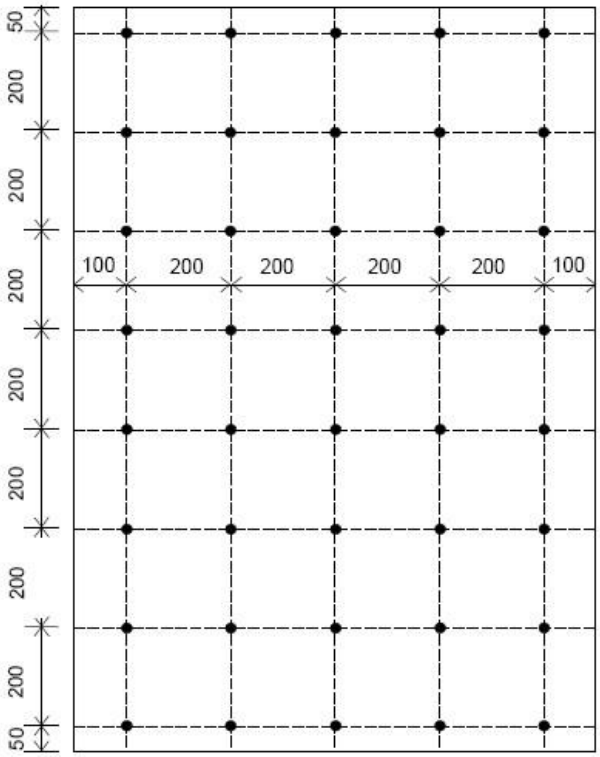

Figure A2

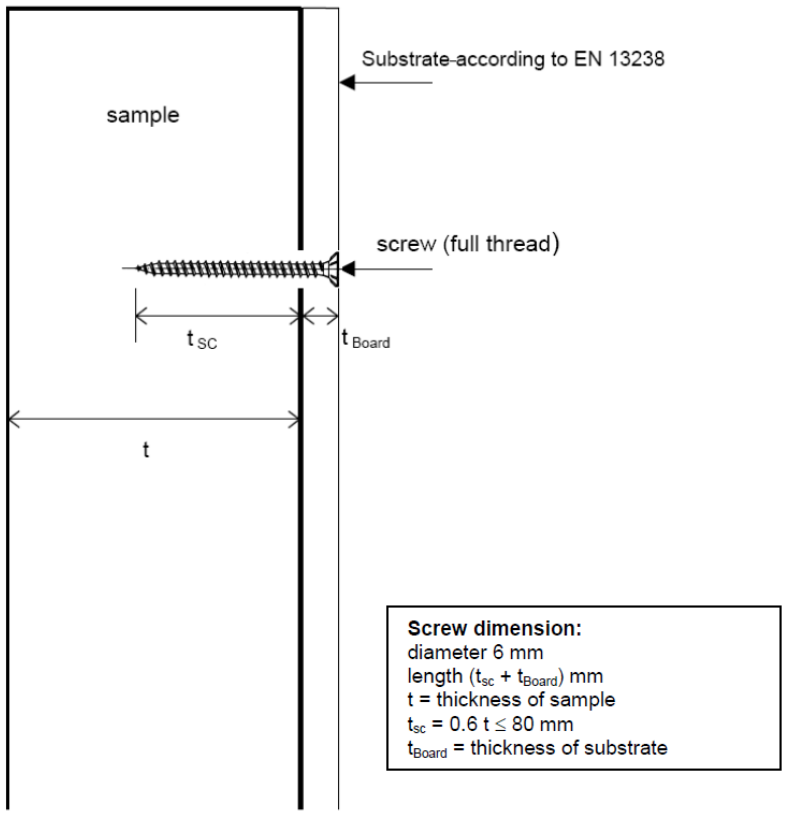

Figure A3

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A.4 Testing acording to EN ISO 11925-2

A.4.1 Loose-fill product

The product shall be tested with a thickness of 40 mm, directly exposed to surface flame attack. Edge flame attack is not necessary, as mentioned in clause 4.5 of EN ISO 11925-2. The results obtained are valid for thicknesses equal to or greater than 40 mm.

Test shall be carried out with specimens of the highest and lowest nominal loose density. The test results are valid for the whole range of densities between those evaluated.

The mounting and fixing of insulation product shall be carried out according to EN ISO 11925-2, clause 4.5.

The specimen holder for testing the loose-fill insulation product shall be similar to the one defined in Figure 5 of EN 11925-2, except the size of the mesh, which may be reduced in order to retain the small size particles.

A.4.2 Compound product

Due to the thickness of the insulation product used in practice, the low energy level of the ignition source and the short time of flame exposure the influence of the end-use condition can be considered as negligible when testing the specimens. Hence the insulation material shall be tested without any substrate behind.

Testing of all specimens shall be conducted with edge exposure according to clause 7.3.3.2 of the test standard.

The following parameters shall be taken into account when preparing the specimens:

- each different chemical composition,
- the greatest thickness (usually that means the greatest testable thickness of 60 mm),
- the lowest density,
- the highest amount of organic components, and
- the lowest amount of flame retardant.

The test results are valid for the variation tested and any variant of the product

- with the same chemical composition,
- with higher densities,
- with lower amounts of organic components,
- with higher amounts of the same type of flame retardant as the one which has been tested and

- of any thickness, if the maximum testable thickness of 60 mm was tested.

If a lower thickness than 60 mm was used for testing, test results are valid for lower thicknesses.

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ANNEX B: DETERMINATION OF PROPENSITY TO UNDERGO CONTINUOUS SMOULDERING

B.1 Sample taking

In addition to EN 16733, the following conditions and parameters shall be considered when performing sampling and preparing test samples:

- product-variations of a product family (as defined by a certain combination of raw materials, type and amount of binder / treatment, and produced in a certain type of production process);
- the product or product variant with the highest as well as lowest density.

B.2 Preparation of test specimens

B.2.1 Loose-fill product

The tests shall be done on free-hanging specimens using the specimen holder for loose-fill products as specified in the test standard (wire mesh box with a thickness of 100 mm). Wire mesh dimensions may be reduced in order to retain smaller size particles. No consideration is done of the intended end-use conditions, because propensity to undergo continuous smouldering is hardly affected by end-use conditions.

B.2.2 Compound product

The test sample shall be rectangular with the dimensions 800 x 300 ± 3 mm and its end-use thickness, up to a maximum of 100 mm.

B.3 Extended application of test results

The results of tests considering the aforementioned parameters in fully are also valid for products:

- of the same defined product-family,
- with any densities between those evaluated,
- with any thickness,
- for any end-use conditions.

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ANNEX C: DETERMINATION OF RESISTANCE OF MOULD FUNGUS

C.1 Principle

A test specimen is exposed for a defined period of 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.

C.2 Apparatus

C.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 C.2.2.

C.2.2 Cage made of stainless steel with an internal volume of approx. 0.05 litres for loose-fill materials.
Cage A, for large particles, with a mesh size of 10 mm x 10 mm and a wire thickness of 0.4 mm.
Cage B, for small particles, with a mesh size of 1 mm x 1 mm and a wire thickness of 0.25 mm.

C.3 Testing conditions

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

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

C.4 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.

C.5 Expression of results

The presence of mould fungus is expressed according to Table 4 of EN ISO 846.

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ANNEX D: DETERMINATION OF METAL CORROSION DEVELOPING CAPACITY

Note: *The determination method is adapted from EN 15101-1+A1, Annex E.*

D.1 Principle

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

Note: *This is an accelerated test and analytical laboratory hygiene is required at all stages.*

D.2 Conditioning

Each test specimen shall be conditioned at (23 ± 2) ºC and (50 ± 5) % relative humidity at least 24 h prior to testing.

D.3 Reagents and materials

D.3.1 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 incandescent light bulb.

D.3.2 Trichloroethylene, of analytical reagent quality.

Note: *Attention is drawn to the possible health risks when using this material.*

D.3.3 Sulphuric acid, (C) H_2SO_4= 0.5 mol/l to 1 mol/l.

D.3.4 Saturated ammonium acetate solution.

D.4 Apparatus

D.4.1 Humidity chamber maintained at (40 ± 2) ºC and 90 % to 95 % relative humidity.

D.4.2 Four cylindrical glass crystallising dishes, well washed, nominally 90 mm in diameter and 50 mm deep.

D.4.3 Rubber or PVC gloves.

D.4.4 Stainless steel spatula.

D.4.5 Tweezers.

D.5 Procedure

Carry out the procedure as follows:

Wash each metal 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 the insulation product and mix each with 150 ml of distilled or deionized water at room temperature in clean glass beaker.

b) Transfer approximately half of one sample of the saturated insulation product, using gloved hands and a clean stainless spatula, to one of the crystallising dishes and tamp level such that a layer of

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10 mm to 15 mm thickness is formed. Place one of the metal coupons horizontally on this layer by introducing one end at slight angle to the saturated material, progressively pressing the reminder 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 reminder 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 the 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 perforations within 3 mm of the edge of a coupon and note only those perforations within the remaining central zone.

D.6 Declaration of results

The results shall be declared as follows:

CR – Test passed: No perforation of the coupons shall be observed as defined in D.5.

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ANNEX E: DETERMINATION OF FRACTILE VALUE OF THERMAL CONDUCTIVITY AND THE MASS -RELATED MOISTURE CONVERSION COEFFICIENT TO HIGH MOISTURE CONTENT

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

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

E.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.

E.1.1.2 The thermal conductivity of the test specimens conditioned according to E.1.1.1 shall be measured according to EN 12667 or EN 12664 for compound 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.

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

E.1.2.1 The λ fractile value at 10 °C, at dry conditions ($\lambda_{10,dry,90/90}$) representing at least 90% of the production with a confidence limit of 90% shall be calculated using the principles as detailed in EN ISO 10456, Annex C.

E.2 Determination of the mass-related moisture conversion coefficient ($f_{u,1}$)

For the determination of the mass-related moisture conversion coefficient $f_{u,1}$, two sets of measurements are needed.

Set 1

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

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).

E.2.1 Procedure

E.2.1.1 Set 1

E.2.1.1.1 Dry the test specimens following the procedure in E.1.1.1.

E.2.1.1.2 Determine for each test specimen the mass in dry condition. Average the values to determine the m_{dry}. The u_{dry}, being the moisture content in dry condition, is by definition set to 0.

E.2.1.1.3 Determine for each test specimen the λ value at 10 °C following the procedure in E.1.1.2. Average the values to determine the $\lambda_{10,dry}$.

E.2.1.2 Set 2

E.2.1.2.1 Condition the test specimens at (23 ± 2) °C and (50 ± 5)% relative humidity following the procedures detailed in EN ISO 10456.

E.2.1.2.2 Determine for each test specimen the mass at (23 ± 2) °C and (50 ± 5)% relative humidity.

Average the values to determine the mass at 23 °C and 50% relative humidity as $m_{23,50}$.

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E.2.1.2.3 Calculate $u_{23,50}$ by the following formula:

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

where,

$m_{23,50}$ is the mass at 23 °C and 50% relative humidity according to E.2.1.2.2;

m_{dry} is the mass according to E.2.1.1.2.

E.2.1.2.4 Determine for each test specimen conditioned according to E.2.1.2.1 the λ value in accordance with EN 12667 or EN 12664 for compound products, at a mean temperature of(10 ± 0.3) °C.

Average the values to determine $\lambda_{10,(23,50)}$.

E.2.1.3 Calculation of the mass-related moisture conversion coefficient ($f_{u,1}$)

The mass-related moisture conversion coefficient $f_{u,1}$ shall be calculated by the following formula (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,

$\lambda_{10,(23,50)}$ is determined according to E.2.1.2.4;

$\lambda_{10,dry}$ is determined according to E.2.1.1.3;

$u_{23,50}$ is determined according to E.2.1.2.3;

u_{dry} is determined according to E.2.1.1.2 and is defined to be 0.

E.3 Determination of the mass-related moisture conversion coefficient ($f_{u,2}$) to high moisture content

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

Set 1

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).

Set 2

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

E.3.1 Procedure

E.3.1.1 Set 1

Determine the $\lambda_{10\,(23,50)}$ and $u_{23,50}$ in accordance with E.2.1.2.

E.3.1.2 Set 2

E.3.1.2.1 Condition the test specimens at (23 ± 2) °C and (80 ± 5)% relative humidity until stabilization at constant weight is achieved, Stabilisation is obtained when the relative change in weight does not exceed 0.5% between two consecutive daily measurements.

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E.3.1.2.2 Determine for each test specimen the mass at (23 ± 2) °C and (80 ± 5)% relative humidity.

Average the values to determine the mass at 23 °C and 80% relative humidity as $m_{23,80}$.

E.3.1.2.3 Calculate $u_{23,80}$ by the following formula:

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

where,

$m_{23,80}$ is the mass at 23 °C and 80% relative humidity according to E.3.1.2.2;

m_{dry} is the mass according to E.2.1.1.2.

E.3.1.2.4 Determine for each test specimen conditioned according E.3.1.2.1 the λ value in accordance with EN 12667 or EN 12664 for compound products, at a mean temperature of (10 ± 0.3) °C.

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

E.3.1.3 Calculation of the mass-related moisture conversion coefficient to high moisture content ($f_{u,2}$)

The mass-related moisture conversion coefficient to high moisture content $f_{u,2}$ shall be calculated by the following formula (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,

$\lambda_{10,(23,80)}$ is determined according to E.3.1.2.4;

$\lambda_{10,(23,50)}$ is determined according to E.2.1.2.4;

$u_{23,80}$ is determined according to E.3.1.2.3.

$u_{23,50}$ is determined according to E.2.1.2.3.

Note 1*: 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.*

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