



BSI Standards Publication

Thermal insulation products for buildings - In-situ formed loose fill cellulose (LFCI) products

Part 1: Specification for the products before installation

National foreword

This British Standard is the UK implementation of EN 15101-1:2013+A1:2019. It supersedes BS EN 15101-1:2013, which is withdrawn.

The start and finish of text introduced or altered by amendment is indicated in the text by tags. Tags indicating changes to CEN text carry the number of the CEN amendment. For example, text altered by CEN amendment A1 is indicated by A1 A1.

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English Version

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

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

Wärmedämmstoffe für Gebäude - An der
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 and includes Amendment 1 approved by CEN on 6 January 2019.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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European Foreword

This document (EN 15101-1:2013+A1:2019) 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of an identical text or by endorsement, at the latest by October 2019, and conflicting national standards shall be withdrawn at the latest by October 2019.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN 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 A1 *deleted text* A1.

For relationship with EU A1 Regulation A1(s), see informative Annex ZA, which is an integral part of this document.

This document includes Amendment 1 approved by CEN on 01 January 2019.

This document supersedes EN 15101-1:2013.

The start and finish of text introduced or altered by amendment is indicated in the text by tags A1 A1.

This European Standard consists of two parts which form a package. The first part is the harmonized part satisfying the mandate A1 *deleted text* A1 and is the basis for the CE marking covering the products, which are placed on the market. The second part, which is the non-harmonized 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.

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, Serbia Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

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 and cladding products from metal sheet - Specification for self-supporting 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 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 13172:2012, *Thermal insulation 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 16733, *Reaction to fire tests for building products - Determination of a building product's propensity to undergo continuous smouldering*

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 10456:2007)*

EN ISO 11654, *Acoustics - Sound absorbers for use in buildings - Rating of sound absorption (ISO 11654:1997)*

EN ISO 11925-2, *Reaction to fire tests - Ignitability of products subjected to direct impingement of flame - Part 2: Single-flame source test (ISO 11925-2:2010)*

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

A1 Deleted text A1

3.1.9**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 $\boxed{A_1}$ level $\langle A_1 \rangle$ for corrosion
SH	is the declared class of settlement for horizontal applications loft and floors
SC	is the declared $\boxed{A_1}$ level $\langle A_1 \rangle$ 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

- $\boxed{A_1}$ TT is Type Testing $\langle A_1 \rangle$
- 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).

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 (≤ 1 %)
SH 5	≤ 5 %
SH 10	≤ 10 %
SH 15	≤ 15 %
SH 20	≤ 20 %
SH 25	≤ 25 %
SH 30	> 25 %

4.2.2.3 Cavity insulation, frame constructions and cavity walls

Settlement shall be ~~A₁~~ declared in accordance with Table 2. The ~~A₁~~ declaration ~~A₁~~ 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 —  Declaration  for settlement for cavity insulation, frame constructions and cavity walls



Settlement (%)
SC



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	$\leq 2,0 \text{ kg/m}^2$
WS 3	$> 2.0 \text{ kg/m}^2$



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

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.

A1 Deleted text **A1**

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

4.3.5 Corrosion resistance of the insulation material on certain metals

A1 Corrosion resistance shall be declared CR after testing in accordance with Annex E. **A1**

A1 Deleted text **A1**

4.3.6 Mould fungi resistance

A1 Resistance to mould fungi shall be classified and declared in accordance with Table F.1 after testing in accordance with the procedure given in Annex F. **A1**

Table 4 — 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

A1 When declared, the continuous smouldering combustion shall be tested in accordance with EN 16733.

If the product does not show propensity for continuous smouldering combustion, NoS shall be included in the designation code.

If the product shows propensity for continuous smouldering combustion, S shall be included in the product designation code. **A1**

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 standardized 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 stabilization at constant weight is achieved. Stabilization 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 $m_{23,\text{dry}}$.
- 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 stabilization, and then weighed. Stabilization, 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)

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

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.

Table 5 — Test methods, test specimens and conditions

Clause	Title	Test method	Test specimen		Specific conditions
			Dimensions	No. to get one result	
4.2.1	Thermal resistance and thermal conductivity	EN 12667 or EN 12939	See EN 12667 or EN 12939	1	Measuring area: In order to maintain uniform material of the samples the measuring area should be sufficiently large.
4.2.2	Settlement	B.1	600 mm x 600 mm x 300 mm	1	
4.2.2.2	a) Lofts and floors				
4.2.2.3	b) Frame constructions and cavity walls	B.2	2300 mm x 600 mm x 240 mm minimum and 2300 mm x 600 mm x 100 mm minimum	1	
4.2.3	Reaction to fire	See EN 13501-1 and Annex C			
4.3.2	Short-term water absorption	EN 1609, Method A	200 mm x 200 mm x 150 mm or diameter 200 mm x 150mm	4	
4.3.3	Water vapour diffusion resistance factor	EN 12086	See 6.1 of EN 12086:2013	5	
4.3.4	Release of dangerous substances	-	-		a
4.3.5	Corrosion resistance	Annex E	20 g test specimens	4	

Clause	Title	Test method	Test specimen		Specific conditions
			Dimensions	No. to get one result	
4.3.6	Mould fungi resistance	Annex F	Petri Dish 90 mm	4	
4.3.7	Airflow resistivity	EN 29053, Method A	See EN 29053 Thickness 100 mm	9	
4.3.8	Continuous  smouldering  combustion	—	—	—	 EN 16733 
4.3.9	Sound absorption	EN ISO 354:2003, A.1	Minimum 10m ²	1	
4.3.10	Reaction to fire of products in standardized assemblies simulating end-use applications	Annex J	—	1	—
^a Test not yet available.					

5.3.2 Thermal resistance and thermal conductivity

Thermal resistance and thermal conductivity shall be determined in accordance with EN 12667 or EN 12939 for thick products and under the following conditions:

- at mean temperature of $(10 \pm 0,3) ^\circ\text{C}$;
- after conditioning according to step 1 of 5.2 (i.e. under dry conditions);
- using the test specimens prepared by the procedure given in Annex H.

Thermal resistance and thermal conductivity may also be measured at mean temperatures other than 10 °C, providing that the accuracy of the relationship between temperature and thermal properties is well documented.

Thermal resistance and thermal conductivity shall be determined directly at measured thickness. In the event that this is not possible, they shall be determined by measurements on other thicknesses of the product providing that:

- product is of similar chemical and physical characteristics and is produced on the same production line;
- it can be demonstrated in accordance with EN 12939 that the thermal conductivity, λ , does not vary more than 2 % over the range of thicknesses where the calculation is applied.

NOTE The procedures for converting the values of thermal conductivity from one set of temperature and humidity conditions to another are contained in EN ISO 10456 which also contains tabulated values for some products.

6 Designation code

The manufacturer shall give a designation code for a LFCI product. The following shall be included except when there is no requirement for a property as described in 4.3:

- Loose-fill cellulose Insulation (LFCI),
- This European Standard number,
- Settlement $\langle A_1 \rangle$ *deleted text* $\langle A_1 \rangle$ for horizontal applications SHi,
- Settlement $\langle A_1 \rangle$ *deleted text* $\langle A_1 \rangle$ for cavity insulation SCi,
- Water absorption $\langle A_1 \rangle$ level $\langle A_1 \rangle$ WSi,
- Corrosion resistance class CRi,
- Class for resistance to biological agents BAi,
- Airflow resistivity AFri,
- Euroclass for reaction to Fire,
- $\langle A_1 \rangle$ Continuous smouldering combustion $\langle A_1 \rangle$
- Sound absorption,
- Thermal conductivity (declared density range),

where “i” shall be used to indicate the relevant class or level.

The designation code for a loose-fill cellulose insulation product declared for use as cavity insulation is illustrated by the following example:

EXAMPLE $\langle A_1 \rangle$ LFCI EN 15101—SC0 % – WS2 – CRmm2 – BA1 – AFR5 – ...Reaction to fire..... $\langle A_1 \rangle$

7 $\langle A_1 \rangle$ Assessment and Verification of Constancy of Performance (AVCP) $\langle A_1 \rangle$

7.1 General

$\langle A_1 \rangle$ The Assessment and Verification of Constancy of Performance (AVCP) shall be carried out in accordance with EN 13172.

The compliance of the *In situ* formed loose fill cellulose (LFCI) with the characteristics of this standard and with the performances declared by the manufacturer in the DoP shall be demonstrated by:

- determination of the product type
- Factory Production Control (FPC) by the manufacturer, including product assessment.

If a manufacturer decides to group his products, it shall be done in accordance with EN 13172. $\langle A_1 \rangle$

7.2 $\langle A_1 \rangle$ *Deleted text* $\langle A_1 \rangle$ Type Testing

$\langle A_1 \rangle$ All performances related to characteristics included in this standard shall be determined when the manufacturer intends to declare the respective performances unless the standard gives provisions for

declaring them without performing tests. (e.g. use of previously existing data, CWFT and conventionally accepted performance).

The type testing (TT) shall be carried out in accordance with Annex I. ^{A1}

7.3 Factory production control

^{A1} The manufacturer shall establish, document and maintain an FPC system to ensure that the products placed on the market comply with the declared performance of the essential characteristics.

The minimum frequencies of tests in the factory production control (FPC) shall be in accordance with Annex I.

When indirect testing is used, the correlation to direct testing shall be established in accordance with EN 13172. ^{A1}

7.4 ^{A1} Initial Inspection

The initial inspection of the factory and of the FPC shall be carried out in accordance with EN 13172.

7.5 Continuous Surveillance

The continuous surveillance of FPC shall be carried out in accordance with EN 13172.

^{A1} Deleted text ^{A1}

Annex A (normative)

Determination of declared thermal resistance and thermal conductivity

A.1 General

A1 Deleted text **A1** The declared value of thermal resistance and thermal conductivity of a product are the expected value of the property during an economically reasonable working life under normal conditions, assessed through measured data at reference conditions. Thermal conductivity can be measured under dry conditions. The declared values are to be given for a moisture content equal to the one the material has when equilibrium with the air at 23 °C and relative humidity of 50 %. The effects of moisture shall be calculated in accordance with EN ISO 10456. The moisture factors can either used as tabulated values from EN ISO 10456 or can be individually determined as described in Annex D of EN 13171:2012.

A.2 Input data

A1 At least 10 test results for thermal resistance and thermal conductivity shall be obtained from external direct or from internal direct measurements in order to calculate the declared value. **A1** The thermal resistance and thermal conductivity measurements shall be carried out at regular intervals spread over a period of the last 12 months. If less than 10 direct test results are available, that period may be extended until 10 test results are obtained, but with a maximum period of 3 years, within which the product and production conditions have not changed significantly.

For new products, the 10 thermal resistance and thermal conductivity test results shall be carried out spread over a minimum period of 10 days.

The declared value shall be calculated according to the method given in A.3 and shall be recalculated at intervals not exceeding 3 months of production.

A.3 Declared values of thermal resistance and thermal conductivity

The derivation of the declared values R_D and λ_D from the calculated values $R_{90/90}$ and $\lambda_{90/90}$ shall be in accordance with 4.2.1, including the rounding conditions.

The declared value λ_D shall be derived from the calculated value, $\lambda_{90/90}$, which is determined using Formulae (A.1), (A.2) and (A.3), where d_D is the declared thickness and the declared value R_D according to Formulae (A.3):

$$\lambda_{90/90} = \lambda_{\text{mean}} + k \times s_{\lambda} \quad (\text{A.1})$$

$$s_{\lambda} = \sqrt{\frac{\sum_{i=1}^n (\lambda_i - \lambda_{\text{mean}})^2}{n-1}} \quad (\text{A.2})$$

$$R_{90/90} = \frac{d_D}{\lambda_{90/90}} \quad (\text{A.3})$$

k is a factor related to the number of test results available. Values of k are given in Table A1.