EUROPEAN ASSESSMENT DOCUMENT

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IN-SITU LOOSE FILL THERMAL AND/OR ACOUSTIC INSULATING PRODUCTS MADE OF VEGETABLE FIBRES TO BE USED IN FLOOR CONSTRUCTIONS WITHOUT ADDITIONAL LOAD-BEARING STRUCTURES

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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 in-situ loose-fill thermal and/or acoustic insulating product made of vegetable fibres to be used in floor constructions without additional load-bearing structures is an insulation product consisting of vegetable fibres with or without a binding agent, supplied as loose fill insulation for manual or mechanical installation in floor constructions, hereinafter referred to as “insulating product”.

The insulating product is placed between the bearing structure and the (dry) screed of the floor and contributes to the distribution of the load that the floor has to support.

The vegetable fibres consist for example of hemp shives or fibres, recycled and/or pelletized paper or untreated chipped wood. The type(s) of vegetable fibres are to be stated in the ETA. The nature and the amount of the binding agent and additives are to be stated in the ETA.

The insulating product may be treated with a flame retardant.

The ETA will be issued for the product on the basis of agreed data/information, deposited with the Technical Assessment Body, which identifies the product that has been assessed.

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

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

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

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

1.2 Information on the intended use(s) of the construction product

1.2.1 Intended use(s)

In-situ formed thermal insulation material and/or acoustic insulation material to be used in floor constructions, supplied as loose fill for manual or mechanical installation.

The loose-fill material is intended to be used as an insulation without additional load-bearing structures within the insulation layer, see the following example image:

Figure 1: Example of application of the insulating product under dry screed panels

The load-bearing function is not intended to ensure the mechanical strength and stability of the building.

The assessment of the insulating product only applies if the product is used in structures where it will not be exposed to precipitation, wetting or weathering and for construction elements with no contact to water and soil or in constructions with no risk that the critical moisture content will be exceeded.

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 insulating product for the intended use of 50 years when installed in the works provided that the insulating 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 product the intended use as foreseen by the manufacturer shall be taken into account. The real working life may be, in normal use conditions, considerably longer without major degradation affecting the basic requirements for works[1].

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

1 The real working life of a product incorporated in a specific works depends on the environmental conditions to which that works is subject, as well as on the particular conditions of the design, execution, use and maintenance of that works. Therefore, it cannot be excluded that in certain cases the real working life of the product may also be shorter than referred to above.

2 ESSENTIAL CHARACTERISTICS AND RELEVANT ASSESSMENT METHODS AND CRITERIA

All undated references to standards or to EAD's in this EAD are to be understood as references to the dated versions listed in clause 4.

2.1 Essential characteristics of the product

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

Table 2.1.1 Essential characteristics of the product and methods and criteria for assessing the performance of the product in relation to those essential characteristics

No	Essential characteristic	Assessment method	Type of expression of product performance
Basic Works Requirement 2: Safety in case of fire			
1a	Reaction to fire	2.2.1.1	Class
1b	Propensity to undergo continuous smouldering	2.2.1.2	Description
Basic Works Requirement 3: Hygiene, health and the environment			
2	Biological resistance	2.2.2	Class
Basic Works Requirement 4: Safety and accessibility in use			
3	Compressive stress or strength	2.2.3	Level
4	Deformation under specified compressive load and temperature conditions	2.2.4	Level
5	Compressive creep*	2.2.5	Level
6	Dynamic stiffness	2.2.6	Level
7	Corrosion developing capacity	2.2.7	Level, class, description
Basic Works Requirement 5: Protection against noise			
8	Impact sound reduction	2.2.8	Level
9	Thickness and compressibility	2.2.9	Level
10	Specific airflow resistance	2.2.10	Level
Basic Works Requirement 6: Energy economy and heat retention			
11	Thermal conductivity	2.2.11	Level
12	Water vapour diffusion resistance	2.2.12	Level
13	Water absorption	2.2.13	Level
14	Density	2.2.14	Level
15	Hygroscopic sorption properties	2.2.15	Level, description
16	Retention of additives	2.2.16	Level

* This characteristic also relates to BWR 5

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 Safety in case of fire

2.2.1.1 Reaction to fire

The insulating product shall be tested according to EN ISO 11925-2 and classified according to EN 13501-1 and Delegated Regulation (EU) 2016/364.

Provisions for the arrangement of the specimens (mounting and fixing) for the reaction to fire tests as well as for the extended application of test results are given in Annex E of the EAD.

2.2.1.2 Propensity to undergo continuous smouldering

The performance of the insulating product propensity to undergo continuous smouldering 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 F of the EAD.

The results of the tests shall be expressed and stated in the ETA in accordance with clause 11 of EN 16733.

2.2.2 Biological resistance

The assessment of the growth of mould fungus shall be carried out according to Annex B of the EAD.

2.2.3 Compressive stress or strength

The compressive stress at 10 % deformation, σ_{10}, or the compressive strength, σ_m, is assessed according to EN 826 with 5 test pieces of 200 mm x 200 mm or 3 test pieces of 300 mm x 300 mm.

The tests shall be carried out in dimensionally stable square test frames. The filling heights and the degree of compression shall be according to the characteristics of the insulating product at built-in state.

2.2.4 Deformation under specified compressive load and temperature conditions

The deformation under specified compressive load and temperature conditions shall be assessed with the number of test pieces according to EN 1605 for test condition 1 (20 kPa / 80°C / 48h).

The tests shall be carried out in dimensionally stable square test frames with the clear dimensions of 200 mm x 200 mm. The filling heights and the degree of compression shall be according to the characteristics of the product at built-in state.

NOTE: The test condition is the preferred one. Depending on the special case other test conditions can be used. The test condition shall be indicated in the ETA.

2.2.5 Compressive creep

The compressive creep and the total thickness reduction shall be assessed after at least 122 days of testing at three different compressive stresses according to EN 1606, clause 7.1 with test pieces of 200 mm x

200 mm or 300 mm x 300 mm, according to EN 1606, clause 6.1 and depending on which size was used for the compressive stress test according to EN 826.

The test specimens shall also be taken from the same specimen with the same preparation as the specimens used for the compression test according to EN 826.

The tests shall be carried out in dimensionally stable square test frames. The filling heights and the degree of compression shall be according to the characteristics of the insulating product at built-in state.

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

Compressive creep X_{ct} and the total thickness reduction X_t shall be stated in the ETA.

2.2.6 Dynamic stiffness (for impact sound insulation product only)

The dynamic stiffness s' shall be assessed according to EN 29052-1. Minimum and maximum insulation material thickness shall be at least tested.

The tests shall be carried out in dimensionally stable square test frames with the clear dimensions of 200 mm x 200 mm. The filling heights and the degree of compression shall be according to the characteristics of the insulating product at built-in state.

The dynamic stiffness and the used test conditions (such as thickness, compression) are given in the ETA.

2.2.7 Corrosion developing capacity

The corrosion developing capacity on metal construction products shall be assessed on the basis of the composition of the insulating product including additives.

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

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

The impact sound reduction ΔL on a heavyweight standard floor using the insulating product is assessed according to EN ISO 10140-1, EN ISO 10140-3, EN ISO 10140-4 and EN ISO 10140-5 as appropriate using the provisions of category II according to Annex H, clause H.2.2.2 of EN ISO 10140-1.

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 (such as minimum mass per unit area of the floating screed and thinnest insulation thickness covered by the ETA.) If necessary, the tests shall be carried out with several build-ups.

The weighted impact sound reduction ΔL_w (if necessary, 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 stated impact sound reduction applies. In particular the minimum mass per unit area of the screed shall be given in the ETA.

2.2.9 Thickness and compressibility (for impact sound insulation only)

The thickness d_L and d_B is assessed according to EN 12431 with maximum insulating product thickness and a pause of 120 s before measuring d_B.

The tests shall be carried out in dimensionally stable square test frames with the clear dimensions of 200 mm x 200 mm or 300 mm x 300 mm. The filling heights and the degree of compaction shall be according to the characteristics of the product at built-in state.

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.

2.2.10 Specific airflow resistance (for airborne sound insulation material only)

The specific airflow resistance shall be assessed out according to EN ISO 9053-1.

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

2.2.11 Thermal conductivity

Lambda fractile value at 10 °C, at dry conditions

The lambda 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 assessed in accordance with Annex A, clause A.1 of the EAD. At least 4 measurements shall be performed.

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 $\lambda_{23,50}$ shall be assessed according to Annex A, clause A.2 of the EAD 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 shall be carried out in accordance with Annex A, clause A.3 of the EAD.

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 %, shall be stated in the ETA.

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 assessed in accordance with Annex A, clause A.4 of the EAD.

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 shall be 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 $\lambda_{23,80}$ shall be assessed in accordance with EN ISO 10456, equation (4).

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

2.2.12 Water vapour diffusion resistance

The water vapour transmission shall be assessed according to EN 12086. The climate condition according to EN 12086, clause 7.1 (A or C), used for testing shall be given in the ETA.

The water vapour resistance factor μ shall be stated in the ETA.

2.2.13 Water absorption

The short-term water absorption by partial immersion shall be assessed according to EN 1609 method A.

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

2.2.14 Density

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

The bulk density is given in the ETA.

2.2.15 Hygroscopic sorption properties

The hygroscopic sorption properties shall be carried out according to EN ISO 12571 for the standard humidity nr. 2 to 6 according to table 1 of EN ISO 12571.

The hygroscopic sorption and desorption curves shall be given in the ETA.

2.2.16 Retention of additives

The retention of chemical additives on the surface of the fibres shall be assessed according to Annex D of the EAD.

The weight percentage of dust left on the black foil shall be given in the ETA.

3 ASSESSMENT AND VERIFICATION OF CONSTANCY OF PERFORMANCE

3.1 System(s) of assessment and verification of constancy of performance to be applied

For the insulating 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 (including propensity to undergo continuous smouldering) the applicable European legal act is: Decision 1999/91/EC as amended (Decision 2001/596/EC) the system(s) are 1, 3 or 4.

3.2 Tasks of the manufacturer

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

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
Factory production control (FPC) [including testing of samples taken at the factory in accordance with a prescribed test plan]					
1a	Reaction to fire	EN ISO 11925-2	Control Plan	1	Once a week
1b	Propensity to undergo continuous smouldering	EN 16733	Control Plan	1	Once a year
2	Specific airflow resistance	2.2.10	Control Plan	Control Plan	Once a year
3	Biological resistance	2.2.2	Control Plan	Control Plan	Once a year
4	Impact sound reduction	2.2.8	Control Plan	Control Plan	Once a year
5	Thickness and compressibility	2.2.9	Control Plan	Control Plan	Once a week
5	Thermal conductivity	2.2.11	Control Plan	Control Plan	Once a month
6	Water absorption	2.2.13	Control Plan	Control Plan	Once a month
7	Density	2.2.14	Control Plan	Control Plan	Daily
8	Compressive stress or strength	2.2.3	Control Plan	Control Plan	Once a week
9	Deformation under specific compressive load and temperature conditions	2.2.4	Control Plan	Control Plan	Once a year
10	Dynamic stiffness	2.2.6	Control Plan	Control Plan	Once a month
11	Hygroscopic sorption properties	2.2.15	Control Plan	3	Once a year

3.3 Tasks of the notified body

The cornerstones of the actions to be undertaken by the notified body of the product in the procedure of assessment and verification of constancy of performance are laid down in Table 3.3.1.

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 *(for systems 1 only)*					
1	The notified body shall verify the ability of the manufacturer for a continuous and orderly manufacturing of the product according to the European Technical Assessment. In particular the following items shall be appropriately considered - Personnel and equipment - The suitability of the factory production control established by the manufacturer - Full implementation of the prescribed test plan	-	Control plan	-	When starting the production or a new line
2	Basic Work Requirement 2 – Safety in case of fire: - Presence of suitable test equipment - Presence of trained personnel - Presence of an appropriate quality assurance system and necessary stipulations	Clauses 2.2.1.1 and 2.2.1.2	Control plan	-	When starting the production or a new line
Continuous surveillance, assessment and evaluation of factory production control *(for systems 1 only)*					
3	Basic Work Requirement 2 – Safety in case of fire: - Inspection of factory, of the production of the product and of the facilities for factory production control - Evaluation of the documents concerning factory production control - Issuing a report of surveillance	Clauses 2.2.1.1 and 2.2.1.2	Control plan	-	Once a year

4 REFERENCE DOCUMENTS

EN ISO 717-2:2013 Acoustics – Rating of sound insulation in buildings and of building elements – Part 2: Impact sound insulation

EN 826:2013 Thermal insulating products for building applications – Determination of compression behaviour

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 load and temperature conditions

EN 1606:2013 Thermal insulating products for building applications – Determination of compressive creep

EN 1609:2013 Thermal insulating products for building applications – Determination of short term water absorption by partial immersion

EN ISO 10140-1:2016 Acoustics – Laboratory measurement of sound insulation of building elements – Part 1: Application rules for specific products

EN ISO 10140-2:2010 Acoustics – Laboratory measurement of sound insulation of building elements – Part 2: Measurement of airborne sound insulation

EN ISO 10140-3:2015 Acoustics – Laboratory measurement of sound insulation of building elements – Part 3: Measurement of impact sound insulation (ISO 10140-3:2010 + Amd. 1:2015)

EN ISO 10140-4:2010 Acoustics – Laboratory measurement of sound insulation of building elements – Part 4: Measurement procedures and requirements (ISO 10140-4:2010)

EN ISO 10140-5:2014 Acoustics – Laboratory measurement of sound insulation of building elements – Part 5: Requirements for test facilities and equipment (ISO 10140-5:2010 + Amd.1:2014)

EN ISO 10456:2010 Building materials and products – Hygrothermal properties – Tabulated design values and procedures for determining declared and design thermal values

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 12086:2013 Thermal insulating products for building applications – Determination of water vapour transmission properties

EN 12431:2013 Thermal insulating products for building applications – Determination of thickness for floating floor insulating products

EN ISO 12571:2013 Hygrothermal performance of building materials and products – Determination of hygroscopic sorption properties

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 13171:2012+A1:2015 Thermal insulation products for buildings – Factory made wood fibre (WF) products – Specification

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

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 9053-1:2018 Acoustics – Determination of airflow resistance – Part 1: Static airflow method

EN ISO 846:2019 Plastics – Evaluation of the action of microorganisms

ANNEX A – ASSESSMENT OF THE 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 ventilated 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 Calculation of the λ fractile value at 10 °C, at dry conditions ($\lambda_{10,dry,90/90}$)

A.1.2.1 The λ 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 % shall be calculated using the example in EN ISO 10456, Annex C. It shall be noted that the λ_D shall be calculated in accordance with A.3.

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, 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 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 factor 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 – ASSESSMENT OF RESISTANCE TO MOULD FUNGUS[2]

Resistance to mould fungus

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 cage of wire according to B.2.2.

B.2.2 Cage made of stainless steel with an internal volume of approximately 0,05 litres.

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 Sample preparation for loose fill materials

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

Care shall be taken that the density in the cage is the stated bulk density.

B.5 Procedure

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

B.6 Expression of results

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

2 Test method is based on the Austrian Standard ÖNORM B 6010, clause 3.22.

ANNEX C – ASSESSMENT OF METAL CORROSION DEVELOPING CAPACITY[3]

C.1 Principle

This test shows 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 (such as 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.

C.2 Reagents and materials

C.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 coil incandescent light bulb.

C.2.2 Trichloroethylene, of analytical reagent quality.

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

C.2.3 Sulphuric acid, (C) H2SO4 = 0.5 mol/l to 1 mol/l.

C.2.4 Saturated ammonium acetate solution.

C.3 Apparatus

C.3.1 Humidity chamber maintained at 40 + 2 °C and 90 % to 95 % RH.

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

C.3.3 Rubber or PVC gloves.

C.3.4 Stainless steel spatula.

C.3.5 Tweezers.

C.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 shall 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.

3 Test method is based on the British Standard BS 5803 Part 3:1985 Appendix B

(b) Transfer approximately half of one sample of the saturated fibrous insulation, using gloved hands and a clean stainless spatula, to one of the crystallising dishes and tamp level such that a layer of 10 mm to 15 mm thickness is formed. Place one of the metal coupons horizontally on this layer by introducing one end at a slight angle to the saturated material, progressively pressing the remainder of the coupon gently down and shaking the dish slightly, in such a way that all air bubbles are expelled from the underside of the coupon. If necessary, gently tamp the saturated layer and coupon level again.

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

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

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

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

(d) Leave the test assemblies undisturbed in the humidity chamber for 336 + 4 h (14 days), except for brief and occasional opening of the chamber for visual inspection or the introduction of other test assemblies. If, as a result of a visual inspection, it is found that a detectable drying of the surface of a composite test assembly has occurred, the minimum quantity of distilled or deionized water necessary to restore the original condition may be sprayed onto that surface, and a check made on the functioning of the chamber.

(e) Upon completion of the test period, take the metal coupons from the assemblies and remove loose corrosion products by immersion for not longer than 30 s, as follows:

i. copper coupons in sulphuric acid at room temperature,

ii. zinc coupons in saturated ammonium acetate solution at room temperature.

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

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

ANNEX D – TEST OF RETENTION OF CHEMICAL ADDITIVES ON FIBRES (HANDLING TEST)

NOTE: The retention of chemical additives on fibres is tested with regard to maintain the
− safety in case of fire (see clause 2.2.1 of EAD),
− biological resistance (see clause 2.2.2 of EAD).

The dry material is placed on a black foil in an open box of clear dimensions of 0,55 m x 0,55 m x 0,33 m (volume = 0,10 m^3).

The box is then tilted at one edge by 10 cm and released so that it falls back from this height to the (hard) ground. The test is repeated alternatively 10 times each at two opposite edges.

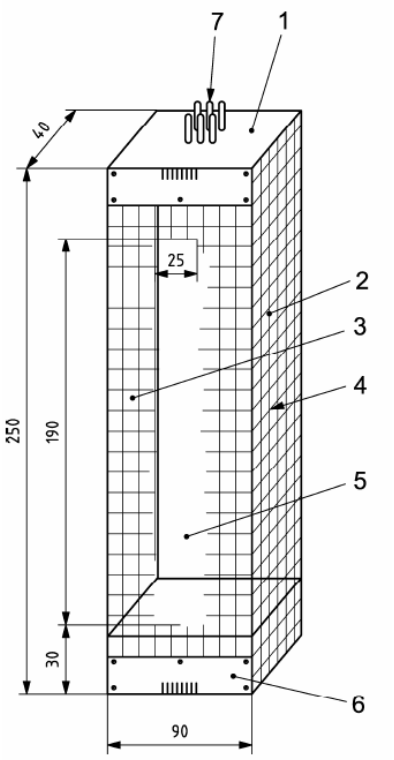
Then the material is taken off the box and tested in accordance with clause 2.2.1 and 2.2.2 of the EAD.

The result is compared to the result obtained with the specimen not subjected to this procedure. The weight percentage of dust eventually left on the black foil after the test shall be assessed.

ANNEX E – REACTION TO FIRE TESTS

E.1 Mounting and fixing of loose fill material in the EN ISO 11925-2 test configuration

- A sample holder as shown below shall be used.
- When making the samples the surface shall be as even as possible.
- Only for such materials which fall from the opening in such a way that hollow spaces inside the sample holder develop the harp-like stringing consisting of 11 rows at intervals of 0,2 mm wire shall be used.
- If the material is a mixture of various grain sizes the dropping out of smaller particles from the open central surface does not suffice to justify the use of the harp.
- It is deemed sufficient to carry out the tests with a surface flame attack. Edge flame attack tests do not seem to be necessary.



1) small hardwood blocks, 90 mm x 40 mm x 25 mm (beech or oak)

2) back panel (not shown) door as filling hole

3) side panel (not shown)

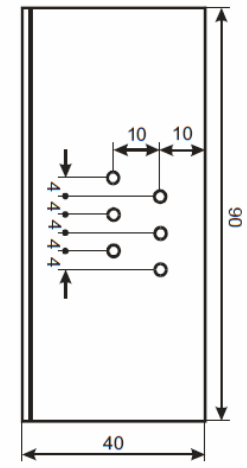
4) wire mesh, zinc-coated width of mesh from 5,5 to 9,1 mm and wire size (1 ± 0,2) mm

5) flame attack opening 190 mm x 25 mm resistance wire is used as bracing wire, diameter 0,2 mm; 15,6 ohm/m

6) screwed on sheet metal, 16 mm x 1,4 mm with 11 guide notches at top and bottom, spaced at intervals of 2 mm

7) metal pins for wire mesh fixing

Top view



E.2 Extended application of results of reaction to fire tests

For the extended application of test results the provisions of the following table shall apply.

Product parameters	**Test method according EN ISO 11925-2 and validity of test results**
Thickness	For any thickness
Bulk density	The result is valid for the tested bulk density ±10 %. or The result is valid for the range between tested highest and lowest bulk density.
Composition	For the tested composition only.
Substrate	For any substrates in end-use

ANNEX F – PROPENSITY TO UNDERGO CONTINUOUS SMOULDERING

For the assessment of propensity to undergo continuous smouldering of in-situ loose-fill insulation products by tests according to EN 16733, the following conditions and parameters shall be considered within the tests:

- the product type[4] of the insulating product (type of fibres, type of binder and additives/treatment, type of production process etc.)
- highest as well as lowest bulk density (assessment of the bulk density shall be in accordance with EN 1097-3)

At least one test shall be performed on specimen taking into account each relevant parameter. And with the most onerous specimen configuration the tests shall be repeated as often as prescribed to obtain the number of tests needed for assessment.

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 about 100 mm) without consideration of the intended end-use conditions.

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

- of the same chemical composition,
- with any bulk densities between those evaluated
- with any thickness,
- for any end-use conditions.

4 To permit the TAB to draft EXAP-rules, the manufacturer shall provide sufficient information (e. g. on the basis of the composition of the products in question), allowing the TAB to determine which products or product variants shall be submitted to testing.