EUROPEAN ASSESSMENT DOCUMENT

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FACTORY-MADE THERMAL AND/OR ACOUSTIC INSULATION PRODUCTS MADE OF VEGETABLE OR ANIMAL FIBRES

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This European Assessment Document (EAD) has been developed taking into account up-to-date technical and scientific knowledge at the time of issue and is published in accordance with the relevant provisions of Regulation (EU) No 305/2011 as a basis for the preparation and issuing of European Technical Assessments (ETA).

Contents

1 SCOPE OF THE EAD

1.1 Description of the construction product

The construction products consist of vegetable or animal fibres with or without binding agent or supporting/binding fibres, in form of mats or boards, with or without a facing, hereinafter referred to as insulation product.

The insulation product can be treated with a flame retardant.

The vegetable fibres consist of e.g. grass, flax, hemp, jute/sisal, paper or untreated chipped wood. The animal fibres consist e. g of sheep wool.

The binding agents or supporting/binding fibres or additives consist of: mineral binding agent (e.g. cement, lime, siliciumdioxid, etc.), potato starch, whey, sodium carbonate, ammonium phosphate, ammonium sulfate, aluminium hydroxide, ferric oxide, urea, calcium chloride, sodium tetraborate (borax)[1], boric acid[1,2] or disodium octaborate tetrahydrate (polybor)[1] as well as reinforcement fibres made of polyester (e.g. bicomponent fibres), products with facings made of inert materials like metal or glass.

The type(s) of vegetable or animal fibres are to be declared in the ETA.

The nature and the amount of the binding agent and the supporting/binding fibres (e.g. synthetic fibres) are to be declared in the ETA.

The nature of the facing is to be declared in the ETA.

This EAD does not apply to insulation product made of bale of straw.

The ETA will be issued for the product on the basis of the chemical composition and the other agreed data/information which are deposited with the issuing Technical Assessment Body. Modifications should be notified to the Technical Assessment Body bevor the changes are introduced.

The ETA issued on the basis of this EAD is only valid for products which correspond to the a.m. data/information.

The product is not covered by a harmonised European standard (hEN).

Concerning product packaging, transport, storage, maintenance, replacement and repair it is the responsibility of the manufacturer to undertake the appropriate measures and to advise his clients on the transport, storage, maintenance, replacement and repair of the product as he considers necessary.

It is assumed that the product will be installed according to the manufacturer's instructions or (in absence of such instructions) according to the usual practice of the building professionals.

Relevant manufacturer's stipulations having influence on the performance of the product covered by this European Assessment Document, shall be considered for the determination of the performance and detailed in the ETA.

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1 If the substances sodium tetraborate, boric acid or disodium octaborate tetrahydrate are used the insulation product has to be covered to avoid direct contact with the user of the building.

2 Boric acid is an existing biocidal active substance for which a decision for non-inclusion into Annex I or IA of Directive 98/8/EC has been adopted for Product Type 9 (fibre, leather, rubber and polymerised materials preservatives). Therefore the use of boric acid as a biocide active substance is prohibited for such product types according to Article 4(2) of Regulation (EC) No 2031/2003.

1.2 Information on the intended uses of the construction product

1.2.1 Intended uses

- Thermal and/or airborne sound insulation product used for buildings as insulation of walls, ceilings, floors, roofs, between rafters and timber work
- Impact sound insulation product to be used under floating floors inside buildings.

The assessment of the 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.

Concerning the application of the insulation product, the respective national regulations shall be observed.

The design level of the thermal conductivity shall be laid down according to relevant national provisions.

2 ESSENTIAL CHARACTERISTICS AND RELEVANT ASSESSMENT METHODS AND CRITERIA

2.1 Essential characteristics of the product

Table 1 shows how the performance of the insulation product is assessed in relation to the essential characteristics.

Table 1 Essential characteristics of the product and methods and criteria for assessing the performance of the product in relation to those essential characteristics

No	Essential characteristic	Assessment method	Type of expression of product performance *(level, class, description)*
Basic Works Requirement 2: Safety in case of fire			
1	Reaction to fire	See clause 2.2.1	Class
Basic Works Requirement 3: Hygiene, health and the environment			
2	Biological resistance	See clause 2.2.2	See clause 2.2.2
Basic Works Requirement 4: Safety and accessibility in use			
3	Corrosion developing capacity	See clause 2.2.3	See clause 2.2.3 (for specific application only)
Basic Works Requirement 5: Protection against noise			
4	Specific airflow resistivity	See clause 2.2.4	level
5	Dynamic stiffness	See clause 2.2.5	level (for impact sound insulation product only)
6	Impact sound reduction	See clause 2.2.6	level (for impact sound insulation product only)
7	Compressibility	See clause 2.2.7	level (for impact sound insulation product only)
8	Sound absorption	See clause 2.2.8	level (for sound absorption product only; sound absorption index)

No	Essential characteristic	Assessment method	Type of expression of product performance *(level, class, description)*
Basic Works Requirement 6: Energy economy and heat retention			
9	Thermal conductivity	See clause 2.2.9	See clause 2.2.9
10	Water vapour diffusion resistance*)	See clause 2.2.10	level (μ)
11	Water absorption	See clause 2.2.11	level (for specific applications only)
12	Geometry*)	See clause 2.2.12	level, tolerances
13	Density*)	See clause 2.2.13	See clause 2.2.13
14	Flatness after one-sided wetting	See clause 2.2.14	level (for specific applications only)
15	Compressive stress or strength*)	See clause 2.2.15	level (for boards exposed to compression loads only)
16	Dimensional stability*)	See clause 2.2.16	level
17	Deformation under specified compressive load and temperature conditions*)	See clause 2.2.17	level (for boards exposed to compression loads and impact sound insulation product only)
18	Tensile strength (parallel)*)	See clause 2.2.18	See clause 2.2.18
19	Tensile strength (perpendicular)*)	See clause 2.2.19	level (for specific applications only)
20	Tensile strength perpendicular to faces in wet conditions	See clause 2.2.20	level (for specific applications only)
21	Compressive creep*)	See clause 2.2.21	level (for boards exposed to compression loads and impact sound insulation product only)
22	Behaviour under point load*)	See clause 2.2.22	level (for specific applications only)
23	Shear strength and shear modulus of elasticity	See clause 2.2.23	level (for specific applications only)
*) This characteristic also relates to BWR5			

2.2 Methods and criteria for assessing the performance of the product in relation to essential characteristics of the product

For sampling, conditioning and testing (dimensions of the test specimens, minimum number of measurements, specific conditions), EN 13171 shall apply, unless otherwise is specified in the following. The value to be stated for each characteristic has to be representative for the range of density and thicknesses. The test specimens shall be chosen accordingly (number of test specimens, thickness and density of test specimens).

The subject of the references to the required content of the ETA concerning the performance of the product is the method of declaring the product performance. This just applies if the manufacturer wishes to declare such performance.

2.2.1 Reaction to fire

The insulation product is tested, using the test method(s) relevant for the corresponding reaction to fire class, in order to be classified according to EN 13501-1.

For reaction to fire testing the instructions for mounting and fixing according to EN 15715 using the product specific details for wood fibre products (Tables A.40 and A.41) shall be used. In deviation from the standard EN 15715, Table A.40, minimum and maximum thickness of the insulation product shall be tested.

Note: A final European assessment method of glowing combustion behaviour does not yet exist. As soon as an appropriate European assessment method is available the EAD will be amended in this regard.

The product is classified according to EN 13501-1.

2.2.2 Biological resistance

Growth of mould fungus

For animal and vegetable fibres the determination of the growth of mould fungus is carried out according to Annex B.

The growth of mould fungus is stated according to Table 4 of EN ISO 846:1997.

Resistance to attack by vermin

For animal fibres only, the determination of the resistance to attack by vermin (insects, moths, anthrenus) is carried out according to ISO 3998 (short-term test).

In addition to the short-term test according to ISO 3998 a long-term test is carried out according to Annex C.

The lethal rate and the loss of weight due to vermin' attack (eaten away) is determined.

2.2.3 Corrosion developing capacity

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

If such an assessment is not feasible the test according to Annex D is applied. The test results are given in the ETA.

2.2.4 Specific airflow resistivity

The determination of the specific airflow resistivity is carried out according to EN 29053 (ISO 9053), method A.

The airflow resistance is given in the ETA in levels using steps of 1 kPa·s/m².

NOTE: The specific airflow resistivity is determined for quality control reasons to ensure that the acoustic properties (determined by national test methods) of the building elements incorporating vegetable fibres remain the same.

2.2.5 Dynamic stiffness (for impact sound insulation product only)

The determination of dynamic stiffness s´ is carried out according to EN 29052-1.

At least minimum and maximum insulation product thickness shall be tested.

The value s' for different insulation product and different thickness are given in the ETA in levels using steps of 1 MN/m³.

2.2.6 Impact sound reduction (for impact sound insulation product only)

The impact sound reduction ΔL by floating screeds on a heavyweight standard floor using the insulation product is determined according to the relevant parts of EN ISO 10140-1 to 5 (category II).

Using this data the weighted impact sound reduction ΔL_w is calculated according to EN ISO 717-2.

The test shall be performed with the floor build-up representing the worst case for impact sound reduction (e. g. minimum mass per unit area of the floating screed and thinnest insulation layer covered by the ETA). If need be, the tests shall be carried out with several build-ups.

The weighted impact sound reduction ΔL_w (if need be, for different build-ups) is given in the ETA. The assessed floor build-up shall be described in detail in the ETA. It shall be stated clearly to which 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.

2.2.7 Compressibility (for impact sound insulation product only)

The determination of thickness d_L and d_B is carried out 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 value c is stated and shall not be greater than c = 5 mm according to EN 13171.

2.2.8 Sound absorption (sound absorption index)

The determination of the sound absorption coefficient is performed according to EN ISO 354. 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 results for α_p and α_w are rounded to the nearest 0,05 (α_p larger than 1 shall be expressed as $\alpha_p = 1$).

The results for α_p and α_w are given in levels with steps of 0,05.

2.2.9 Thermal conductivity

Lambda fractile at 10 °C, at dry conditions

The determination of the lambda fractile at 10 °C, at dry conditions ($\lambda_{10,dry,90/90}$), representing at least 90 % of the production with a confidence limit of 90 % is carried out in accordance with Annex A, clause 1.

At least 4 measurements shall be performed at a notified testing laboratory.

Mass-related moisture conversion coefficient ($f_{u,1}$)

The mass-related moisture conversion coefficient ($f_{u,1}$) for the conversion of $\lambda_{10,dry}$ to $\lambda_{23,50}$ is determined in accordance with Annex A, clause 2 and stated in the ETA.

Lambda declared at 23 °C and 50 % relative humidity $\lambda_{D(23,50)}$

The calculation of the lambda declared at 23 °C and 50 % relative humidity is carried out in accordance with Annex A, clause 3.

The calculated lambda declared at 23 °C and 50 % relative humidity $\lambda_{D(23,50)}$, representing at least 90 % of the production with a confidence level of 90 %, is stated in the ETA.

Mass-related moisture conversion coefficient to high moisture content ($f_{u,2}$)

The determination of the mass-related moisture conversion coefficient to high moisture content ($f_{u,2}$) is carried out in accordance with Annex A, clause 4.

The mass-related moisture conversion coefficient to high moisture content ($f_{u,2}$), and the moisture content mass by mass (m/m) at 23 °C and 50 % relative humidity and 23 °C and 80 % relative humidity is given in the ETA.

Moisture conversion factor (dry-23/50 and 23/50-23/80)

The moisture conversion factor F_{m1} for the conversion of $\lambda_{10,dry}$ to $\lambda_{23,50}$ and F_{m2} for the conversion of $\lambda_{23/50}$ to $\lambda_{23,80}$ is determined in accordance with EN ISO 10456:2010, equation (4).

For insulation product made of sheep wool the conversion factor $F_{m1} = F_{m2} = 1,02$ can be used without testing.

For insulation product made of hemp, flax, jute and cellulose (made from paper) without mineral binding agent or potato starch the moisture conversion factor $F_{m1} = 1,05$ and $F_{m2} = 1,06$ can be used without testing.

The moisture conversion factors F_{m1} and F_{m2} are given in the ETA.

2.2.10 Water vapour diffusion resistance

The determination of the water vapour transmission is carried out according to EN 12086. The climate condition according to EN 12086:2013, paragraph 7.1 (A or C), used for testing is given in the ETA.

The μ value is stated in the ETA.

In the absence of measurement, the water vapour resistance factor μ of products made of vegetable or animal fibres without mineral binding agent and with a density less than 115 kg/m³ may be assumed to be between 1 and 4.

2.2.11 Water absorption

The determination of short term water absorption by partial immersion is carried out according to EN 1609 method A.

The water absorption in kg/m² is stated in the ETA in levels using steps of 1 kg/m².

2.2.12 Geometry

The determination of length and width is carried out according to EN 822. The determination of thickness is carried out according to EN 823. The load shall be 50 Pa, except for products with a level of compressive stress or compressive strength of 10 kPa or greater (see 2.2.15), where the load shall be 250 Pa.

For boards only: The squareness is carried out according to EN 824, the flatness according to EN 825.

The length is given in the ETA and shall be within the following tolerances: $\pm$ 2 % according to EN 13171 (no upper limit for rolls).

The width is given in the ETA and shall be within the following tolerances: $\pm$ 1,5 % according to EN 13171.

The thickness is given in the ETA. The tolerance on thickness shall be in accordance with Table 1 of EN 13171.

The class of thickness tolerance is stated in the ETA.

For boards only:

The deviation from squareness on length and width of boards, S_b, shall not exceed 5 mm/m according to EN 13171.

The deviation from flatness, S_{max}, shall not exceed 6 mm according to EN 13171.

2.2.13 Density

The determination of density is carried out according to EN 1602.

The density range of the product in relation to its given thermal conductivity λ_D is stated in the ETA.

2.2.14 Flatness after one-sided wetting

The change in deviation from flatness after one-side wetting is determined from measurements of flatness made according to EN 825 before and after conditioning the product in accordance with clause 5.3.3 of EN 13165:2013 with test pieces either a full size product or 1200 mm x 600 mm.

The change in deviation from flatness for each side is stated in the ETA.

2.2.15 Compressive stress or strength

For boards exposed to compression loads, the compressive stress at 10 % deformation, σ_{10}, or the compressive strength, σ_m, is determined according to EN 826 with test with 5 test pieces of 200 mm x 200 mm or 3 test pieces of 300 mm x 300 mm, according to EN 13171:2013, Table 8.

For boards exposed to compression loads, the compressive stress or compressive strength is stated in levels according to Table 3 of EN 13171.

2.2.16 Dimensional stability under specified temperature and humidity

The determination of the dimensional stability under specified temperature and humidity conditions is carried out according to EN 1604. The test is carried out after storage of 48 h at (70 ± 2)°C and/or at (70 ± 2)°C / (90 ± 5)% relative humidity according to EN 13171:2013, Table 2.

The relative change of dimensions in length, $\Delta\varepsilon l$, width, $\Delta\varepsilon b$, and thickness, $\Delta\varepsilon d$, and the levels are stated in in the ETA in accordance with EN 13171:2013, Table 2.

2.2.17 Deformation under specified compressive load and temperature conditions

The determination of the deformation under specified compressive load and temperature conditions is carried out according to EN 1605 with 3 test pieces of 200 mm x 200 mm or 300 mm x 300 mm for test condition 1 (20 kPa / 80 °C) or test condition 2 (40 kPa / 70 °C).

The relative change in thickness, $\Delta\varepsilon d$, is given in the ETA for test condition 1 (20 kPa / 80 °C) or test condition 2 (40 kPa / 70 °C).

2.2.18 Tensile strength parallel (for products not exposed to compression loads)

The determination of tensile strength parallel to faces σ_t is carried out according to EN 1608.

For handling purpose, products shall have a tensile strength parallel to faces of 10 kPa according to EN 13171:2013.

2.2.19 Tensile strength perpendicular to faces

The determination of the tensile strength perpendicular to faces, σ_{mt}, is carried out according to EN 1607 with test with 5 test pieces of 200 mm x 200 mm or 3 test pieces of 300 mm x 300 mm according to EN 13171:2013, Table 8.

The tensile strength perpendicular to faces, σ_{mt}, is declared in the ETA in kPa, according to the levels in Table 4 of EN 13171:2013 or as a minimum measured result.

2.2.20 Tensile strength perpendicular to faces in wet conditions

The tests are performed, using the same number and size of test samples given in clause 2.2.19.

The tensile strength after each conditioning is given in the ETA as a minimum measured result.

2.2.21 Compressive creep

2.2.21.1 Compressive creep for impact sound insulation product:

If the imposed load on the screed is higher than 5 kPa the determination of compressive creep X_{ct} and the total thickness reduction, X_t is carried out according to EN 1606 on 3 test pieces of 200 mm x 200 mm according to EN 13171:2013, Table 8, over a period of at least 122 days of testing with the imposed load plus the self-weight of the screed.

The declared compressive creep X_{ct} and the total thickness reduction, X_t is determined after 122 days of testing and the measured values are extrapolated thirty times, which corresponds to ten years.

2.2.21.2 Compressive creep for boards exposed to compression loads:

The compressive creep, X_{ct}, and the total thickness reduction, X_t, is determined after at least 122 days of testing at the declared compressive stress, σ_c (see 2.2.155), according to EN 1606 with 3 test pieces of 200 mm x 200 mm according to EN 13171:2013, Table 8.

The declared compressive creep X_{ct} and the total thickness reduction, X_t is determined after 122 days of testing and the measured values are extrapolated thirty times, which corresponds to ten years.

2.2.22 Behaviour under point load

The determination of the point load at 5 mm deformation is carried out according to EN 12430.

The point load is declared in levels with steps of 50 N according to EN 13171:2013, paragraph 4.3.6.

2.2.23 Shear strength and shear modulus of elasticity

The determination of the shear strength and shear modulus of elasticity is carried out according to EN 12090. Shear strength and shear modulus of elasticity are given in the ETA.

3 ASSESSMENT AND VERIFICATION OF CONSTANCY OF PERFORMANCE

3.1 Systems of assessment and verification of constancy of performance to be applied

For the products covered by this EAD the applicable European legal act is: Decision 1999/91/EC

The system is: 3.

In addition with regard to reaction to fire the applicable European legal act is: Decision 2001/596/EC for products covered by this EAD.

The system(s) are: 1, 3 or 4.

3.2 Tasks of the manufacturer

The corner stones of the actions to be undertaken by the manufacturer of the insulation product in the procedure of assessment and verification of constancy of performance are laid down in Table 2.

Table 2 Control plan for the manufacturer; corner stones

No	Subject/type of control	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control*
Factory production control (FPC) [including testing of samples taken at the factory in accordance with a prescribed test plan]					
1	Reaction to fire	EN ISO 11925-2	See clause 2.2.1	1	Once a week
		EN 13823 (for class D or higher)			Once a year
2	Biological resistance (growth of mould fungus)	See clause 2.2.2	See clause 2.2.2	See clause 2.2.2	Once a year
3	Airflow resistance	See clause 2.2.4	See clause 2.2.4	See clause 2.2.4	Once a year
4	Dynamic stiffness	See clause 2.2.5	See clause 2.2.5	See clause 2.2.5	Once a month
5	Impact sound reduction	See clause 2.2.6	See clause 2.2.6	See clause 2.2.6	Once a year
6	Compressibility	See clause 2.2.7	See clause 2.2.7	See clause 2.2.7	Once a week
7	Thermal conductivity	See clause 2.2.9	See clause 2.2.9	1	Once a month
8	Water absorption	See clause 2.2.11	See clause 2.2.11	See clause 2.2.11	Quarterly
9	Geometry	See clause 2.2.12	See clause 2.2.12	See clause 2.2.12	Every 4h (flatness: every 8h)
10	Density	See clause 2.2.13	See clause 2.2.13	See clause 2.2.13	Every 4h
11	Compressive stress/strength	See clause 2.2.15	See clause 2.2.15	See clause 2.2.15	Once a week
12	Dimensional stability	See clause 2.2.16	See clause 2.2.16	See clause 2.2.16	Once a year
13	Deformation	See clause 2.2.17	See clause 2.2.17	See clause 2.2.17	Once a year
14	Tensile strength (parallel)	See clause 2.2.18	See clause 2.2.18	See clause 2.2.18	Quarterly
15	Tensile strength perpendicular to faces	See clause 2.2.19	See clause 2.2.19	See clause 2.2.19	Daily
16	Shear strength	See clause 2.2.23	See clause 2.2.23	See clause 2.2.23	Once a month

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

3.3 Tasks of the notified body

The corner stones of the actions to be undertaken by the notified body in the procedure of assessment and verification of constancy of performance for the insulation product are laid down in Table 3.

A notified certification body should be involved only in case of reaction to fire classes A1, A2, B or C if a clearly identifiable stage in the production process results in an improvement of the reaction to fire classification (e.g. an addition of fire retardants or a limiting of organic material).

Table 3 Control plan for the notified body; corner stones

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 *(for system 1 only)*					
Reaction to fire**		Presence of suitable test equipment			Annually
		Presence of trained personnel			Annually
		Presence of an appropriate quality assurance system and necessary stipulations			Annually
Continuous surveillance, assessment and evaluation of factory production control *(for system 1 only)*					
Reaction to fire**		Inspection of factory, of the production of the product and of the facilities for factory production control			Annually
		Evaluation of the documents concerning the factory production control			Annually
		Issuing a report of surveillance			Annually

4 REFERENCE DOCUMENTS

As far as no edition date is given in the list of standards thereafter, the standard in its current version at the time of issuing the European Technical Assessment is of relevance, unless a dated reference is given in clause 2.2 of this EAD.

EN ISO 10140-1 to 5	Acoustics - Laboratory measurement of sound insulation of building elements
EN ISO 354	Acoustic measurement of sound absorption in a reverberation room
EN ISO 717-2	Acoustics - Rating of sound insulation in buildings and of building elements – Part 2: Impact sound insulation
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 ISO 846	Plastics – Evaluation of action of micro organisms
EN 1602	Thermal insulating products for building applications - Determination of the apparent density
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 tensile strength perpendicular to faces
EN 1607	Thermal insulating products for building applications - Determination of compressive creep
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
ISO 3998	Textiles - Determination of resistance to certain insect pests
EN ISO 10456	Building materials and products – Hygrothermal properties – Tabulated design values and procedures for determining declared and design thermal values
EN ISO 11654	Sound absorbers for use in buildings - Rating of sound absorption
EN ISO 11925-2	Reaction to fire tests - Ignitability of products subjected to direct impingement of flame - Part 2: Single-flame source test
EN 12086	Thermal insulating products for building applications - Determination of water vapour transmission properties
EN 12090	Thermal insulating products for building applications - Determination of shear behaviour
EN 12354-2	Building acoustics - Estimation of acoustic performance of buildings from the performance of elements - Part 2: Impact sound insulation between rooms
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 12939	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 13162	Thermal insulation products for buildings - Factory made mineral wool (MW) products – Specification
EN 13165	Thermal insulation products for buildings - Factory made rigid polyurethane foam (PU) products – Specification
EN 13171	Thermal insulation products for buildings - Factory made wood fibre (WF) products - Specification
EN 13501-1	Fire classification of construction products and building elements – Part 1: Classification using test data from reaction to fire tests
EN 13823	Reaction to fire tests for building products – Building products excluding floorings exposed to the thermal attack by a single burning item
EN 15715	Thermal insulation products - Instructions for mounting and fixing for reaction to fire testing - Factory made products
EN 29052-1	Acoustics; determination of dynamics stiffness; part 1: materials used under floating floors in dwellings
EN 29053	Acoustics; materials for acoustical applications; determination of airflow resistance (ISO 9053)

Annex A:

Determination of declared thermal conductivity and the mass-related moisture conversion coefficient to high moisture content

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

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

A.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 (65 ± 2)°C in an oven ventillated with air taken at (23 ± 2)°C and (50 ± 5)% relative humidity.

A 1.1.2 The thermal conductivity of the test specimens conditioned according to A.1.1.1 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.

A.1.2.1 **Calculation of the λ fractile value at 10°C, at dry conditions ($\lambda_{10,dry,90/90}$)**
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 13162:2013, Annex A.

A.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).

A.2.1 Procedure

A.2.1.1 Set 1

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

A.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.

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

A.2.1.2 Set 2

A.2.1.2.1 Condition the test specimens at (23 ± 2)°C and (50 ± 5)% relative humidity following the procedures detailed in EN 13171:2013, clause 5.2, step 2.

A.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 $m_{23,50}$.

A.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 A.2.1.2.2
m_{dry} is the mass according to A.2.1.1.2

A.2.1.2.4 Determine for each test specimen conditioned according to A.2.1.2.1 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 values to determine $\lambda_{10,(23,50)}$.

A.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 10456:2010, 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 A.2.1.2.4;
$\lambda_{10,dry}$ is determined according to A.2.1.1.3;
$u_{23,50}$ is determined according to A.2.1.2.3;
u_{dry} is determined according to A.2.1.1.2 and is defined to be 0.

A.3 Calculation of the declared thermal conductivity λ_D
The declared thermal conductivity λ_D shall be calculated using the following formula:

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

where,
$\lambda_{10,dry,90/90}$ is determined according to A.1.2;
$f_{u,1}$ is determined according to A.2.1.3;
$u_{23,50}$ is determined according to A.2.1.2.3;
u_{dry} is determined according to A.2.1.1.2 and is defined to be 0.

The calculated value $\lambda_{(23/50)}$ shall be rounded upwards to the nearest 0,001W/(m·K) and declared as $\lambda_{D(23,50)}$.

A.4 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).

A.4.1 Procedure
A.4.1.1 Set 1
Determine the $\lambda_{10,(23,50)}$ and $u_{23,50}$ in accordance with A.2.1.2
A.4.1.2 Set 2
A.4.1.2.1 Condition the test specimens at (23 ± 2)°C and (80 ± 5)% relative humidity following the procedures detailed in EN 13171:2013, clause 5.2, step 2.
A.4.1.2.2 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 $m_{23,80}$.

A.4.1.2.3 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 A.4.1.2.2
m_{dry} is the mass according to A.2.1.1.2

A.4.1.2.4 Determine for each test specimen conditioned according A.4.1.2.1 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 values to determine $\lambda_{10,(23,80)}$.

A.4.1.3 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 10456:2010, 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 A.4.1.2.4;
$\lambda_{10,(23,50)}$ is determined according to A.2.1.2;
$u_{23,80}$ is determined according to A.4.1.2.3.
$u_{23,50}$ is determined according to A.2.1.2.

NOTE 1: For the determination of the mass-related moisture conversion coefficient $f_{u,1}$ and the mass-related moisture conversion coefficient 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.

Annex B: Determination of resistance to mould fungus

Resistance to mould fungus

Note: *The determination method is taken from the Austrian Standard ÖNORM B 6010:1998/, clause 3.22.*

B.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.

B.2 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 litres for loose fill materials.
Cage A, for large fibres, with a mesh size of 10 mm x 10 mm and a wire thickness of 0,4 mm.
Cage B, for small fibres, with a mesh size of 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 necessary to avoid any condensation during the exposure period.*

B.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 846:1997, clause 9.1.

B.5 Expression of results

The presence of mould fungus is expressed according to Table 4 of EN ISO 846:1997.

Annex C: Determination of resistance to attack by vermin's

C.1 Principle

Conditioned test specimens and test control specimens are placed in contact with eggs and larvae of selected vermin's for 6 months (maximum).

It is verified whether the protective effect of chemical additives on the wool will kill all vermin's during development of the first generation or prohibit the development of a second generation. Eggs and larvae of clothes moth (Tineola biselliella) as well as carpet beetle (Anthrenus flavipes) are used as test vermin's.

C.2 Specimens

Test specimens
6000 ± 500 mg or at least 200 cm³ of insulation product

Test control specimens
6000 ± 500 mg or at least 200 cm³ of woollen material without chemical additives for improvement of resistance to attack by vermin's

Note*: A test control specimen is used to check that the test has been done correctly and that the test vermin's are viable.*

Only if the effect of the additives is reduced due to evaporation or humidity ageing:

Ageing of test specimens is achieved by storage at humid atmosphere of 70°C and 50% RH for three weeks before testing.

C.3 Conditioning

Conditioning of test specimens and of test control specimens is achieved by storage at a temperature of (27 ± 1)°C and (70 ± 10)% air humidity for 3 days.

C.4 Procedure

Four tests with test specimens and four tests with test control specimens are performed for each test insect at a temperature of (27 ± 1)°C and (70 ± 10)% air humidity.

Each of the specimens shall be placed in a separate glass container (r=5cm, h=8cm) with a metal screw top. The screw top includes a ventilating opening (r=0,5 cm, covered with gauze).

On each of the specimens the following number of insects shall be placed:

larvae of clothes moth (Tineola biselliella)	20
larvae of carpet beetle (Anthrenus flavipes)	20
eggs of clothes moth (Tineola biselliella)	30
carpet beetle (Anthrenus flavipes)	20 adult beetles for laying eggs, after 14 days the beetles are removed

Each test is performed for 6 months (maximum) or until death of the larvae.
If more than 20% of the insects at the test control specimens die, the test is invalid.

C.5 Expression of the results

The test is passed if no adult vermins (beetles or moths) develop from the eggs.
The damage caused by the vermins is to be stated.

Annex D: Determination of metal corrosion developing capacity

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

Method of test for corrosivity

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

NOTE: Product 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.

D.2 Reagents and materials

D.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.

D.2.2 Trichloroethylene, of analytical reagent quality.

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

D.2.3 Sulphuric acid, (C) H_2SO_4 = 0.5 mol/l to 1 mol/l.

D.2.4 Saturated ammonium acetate solution.

D.3 Apparatus

D.3.1 Humidity chamber maintained at 40 $\pm$ 2 °C and 90 % to 95 % RH.

D.3.2 Four cylindrical glass crystallising dishes, well washed, nominally 90 mm in diameter and 50 mm deep.

D.3.3 Rubber or PVC gloves.

D.3.4 Stainless steel spatula.

D.3.5 Tweezers.

D.4 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 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 $\pm$ 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 perforations within 3 mm of the edge of a coupon and note only those perforations within the remaining central zone.