
Toplotnoizolacijski proizvodi za stavbe - Rzsuti celulozni proizvodi (LFCI) za oblikovanje na mestu vgradnje - 1. del: Specifikacija za proizvode pred vgradnjo

Thermal insulation products for buildings - In-situ formed loose fill cellulose (LFCI) products - Part 1: Specification for the products before installation

Wärmedämmstoffe für Gebäude - An der Verwendungsstelle hergestellter Wärmedämmstoff aus Zellulosefüllstoff (LFCI) - Teil 1: Spezifikation für die Produkte vor dem Einbau

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Produits isolants thermiques destinés aux applications du bâtiment - Isolation thermique formée en place à base de cellulose (LFCI) - Partie 1 : Spécification des produits en vrac avant la mise en oeuvre

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ICS:

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**Thermal insulation products for buildings - In-situ formed loose
fill cellulose (LFCI) products - Part 1: Specification for the
products before installation**

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bâtiment - Isolation thermique formée en place à base de
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Verwendungsstelle hergestellter Wärmedämmstoff aus
Zellulosefüllstoff (LFCI) - Teil 1: Spezifikation für die
Produkte vor dem Einbau

This European Standard was approved by CEN on 8 August 2013.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
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CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

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Foreword

This document (EN 15101-1:2013) has been prepared by Technical Committee CEN/TC 88 "Thermal insulating materials and products", the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by March 2014, and conflicting national standards shall be withdrawn at the latest by March 2014.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this document.

This European Standard consists of two parts which form a package. The first part is the harmonised part satisfying the mandate and the CPD and is the basis for the CE marking covering the products, which are placed on the market. The second part, which is the non-harmonised part, covers the installation checks for the installed products.

This European Standard is one of a series for mineral wool, expanded clay, expanded perlite, exfoliated vermiculite, polyurethane/polyisocyanurate, cellulose, bound expanded polystyrene and expanded polystyrene in-situ formed insulation products used in buildings, but this standard may be used in other areas where appropriate.

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The reduction in energy used and emissions produced during the installed life of insulation products exceeds by far the energy used and emissions made during the production and disposal processes.

According to the CEN-CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

EN 15101-1:2013 (E)**1 Scope**

This European Standard specifies requirements for loose-fill cellulose insulation (LFCI) products for the thermal and/or sound insulation of buildings when installed into walls, floors, galleries, roofs and ceilings.

This European Standard is a specification for the loose-fill cellulose insulation (LFCI) products before installation.

This European Standard describes the product characteristics and includes procedures for testing, marking and labelling and the rules for evaluation of conformity.

Products covered by this European Standard may also be used in prefabricated thermal insulation systems and composite panels; the structural performance of systems incorporating these products is not covered.

Products with a declared thermal conductivity at 10 °C greater than 0,060 W/(m × K) or a declared thermal resistance lower than 0,25 m² × K/W are not covered by this European Standard.

This European Standard does not specify the required level of all properties to be achieved by a product to demonstrate fitness for purpose in a particular application. The required levels are to be found in local regulations or non-conflicting standards.

This European Standard does not cover factory made cellulose products placed on the market as bats, mats or boards intended to be used for the insulation of buildings or loose-fill cellulose products for the insulation of building equipment and industrial installations.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 312, *Particleboards - Specifications*

EN 508-1, *Roofing products from metal sheet — Specification for self-supporting products of steel, aluminium or stainless steel sheet — Part 1: Steel*

EN 520, *Gypsum plasterboards — Definitions, requirements and test methods*

EN 1609, *Thermal insulating products for building applications — Determination of short term water absorption by partial immersion*

EN 12086:2013, *Thermal insulation 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 13172:2012, *Thermal insulating products — Evaluation of conformity*

EN 13238, *Reaction to fire tests for building products — Conditioning procedures and general rules for selection of substrates*

EN 13501-1, *Fire classification of construction products and building elements — Part 1 Classification using data from reaction to fire tests*

EN 13823:2010, *Reaction to fire tests for building products — Building products excluding floorings exposed to the thermal attack by a single burning item*

EN 29053, *Acoustics — Materials for acoustical applications — Determination of airflow resistance (ISO 9053)*

EN ISO 354:2003, *Acoustics — Measurement of sound absorption in a reverberation room (ISO 354:2003)*

EN ISO 10456 *Building materials and products — Hygrothermal properties — Tabulated design values and procedures for determining declared and design thermal values (ISO 10456)*

EN ISO 11654, *Acoustics — Sound absorbers for use in buildings — Rating of sound absorption (ISO 11654)*

EN ISO 11925-2, *Reaction to fire tests — Ignitability of building products subjected to direct impingement of flame — Part 2: Single-flame source test (ISO 11925-2)*

ISO 12491, *Statistical methods for quality control of building materials and components*

3 Terms, definitions, symbols and abbreviations

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1.1

open blow applications

all applications except cavity applications

3.1.2

declared insulation thickness: “open blow” applications

installed insulation thickness minus the thickness loss according to the settlement class of the product

3.1.3

declared insulation thickness: cavity applications

identical with the thickness of the cavity

3.1.4

floor

horizontal division between two storeys, over a crawl space or a floor directly on the ground

3.1.5

frame construction

walls with wood or metal studs, sloping roof with insulation between and above rafters, as well as stud girders and internal and external insulation on solid masonry construction

3.1.6

settlement

decrease of installed insulation thickness in lofts or height in cavities and frame constructions either under vibration, humidity, cyclic conditions and time, expressed as a percentage of the initial installed insulation thickness (after compaction if required)

3.1.7

coverage

mass of insulation per unit area

3.1.8

performance chart

table giving thickness and coverage requirements for different values of declared thermal resistance

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3.1.9

class

combination of two levels of the same property between which the performance is to fall where the levels are given by the declared value of the characteristic concerned

3.1.10

loose-fill cellulose insulation (LFCI)

fibre, fibrous or granulated insulation material derived from paper, paper stock and/or wood, leave or stalk strings with or without binders which are blown, injected or applied with or without moisture

3.2 Symbols

ρ	is the density after settlement testing	kg/m ³
$R_{90/90}$	is the 90 % fractile with a confidence level of 90 % for the thermal resistance	m ² K/W
R_D	is the declared thermal resistance	m ² K/W
R_{mean}	is the mean thermal resistance	m ² K/W
d	is the declared insulation thickness	mm
W_p	is the short-term water absorption	kg/m ²
α_p	practical sound absorption coefficient	
α_w	weighted sound absorption coefficient	
R_a	is the level of airflow resistivity	kPa s/m ²
S_0	is the height before the settlement tests	mm
s_D	is the mean declared settlement value	mm
S_i	is the mean value of measured insulation height for settlement process number i	mm
s_λ	is the estimate of the standard deviation of the thermal conductivity	W/(m × K)
$\lambda_{90/90}$	is the 90 % fractile with a confidence level of 90 % for the thermal conductivity	W/(m × K)
λ_D	is the declared thermal conductivity	W/(m × K)
λ_i	is one test result of thermal conductivity	W/(m × K)
λ_{mean}	is the mean thermal conductivity	W/(m × K)
μ	is the water vapour diffusion resistance factor	
N	is the number of test results	
ρ	is the bulk density before settlement test	kg/m ³
AF	is the symbol for the level of airflow resistivity	
BA	is the symbol for the declared class for resistance to biological agents	
CR	is the symbol for the declared class for corrosion	
SH	is the declared class of settlement for horizontal applications loft and floors	
SC	is the declared class of settlement for cavity insulation, frame constructions and cavity walls	
WS	is the symbol of the declared level for short-term water absorption	

NOTE There are additional symbols in Annex B which are not listed here.

3.3 Abbreviations

- ITT is Initial Type Test
- LFCI is Loose-Fill Cellulose Insulation

4 Requirements

4.1 General

Product properties shall be tested in accordance with Clause 5. To conform to this standard, products shall meet the requirements of 4.2 and 4.3 as appropriate.

This European Standard gives an example of a manufacturer's performance chart (declared thermal resistance related to the declared density range) which can be adapted for any application, see Annex K.

NOTE Different applications can require different classes for settlement. One test result of a product property is the average of the measured values on the number of test specimens given in Table 6.

4.2 For all applications

4.2.1 Thermal resistance and thermal conductivity

Thermal resistance and thermal conductivity shall be based upon measurements carried out in accordance with EN 12667 and/or EN 12939 for thick products and 5.3.2.

The thermal values shall be determined in accordance with Annex A, 5.1 and 5.3.2 and declared by the manufacturer, according to the following:

- the reference mean temperature shall be 10 °C;
- the values shall be measured in dry conditions but the values declared shall be given for the product when conditioned at 23 °C and a relative humidity of 50 % (see 5.2);
- the thermal resistance, R_D , shall always be declared. The thermal conductivity, λ_D , shall be declared where possible;
- the thermal resistance, R_D , and the thermal conductivity, λ_D , shall be given as limit values representing at least 90 % of the production determined with a confidence level of 90 %;
- the measured values shall be expressed to three significant figures;
- the declared thermal resistance, R_D , shall be calculated from the declared thermal insulation thickness and the corresponding λ_D , taking into account the declared settlement s_D (see NOTE below);
- the value of thermal conductivity λ_D shall be rounded upwards to the nearest 0,001 W/(m × K) and declared in levels with steps of 0,001 W/(m × K); the thermal conductivity value shall be declared;
- the value of thermal resistance, R_D , shall be rounded downwards to the nearest 0,05 m² K/W and declared in levels with steps of 0,05 m² K/W; since LFCI can be installed at a variety of thickness (e.g. in a void or cavity) a table giving declared R -values at different thickness shall be used for marking and labelling.

NOTE The thermal resistance for loose-fill cellulose insulation is declared by the manufacturer in accordance with the declared density range using thermal conductivity measurements taken at densities across the declared density range and the worst result used as the declared value (see Annex K).

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4.2.2 Settlement

4.2.2.1 General

Settlement shall be determined by testing by the appropriate method given in Annex B.

4.2.2.2 Horizontal applications, loft and floors

Settlement shall be classified and declared in accordance with Table 1. The classification shall be based on measurements made in accordance with the laboratory method B.1 given in Annex B (temperature and humidity cycle).

Table 1 — Classes for settlement for horizontal applications, lofts and floors

Class	Requirement
SH 0	No measureable settlement ($\leq 1\%$)
SH 5	$\leq 5\%$
SH 10	$\leq 10\%$
SH 15	$\leq 15\%$
SH 20	$\leq 20\%$
SH 25	$\leq 25\%$
SH 30	$> 25\%$

4.2.2.3 Cavity insulation, frame constructions and cavity walls

Settlement shall be classified and declared in accordance with Table 2. The classification shall be based on the long-term settlement experience after installation or measurements made in accordance with the laboratory Method B.2 given in Annex B.

Table 2 — Class for settlement for cavity insulation, frame constructions and cavity walls

Class	Requirement
SC O	No measureable settlement ($\leq 1\%$)

4.2.3 Reaction to fire

Reaction to fire classification of the product, as placed on the market, shall be determined in accordance with EN 13501-1 and the basic mounting and fixing rules given in Annex C.

4.2.4 Durability

4.2.4.1 General

The appropriate durability characteristics have been considered and are covered in 4.2.4.2 to 4.2.4.3.

4.2.4.2 Durability of reaction to fire against ageing/degradation

The long-term fire resistance of LFCI does not change with time.

4.2.4.3 Durability of thermal resistance against ageing/degradation

All durability aspects of thermal conductivity are detailed in Annex A. In particular, settlement and change in thickness over time for open blow applications needs to be considered.

4.3 For specific applications

4.3.1 General

If there is no intended requirement for a property, as described in 4.3, for a product in its end-use application, then the property does not need to be determined and declared by the manufacturer.

4.3.2 Short-term water absorption

Short-term water absorption, W_p , shall be determined in accordance with EN 1609, Method A with specimen preparation in accordance with Annex D. Test results shall be classified according to Table 3.

Table 3 — Classes of short-term water absorption

Class	Requirements
WS1	$\leq 1,0 \text{ kg/m}^2$
WS 2	$\leq 2,0 \text{ kg/m}^2$

4.3.3 Water vapour diffusion resistance factor

Loose-fill Cellulose products have a structure that is highly permeable to water vapour. The water vapour resistance factor, μ , may be assumed to be 1 if no measurements are available. If measurements are undertaken, the product shall be tested in accordance with EN 12086, climatic condition A. Alternatively, values cited in EN ISO 10456 may be used.

4.3.4 Dangerous substances (standards.iteh.ai)

National regulations on dangerous substances may require verification and declaration on release, and sometimes content, when construction products covered by this standard are placed on those markets.

In the absence of European harmonised test methods, verification and declaration on release/content should be done taking into account national provisions in the place of use.

NOTE An informative database covering European and national provisions on dangerous substances is available at the Construction web site on EUROPA accessed through: <http://ec.europa.eu/enterprise/construction/cpd-ds/>

4.3.5 Corrosion resistance of the insulation material on certain metals

Corrosion resistance shall be classified and declared in accordance with Table 4 after testing in accordance with Annex E.

Table 4 — Classes of corrosion resistance

Class	Requirements
CR	Test passed

4.3.6 Mould fungi resistance

Resistance to mould fungi shall be classified and declared in accordance with Table 5 after testing in accordance with the procedure given in Annex F.

Table 5 — Classes for mould fungi resistance

Class BA	<i>Intensity of growth in relation to comparative material</i>
0	no mould visible on specimen surface, examined with reflected-light microscope at 50× magnification
1	mould growth not or hardly visible to the naked eye, but clearly visible at 50× magnification
2	mould clearly visible to the naked eye – considerably weaker than on the comparison material
3	mould clearly visible to the naked eye – equal or more intensive than on the comparison material

4.3.7 Airflow resistivity

The airflow resistivity, r_a , shall be determined in accordance with EN 29053, Method A using specimens prepared in accordance with Annex G. The value of the airflow resistivity shall be declared in levels with steps of 1 kPa s/m². No test result shall be lower than the declared value.

NOTE Airflow resistivity can be used when estimating the risk for reduced thermal resistance caused by convection or when evaluating the sound insulation capability.

4.3.8 Continuous Glowing Combustion

Where subject to regulations, the manufacturer shall declare the glowing combustion of the product. In the absence of an existing test method, the compliance with the requirement shall be made on basis of the existing method used in the place of use of the product.

NOTE A European test method is under development and the standard will be amended when this is available.

4.3.9 Sound absorption

The sound absorption coefficient shall be determined in accordance with EN ISO 354 but always without a plenum. The sound absorption characteristics shall be calculated in accordance with EN ISO 11654 using the values for the practical sound absorption coefficient, α_p , at the frequencies: 125 Hz, 250 Hz, 500 Hz, 1 000 Hz, 2 000 Hz and 4 000 Hz and the single number value for α_w (weighted sound absorption coefficient).

α_p and α_w shall be rounded to the nearest 0,05 ($\alpha_p > 1$ shall be expressed as $\alpha_p=1$) and declared in levels with steps of 0,05. No test result (α_p and α_w) shall be lower than the declared level.

4.3.10 Reaction to fire of product in standardised assemblies simulating end-use applications

Reaction to fire classification of products in standardized assemblies simulating end-use applications shall be determined in accordance with EN 13501-1 with the basic mounting and fixing rules given in Annex J.

This classification offers the opportunity to give a complementary and optional declaration on reaction to fire for standard test configurations of assemblies which include the insulation product.

Detailed information about the test conditions and the field of application of the classification as stated in the reaction to fire classification report shall be given in the manufacturer's literature.

5 Test methods

5.1 Sampling

Sufficient product should be sampled in order to perform all the required tests of the same batch of product.

5.2 Conditioning

For test samples, no conditioning is needed unless otherwise specified in the test standard. In case of dispute, the test samples shall be stored at $(23 \pm 2) ^\circ\text{C}$ and $(50 \pm 5) \%$ relative humidity for at least 6 weeks prior to testing. For FPC no special conditioning of the test samples is needed.

Except for 5.3.2, test specimens shall be conditioned in an atmosphere of $(23 \pm 2) ^\circ\text{C}$ and $(50 \pm 5) \%$ relative humidity until stabilisation at constant weight is achieved. Stabilisation is obtained when the relative change in weight does not exceed 0,5 % between two consecutive weekly measurements. In case of dispute, the following stepwise procedure shall be carried out:

- step 1 (dry reference): The specimens are conditioned for 72 h at $(70 \pm 2) ^\circ\text{C}$, in an oven ventilated with an air taken at $(23 \pm 2) ^\circ\text{C}$ and $(50 \pm 5) \%$ relative humidity, and then weighed. The mass of the test specimen at step 1 is $m_{23,dry}$.
- step 2 (normal reference): After conditioning according to step 1, the specimens are further conditioned in an atmosphere of $(23 \pm 2) ^\circ\text{C}$ and $(50 \pm 5) \%$ relative humidity until stabilisation, and then weighed. Stabilisation, by definition, takes at least 6 weeks with some additional time so that the relative change in moisture does not increase by more than 5 % between two consecutive weekly measurements. The mass of the test specimen at step 2 is $m_{23,50}$.

Moisture content, $u_{23,50}$, expressed in kilogram per kilogram, shall be determined by weighing the specimens at each step with an accuracy of 0,1 g, and calculated using Formula (1)

$$u_{23,50} = \frac{m_{23,50} - m_{23,dry}}{m_{23,dry}} \quad (1)$$

5.3 Testing

5.3.1 General

Table 6 gives the dimensions of the test specimens, the minimum number of measurements required to get one test result and any other specific conditions which are necessary.