



EUROPEAN ASSESSMENT DOCUMENT

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IN-SITU FORMED LOOSE FILL THERMAL AND/OR ACOUSTIC INSULATION PRODUCTS MADE OF VEGETABLE 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).

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1 SCOPE OF THE EAD

1.1 Description of the construction product

The construction product consists of vegetable fibres with or without a binding agent, supplied as in-situ formed loose fill vegetable fibres for manual or mechanical installation, hereinafter referred to as thermal insulation product.

Any vegetable fibres like e.g. grass, flax, hemp, jute/sisal, paper, recycled paper, cotton fibres or untreated chipped wood are considered under the scope of this EAD. 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 products may be treated with a flame retardant.

The product is not covered by a harmonised European standard (hEN). Products according to this EAD are not fully covered by EAD 040138-00-1201 due to changes in the scope: inclusion of cotton fibres and revision of the text referred to the binding agents and additives. In addition, changes due to legal amendments and EC comments have been introduced in this EAD when relevant. In comparison to EAD 040138-00-1201 the following clauses have been modified: section 1.1, section 2.2, section 2.2.1 to section 2.2.6, section 2.2.9, section 3.1 (elimination of the reference to the Decision 2001/596/EC), section 3.2, section 4 and annex A.

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)

Thermal and/or acoustic insulation product, to be used in cavities of roofs, walls and floors, between rafters and timber work, supplied as loose fill for manual or mechanical installation.

The assessment of the insulation product only applies if the product is used in structures where it will not be exposed to compression loads, 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.

In case of thermal insulation products with the substances sodium tetraborate, boric acid or disodium octaborate tetrahydrate the thermal insulation product is covered to avoid direct contact with the user of the building.

1.2.2 Working life/Durability

The assessment methods included or referred to in this EAD have been written based on the manufacturer's request to take into account a working life of the thermal insulation product for the intended use of 50 years when installed in the works provided that the thermal 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 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 works¹.

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

2.1 Essential characteristics of the product

Table 1 shows how the performance of thermal 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
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 2.2.5	See clause 2.2.5
Basic Works Requirement 5: Protection against noise			
3	Sound absorption	See clause 2.2.2	Level (for sound absorption product only; sound absorption index)
Basic Works Requirement 6: Energy economy and heat retention			
4	Thermal conductivity	See clause 2.2.3	Level
5	Water vapour diffusion resistance	See clause 2.2.4	Level (μ)
6	Water absorption	See clause 2.2.6	Level (for specific applications only)
7	Corrosion developing capacity	See clause 2.2.7	Level, class, description
8	Settlement / density	See clause 2.2.8	Level
9	Critical moisture content	See clause 2.2.9	Level
10	Specific airflow resistivity*	See clause 2.2.10	Level
11	Hygroscopic sorption properties	See clause 2.2.11	Level, description

* 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

For sampling, conditioning and testing (dimensions of the test specimens, minimum number of measurements, specific conditions), EN 15101-1:2013 shall apply.

2.2.1 Reaction to fire

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

For testing purposes the provisions of EN 15101, Annex C (except clause C.1.4.7 and tables C.3 and C.4) shall apply. As substrate for the SBI tests only standard substrates as defined in EN 13238 shall be used.

For the extended application of test results the provisions of EN 15715, tables A.40 and A.41 concerning wood fibre insulation products shall apply, except the rules regarding air gaps, joints and facings, because they are not relevant for in-situ formed loose-fill insulation products.

2.2.2 Sound absorption

The determination of the sound absorption coefficient shall be tested in accordance with section 4.3.9 of EN 15101-1:2013.

The test results and the assessment shall be expressed in accordance with section 4.3.9 of EN 15101-1:2013.

2.2.3 Thermal conductivity

Thermal conductivity

The thermal conductivity shall be determined in accordance with Annex A.

The calculated thermal conductivity $\lambda_{D(23,50)}$ shall be stated in the ETA in accordance with the principles of EN 15101-1:2013, clause 4.2.1.

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 determined according to Annex A, clause 2 and 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 ($f_{u,2}$) shall be 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 shall be stated 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 determined in accordance with EN ISO 10456:2010, equation (4).

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} shall be given in the ETA

2.2.4 Water vapour diffusion resistance

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

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

In the absence of measurement, the water vapour resistance factor μ of products made of vegetable fibres without mineral binding agent and with a density less than 115 kg/m³ may be assumed to be between 1 and 4. It shall be stated in the ETA that the most unfavourable factor μ depending on construction has to be used for calculation.

2.2.5 Biological resistance

The determination of the growth of mould fungus shall be carried out according to method A and/or method B (method B will be preferably used):

Method A:

The determination and the expression of results are performed according to Annex B of this EAD.

Method B:

The determination is performed according to EN 15101-1:2013, Annex F.

The results are expressed according to Table 5 of EN 15101-1:2013.

It shall be stated clearly in the ETA to which method the given results apply.

2.2.6 Water absorption

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

The water absorption in kg/m² shall be stated in the ETA.

2.2.7 Corrosion developing capacity

The corrosion developing capacity on metal construction products shall be assessed according to EN 15101-1:2013, Annex E.

The test result shall be given following EN 15101-1, clause 4.3.5.

2.2.8 Settlement

The settlement depends on the density of the product, the thickness or height of the in-situ formed insulation and the application. Therefore, the settlement should be assessed for different densities, at different thicknesses or heights covering the intended use conditions.

2.2.8.1 Settling of loose fill insulation applied in ceilings

a) Free placing

In the case of free placing (e. g. on the ceiling or between beams) the characteristics shall be determined following EN 15101-1:2013, Annex B3. Deviating from EN 15101-1:2013 the test shall be performed with 3 test specimens stored at (23 ± 2) °C and (50 ± 5) % relative humidity (without conditioning at 40 °C/90 % R.H.). The density of the specimens shall approximately correspond to the minimum density covering in the ETA.

The settling s_v , of the loose fill insulation shall be stated in the ETA together with the minimum installation density and the maximum thickness to be observed. Equation B.6 of EN 15101-1:2013 is used for calculation.

b) Blowing into closed cavities

In the case of subsequent blowing into closed cavities, the characteristics shall be determined according to a). But in this case the insulation material is blown into a closed box.

The settling s_v , of the loose fill insulation shall be stated in the ETA together with the minimum installation density and the maximum thickness to be observed.

2.2.8.2 Settling of loose fill insulation applied in cavities of walls and between rafters

The determination of settlement s_d shall be carried out according to EN 15101:2013, Annex B2. The density of the specimens shall approximately correspond to the minimum density covering by the ETA.

The settling s_d shall be given in the ETA using the class according to EN 15101-1:2013, Table 2, together with the minimum installation density and the maximum thickness to be observed.

2.2.8.3 Settling of loose fill insulation under impact excitation and constant temperature and humidity conditions

The determination of settlement s_D shall be carried out according EN 15101:2013, Annex B3, with specimens representing the density range covered by the ETA.

The settling s_D shall be given in the ETA. The indication of settling s_D is not required if the settling S_{cyc} according to the following clause is given in the ETA.

2.2.8.4 Settling under cyclical temperature and cyclic humidity

The determination of settlement shall be carried out according to EN 15101:2013, Annex B1.

The settling S_{cyc} shall be given in the ETA using the classes according to EN 15101-1:2013, Table 1.

2.2.8.5 Calculating the thermal resistance

The ETA shall include a provision that in case of free placing (e.g. on the ceiling or between beams) a reduced insulation layer thickness for calculating the thermal resistance is to be determined from the installation thickness taking account the settlement.

For this purpose the reduction value in %, determined from the highest value of settlement rounded upwards to the nearest one percent, shall be given in the ETA based on the test results according to 2.2.8.1, 2.2.8.3 and/or 2.2.8.4.

2.2.9 Critical moisture content

The determination of the critical moisture content (the critical moisture level for mould growth on building materials) shall be carried out in accordance with the test method cited in the Swedish Regulation (see section 6:52 of the *Boverket's building regulations- mandatory provisions and general recommendations, BBR. BFS 2011:6 with amendments up to BFS 2016:6*). In absence of calculation, a value of 75 % RH shall be stated as the critical moisture content.

NOTE: The critical moisture content is required according to the Swedish building regulations.

The critical moisture content shall be stated in the ETA.

2.2.10 Specific airflow resistivity

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

The airflow resistance shall be 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.

2.2.11 Hygroscopic sorption properties

The hygroscopic sorption properties shall be carried out according to EN ISO 12571:2013 for the standard humidities nr. 2 to 6 according to table 1 of EN ISO 12571:2013.

The hygroscopic sorption and desorption curves and the method used 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 products covered by this EAD the applicable European legal act is: Decision 1999/91/EC(EU).

The system is: 3 for any use except for uses subject to regulations on reaction to fire.

For uses subject to regulations on reaction to fire the applicable AVCP systems are 1, 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 product in the procedure of assessment and verification of constancy of performance are laid down in Table 2.

Table 2: Control plan for the manufacturer; cornerstones.

No	Subject/type of control		Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control *
Factory production control (FPC) [including testing of samples taken at the factory in accordance with a prescribed test plan]						
1	Reaction to fire		EN ISO 11925-2	Manufacturer's Control Plan	1	Once a week
			EN 13823 (for class D or higher)			Once a year
2	Biological resistance (growth of mould fungus)		See clause 2.2.5.	Manufacturer's Control Plan	Manufacturer's Control Plan	Once a year
3	Specific airflow resistivity		See clause 2.2.10	Manufacturer's Control Plan	Manufacturer's Control Plan	Once a year
4	Thermal conductivity		See clause 2.2.3	Manufacturer's Control Plan	1	Once a month
5	Water absorption		See clause 2.2.6	Manufacturer's Control Plan	Manufacturer's Control Plan	Quarterly
6	Settlement	Method acc. to clause 2.2.8.1	See clause 2.2.8.1	Manufacturer's Control Plan	Manufacturer's Control Plan	Twice a week
		Method acc. to Annex B1 or B3, EN 15101-1	See clause 2.2.8.4 or 2.2.8.3	Manufacturer's Control Plan	Manufacturer's Control Plan	Semi-yearly
7	Bulk density		See clause 2.2.8.1	Manufacturer's Control Plan	Manufacturer's Control Plan	Twice a week
8	Hygroscopic sorption properties		See clause 2.2.11	Manufacturer's Control Plan	3	Once a year

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

3.3 Tasks of the notified body

The cornerstones of the actions to be undertaken by the notified body in the procedure of assessment and verification of constancy of performance are laid down in Table 3.

Table 3: Control plan for the notified body; cornerstones.

No	Subject/type of control	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control
Initial inspection of the manufacturing plant and of factory production control <i>(for systems 1 only)</i>					
1	Reaction to fire**	Presence of suitable test equipment			When starting the production
		Presence of trained personnel			
		Presence of an appropriate quality assurance system and necessary stipulations			
Continuous surveillance, assessment and evaluation of factory production control <i>(for systems 1 only)</i>					
2	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

** Only relevant for products of class C and higher.

Note: The actions of the notified body will be focused in all the aspects that have relation with the ensuring of the declared class of reaction to fire (stages where fire retardants are added, factory production test related with reaction to fire, etc.)”.

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 1609	Thermal insulating products for building applications - Determination of short term water absorption by partial immersion
EN ISO 10456	Building materials and products – Hygrothermal properties – Tabulated design values and procedures for determining declared and design thermal values
EN ISO 11925-2	Reaction to fire tests - Ignitability of products subjected to direct impingement of flame - Part 2: Single-flame source test
EN 12086:2013	Thermal insulating products for building applications - Determination of water vapour transmission properties
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 ISO 12571:2013	Hygrothermal performance of building materials and products - Determination of hygroscopic sorption properties
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 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 15101-1:2013	Thermal insulation products for buildings - In-situ formed loose fill cellulose (LFCI) products - Part 1: Specification for the products before installation;
EN 15715	Thermal insulation products - Instructions for mounting and fixing for reaction to fire testing - Factory made products

Boverket's building regulations- mandatory provisions and general recommendations, BBR. BFS 2011:6 with amendments up to BFS 2016:6.

ANNEX A: DETERMINATION OF THE 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 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 $(10 \pm 0,3)$ °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.

In accordance with the principles of the Annex A of EN 13162:2013 and of the Annex A of EN 15101-1:2013, at least ten measurements are needed. Following the principles of the Annex I of EN 15101-1:2013, at least four measurements shall be carried out at a notified testing laboratory.

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 principles as detailed in EN 13162:2013 Annex A. 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 13171:2013, 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 $(10 \pm 0,3)$ °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 0,001 W/(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 $(10 \pm 0,3)$ °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 same test specimens shall be used for Set 1 and Set 2.

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, 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 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.

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 declared 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 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 846:1997.