BS EN 14308:2015

Thermal insulation products for building equipment and industrial installations — Factory made rigid polyurethane foam (PUR) and polyisocyanurate foam (PIR) products — Specification

National foreword

This British Standard is the UK implementation of EN 14308:2015. It supersedes BS EN 14308:2009+A1:2013 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee B/540, Energy performance of materials components and buildings.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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English Version

Thermal insulation products for building equipment and industrial installations - Factory made rigid polyurethane foam (PUR) and polyisocyanurate foam (PIR) products - Specification

Produits isolants thermiques pour l'équipement du bâtiment et les installations industrielles - Produits manufacturés en mousse rigide de polyuréthane (PUR) et en mousse polyisocyanurate (PIR) - Spécification

Wärmedämmstoffe für die technische Gebäudeausrüstung und für betriebstechnische Anlagen in der Industrie - Werkmäßig hergestellte Produkte aus Polyurethan-Hartschaum (PUR) und Polyisocyanurat-Schaum (PIR) - Spezifikation

This European Standard was approved by CEN on 24 October 2015.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

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

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

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European foreword

This document (EN 14308:2015) 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 June 2016, and conflicting national standards shall be withdrawn at the latest by September 2017.

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 supersedes EN 14308:2009+A1:2013.

This document is identifying those clauses of the standard which are needed for the compliance of the European Standard with the Construction Products Regulation (CPR).

The main technical changes that have been made in this new edition of EN 14308 are the following:

a) an addition to the foreword;

b) an addition in 3.2.2;

c) a new 4.3.9;

d) modification of 5.3.2;

e) modification of Clause 7;

f) modification of Clause 8;

g) modification of Annex A;

h) a new Annex ZA.

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 Regulation (EU) No. 305/2011.

For relationship with Regulation (EU) No. 305/2011, see informative Annex ZA, which is an integral part of this document.

Locally responsible authorities and contracting entities, who are bound by EU Directives to specify their requirements using European harmonized product standards, are allowed to demand additional properties outside the provisions of this standard if this is technically necessary because of prevailing operational conditions of the building equipment or the industrial installation projected or because of safety regulations.

This European Standard contains five annexes:

— Annex A (normative), Factory production control;

— Annex B (normative), Determination of minimum service temperature;

— Annex C (normative), Determination of the aged value of thermal conductivity;

— Annex D (informative), Additional properties;

— Annex ZA (informative), Clauses of this European Standard addressing the provisions of the EU Construction Products Regulation.

This document includes a bibliography.

This European Standard is one of a series of standards for insulation products used in building equipment and industrial installations, but this standard may be used in other areas where appropriate.

In pursuance of Resolution BT 20/1993 revised, CEN/TC 88 have proposed defining the standards listed below as a package of European standards, setting 21 months after availability as the date of withdrawal (dow) of national standards which conflict with the European standards of this package.

The package of standards comprises the following group of interrelated standards for the specifications of factory made thermal insulation products, all of which come within the scope of CEN/TC 88:

EN 14303, *Thermal insulation products for building equipment and industrial installations — Factory made mineral wool (MW) products — Specification*

EN 14304, *Thermal insulation products for building equipment and industrial installations — Factory made flexible elastomeric foam (FEF) products — Specification*

EN 14305, *Thermal insulation products for building equipment and industrial installations — Factory made cellular glass (CG) products — Specification*

EN 14306, *Thermal insulation products for building equipment and industrial installations — Factory made calcium silicate (CS) products — Specification*

EN 14307, *Thermal insulation products for building equipment and industrial installations — Factory made extruded polystyrene foam (XPS) products — Specification*

EN 14308, *Thermal insulation products for building equipment and industrial installations — Factory made rigid polyurethane foam (PUR) and polyisocyanurate foam (PIR) products — Specification*

EN 14309, *Thermal insulation products for building equipment and industrial installations — Factory made expanded polystyrene (EPS) products — Specification*

EN 14313, *Thermal insulation products for building equipment and industrial installations — Factory made polyethylene foam (PEF) products — Specification*

EN 14314, *Thermal insulation products for building equipment and industrial installations — Factory made phenolic foam (PF) products — Specification*

EN 15501, *Thermal insulation products for building equipment and industrial installations — Factory made expanded perlite (EP) and exfoliated vermiculite (EV) products — Specification*

According to the CEN-CENELEC Internal Regulations, the national standards organizations 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.

1 Scope

This European Standard specifies the requirements for factory made rigid polyurethane foam (PUR) and polyisocyanurate foam (PIR) products, with a closed cell content not less than 90 %, with or without facings, which are used for the thermal insulation of building equipment and industrial installations, with an operating temperature range of approximately, - 200 °C to + 200 °C.

Below an operating temperature of - 50 °C, special tests regarding the suitability of the products in the intended application are advised (e.g. liquefaction of oxygen). Manufacturer's advice should be heeded in all cases.

The products are manufactured in the form of blocks, faced or unfaced boards, pipe sections, segments and prefabricated ware.

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

Products covered by this standard are also used in prefabricated thermal insulating systems and composite panels; the performance of systems incorporating these products is not covered.

This European Standard does not specify the required level of a given property that should be achieved by a product to demonstrate fitness for purpose in a particular application. The levels required for a given application are to be found in regulations and invitations to tender.

Products with a declared thermal conductivity greater than 0,100 W/(m·K) at 10 °C are not covered by this European Standard.

This European Standard does not cover products for *in situ*-insulation (spraying or dispensing) or products for the insulation of the building structure.

This European Standard does not cover the following acoustical aspects: direct airborne sound insulation and impact noise transmission index.

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 822, *Thermal insulating products for building applications - Determination of length and width*

EN 823, *Thermal insulating products for building applications - Determination of thickness*

EN 824, *Thermal insulating products for building applications - Determination of squareness*

EN 825, *Thermal insulating products for building applications - Determination of flatness*

EN 826, *Thermal insulating products for building applications - Determination of compression behaviour*

EN 1604, *Thermal insulating products for building applications - Determination of dimensional stability under specified temperature and humidity conditions*

EN 1606, *Thermal insulating products for building applications - Determination of compressive creep*

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

EN 12086, *Thermal insulating products for building applications - Determination of water vapour transmission 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, *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 13165, *Thermal insulation products for buildings - Factory made rigid polyurethane foam (PU) products - Specification*

EN 13172:2012, *Thermal insulation products - Evaluation of conformity*

EN 13467, *Thermal insulating products for building equipment and industrial installations - Determination of dimensions, squareness and linearity of preformed pipe insulation*

EN 13468, *Thermal insulating products for building equipment and industrial installations - Determination of trace quantities of water soluble chloride, fluoride, silicate, sodium ions and pH*

EN 13471, *Thermal insulating products for building equipment and industrial installations - Determination of the coefficient of thermal expansion*

EN 13501-1:2007+A1:2009, *Fire classification of construction products and building elements - Part 1: Classification using data from reaction to fire tests*

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

EN 14706, *Thermal insulating products for building equipment and industrial installations - Determination of maximum service temperature*

EN 14707, *Thermal insulating products for building equipment and industrial installations - Determination of maximum service temperature for preformed pipe insulation*

EN 15715:2009, *Thermal insulation products - Instructions for mounting and fixing for reaction to fire testing - Factory made products*

EN ISO 4590, *Rigid cellular plastics - Determination of the volume percentage of open cells and of closed cells (ISO 4590)*

EN ISO 8497, *Thermal insulation - Determination of steady-state thermal transmission properties of thermal insulation for circular pipes (ISO 8497)*

EN ISO 9229:2007, *Thermal insulation - Vocabulary (ISO 9229:2007)*

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

EN ISO 13787, *Thermal insulation products for building equipment and industrial installations - Determination of declared thermal conductivity (ISO 13787)*

3 Terms, definitions, symbols, units and abbreviated terms

3.1 Terms and definitions

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

3.1.1 Terms and definitions as given in EN ISO 9229:2007

3.1.1.1
block
billet
(insulation) product generally of rectangular cross-section and with a thickness not significantly smaller than the width

Note 1 to entry: In English, some industries define a large block as a billet.

3.1.1.2
board
slab
(insulation) rigid or semi-rigid product of rectangular shape and cross section in which the thickness is uniform and substantially smaller than the other dimensions

Note 1 to entry: Boards are usually thinner than slabs. They may also be supplied in tapered form.

3.1.1.3
pipe section
section
(insulation) product in the shape of a cylindrical annulus which may be split to facilitate application

3.1.1.4
lag
segment
rigid or semi-rigid insulation product for application to large diameter cylindrical or spherical equipment

3.1.1.5
service temperature range
temperature range between the maximum service temperature and the minimum service temperature (see 4.3.2 and 4.3.3)

3.1.2 Additional terms and definitions

3.1.2.1
rigid polyurethane foam (PU)
family of rigid cellular plastic insulation products with a substantially closed cell structure including both polymer types based on PIR and PUR

3.1.2.2
PIR
rigid cellular plastic insulation product with a substantially closed cell structure based on polymers mainly of polyisocyanurate groups

3.1.2.3
PUR
rigid cellular plastic insulation product with a substantially closed cell structure based on polymers mainly of polyurethane groups

Note 1 to entry: Regarding the properties described in this standard PUR and PIR types are not distinguished between.

3.1.2.4
level
given value, which is the upper or lower limit of a requirement

Note 1 to entry: The level is given by the declared value of the characteristic concerned.

3.1.2.5
class
combination of two levels of the same property between which the performance shall fall

3.1.2.6
prefabricated ware
pieces cut, abraded or otherwise formed from a board or block of product, e. g. elbows, T-pieces, etc

3.1.2.7
production line
assemblage of equipment that produces products using a continuous process

3.1.2.8
production unit
assemblage of equipment that produces products in a discontinuous process

3.2 Symbols, units and abbreviated terms

3.2.1 Symbols and units used in this standard

b	is the width	mm
D_i	is the inside diameter of pipe sections	mm
d	is the thickness	mm
d_D	is the declared thickness of the product	mm
$\Delta\varepsilon_b$	is the relative change in width	%
$\Delta\varepsilon_d$	is the relative change in thickness	%
$\Delta\varepsilon_l$	is the relative change in length	%
X_{ct}	is the absolute compressive creep	mm
X_t	is the total thickness reduction	mm
ε_{ct}	is the relative compressive creep	%
ε_t	is the relative deformation	%
f	is the cryogenic thermal stress resistance	—
L	is the deviation from linearity	mm

l	is the length	mm
λ	is the thermal conductivity	W/(m·K)
λ_D	is the declared thermal conductivity	W/(m·K)
μ	is the water vapour diffusion resistance factor	—
R_D	is the declared thermal resistance	$m^2 \cdot K/W$
S_b	is the deviation from squareness for boards on length and width	mm/m
S_d	is the deviation from squareness for boards on thickness	mm
S_{max}	is the deviation from flatness	mm
σ_{10}	is the compressive stress at 10 % deformation	kPa
σ_c	is the compressive stress	kPa
σ_m	is the compressive strength	kPa
v	is the deviation from squareness for pipe sections	mm
W_{lt}	is the long-term water uptake by total immersion	%
W_p	is the short-term water uptake by partial immersion	%
ψ_0	is the closed cell content (corrected)	%
Z	is the water vapour resistance	$m^2 \cdot h \cdot Pa/mg$
CC($i_1/i_2/y$) σ_c	is the symbol of the declared level for compressive creep	
CL	is the symbol of the declared level for soluble chlorides ions	
CS(10\Y)	is the symbol of the declared level for compressive stress or compressive strength	
CV	is the symbol of the declared value for closed cell content	
DS(TH)	is the symbol of the declared value for dimensional stability	
F	is the symbol of the declared value for soluble fluoride ions	
MU	is the symbol of the declared value for water vapour diffusion resistance factor	
NA	is the symbol of the declared value for soluble sodium ions	
pH	is the symbol of the declared value for the pH-value	
SI	is the symbol of the declared value for soluble silicate ions	
ST(+)	is the symbol of the declared level for maximum service temperature	
ST(-)	is the symbol of the declared level for minimum service temperature	
WVT	is the symbol of the declared level for water vapour transmission	
WVP	is the symbol of the declared level for water vapour permanence	
WVPE	is the symbol of the declared level for water vapour permeability	
Z	is the symbol of the declared value for water vapour resistance	

3.2.2 Abbreviated terms used in this standard

AVCP is **A**ssessment and **V**erification of **C**onstancy of **P**erformance (previously named attestation of conformity)

DoP is **D**eclaration of **P**erformance

FPC is **F**actory **P**roduction **C**ontrol

PTD is **P**roduct **T**ype **D**etermination (previously named ITT for Initial Type Test)

PU is rigid **P**oly**U**rethane foam including PUR and PIR

RtF is **R**eaction to **F**ire

ThIBEII is **T**hermal **I**nsulation for **B**uilding **E**quipment and **I**ndustrial **I**nstallations

VCP is **V**erification of **C**onstancy of **P**erformance (previously named evaluation of conformity)

4 Requirements

4.1 General

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

NOTE Information on additional properties is given in Annex D.

One test result for a product property is the average of the measured values on the numbers of test specimens given in Table 4.

4.2 For all applications

4.2.1 Thermal resistance and thermal conductivity

For flat specimens, the thermal conductivity shall be based upon measurements carried out in accordance with EN 12667 or EN 12939 for thick products. For cylindrical specimens, EN ISO 8497 shall be used as specified in 5.3.2.

In both cases, the thermal conductivity values shall be determined by the manufacturer and verified in accordance with EN ISO 13787 and Annex C of this product standard. They shall be declared by the manufacturer according to measuring standards mentioned above, covering the product service temperature range. The following conditions apply:

— the measured values shall be expressed with three significant figures;

— the declared thermal conductivity curve shall be given as a limit curve, defined in EN ISO 13787;

— the value of the declared thermal conductivity, λ_D, shall be rounded upwards to the nearest 0,001 W/(m·K);

— the lowest reference mean test temperature required is - 170 °C.

The declared equation/limit curve is the “declared reference” with three significant figures, that is to

0,000 1 W/(m·K) for λ values below 0,1 W/(m·K) and in 0,001 W/(m·K) for λ values above 0,1 W/(m·K). This shall be used as a reference for the verification of the declaration.

When thermal conductivity is declared as a table derived from the equation, rounding upwards to the next 0,001 W/(m·K) has to be done for the full range of the thermal conductivity.

NOTE Determinations of the declared thermal conductivity of pipe sections, following EN ISO 8497, having joints in the metering area, include the effects of these joints as defined in EN ISO 23993.

4.2.2 Dimensions and tolerances

4.2.2.1 Linear dimensions

The length, *l*, width, *b*, and thickness, *d*, of boards shall be determined in accordance with EN 822 and EN 823. The length, *l*, thickness, *d*, and inside diameter, D_i, of pipe sections, segments and prefabricated ware shall be determined in accordance with EN 13467. No test result shall deviate from the declared values by more than the tolerances given in Table 1.

Products with a surface facing or natural skin shall be tested without removing them.

Table 1 — Dimensional tolerances

Form of delivery	Length	Width	Thickness	Inside diameter
Boards l < 1 000 mm l = 1 000 to 2 000 l = 2 001 to 4 000 l > 4 000	±5 mm ±7,5 mm ±10 mm ±15 mm	±5 mm	±1,5 mm	—
Pipe section	±3 mm	—	±2 mm	– 0 mm + 2 mm[a] – 0 mm + 3 mm[b]
Segments	+ 3 mm	±2 mm	±2 mm	– 0 mm + 4 mm
Prefabricated ware	+ 3 mm	—	±2 mm	—

[a] Applies to inside diameter less than 170 mm.

[b] Applies to inside diameter of 170 mm and greater.

NOTE Smaller tolerances may be declared by the manufacturer.

4.2.2.2 Squareness

Deviation from squareness, S_b, of boards and slabs shall be determined in accordance with EN 824. Deviation from squareness, *v*, of pipe sections shall be determined in accordance with EN 13467. For boards the deviation from squareness on length and width, S_b, shall not exceed 6 mm/m and the deviation from squareness on thickness, S_d, shall not exceed 2 mm. For pipe sections and segments the deviation from squareness, *v*, shall not exceed 3 mm.

Products with a surface facing or natural skin shall be tested without removing them.

4.2.2.3 Flatness

Deviation from flatness, S_{max}, shall be determined in accordance with EN 825. The deviation from flatness, S_{max}, shall not exceed 10 mm.

Products with a surface facing or natural skin shall be tested without removing them.

4.2.2.4 Pipe section linearity

Deviation from linearity, *L*, shall be determined for pipe sections in accordance with EN 13467. The deviation from linearity, *L*, shall not exceed 6 mm.

Products with a surface facing or natural skin shall be tested without removing them.

4.2.3 Dimensional stability under specified conditions

Dimensional stability under specified temperature and humidity conditions shall be determined in accordance with EN 1604; the tests, each on different sets of specimens, shall be carried out under the following test conditions:

1) (48 ± 1) h at (70 ± 2) °C and a relative humidity of (90 ± 5) %;

2) (48 ± 1) h at (- 20 ± 3) °C.

The relative changes in length, $\Delta\varepsilon_l$, width, $\Delta\varepsilon_b$, and thickness, $\Delta\varepsilon_d$, shall not exceed the values given in Table 2 for the declared level.

Table 2 — Levels for dimensional stability

Test conditions	Relative Changes		Level DS(TH)		
			1	2	3
1	$\Delta\varepsilon_l, \Delta\varepsilon_b$	%	≤ 5	≤ 3	≤ 2
	$\Delta\varepsilon_d$	%	≤ 10	≤ 8	≤ 6
2	$\Delta\varepsilon_l, \Delta\varepsilon_b$	%	≤ 1	≤ 0,5	≤ 0,5
	$\Delta\varepsilon_d$	%	≤ 2	≤ 2	≤ 2

4.2.4 Reaction to fire of the product as placed on the market

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 EN 15715:2009.

NOTE This classification is compulsory and always included in the CE Marking label.

EN 13501-1:2007+A1:2009, Table 1, is applicable to products applied to flat surfaces or to curved surfaces with a diameter greater than 300 mm.

If a flat product which has a classification according to EN 13501-1:2007+A1:2009, Table 1, is used in a linear application, it does not require further classification.

EN 13501-1:2007+A1:2009, Table 3, is applicable for products applied on linear objects or with a diameter below or equal 300 mm.

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.

4.2.5 Durability characteristics

4.2.5.1 General

The appropriate durability characteristics have been considered and are covered in 4.2.5.2, 4.2.5.3 and 4.2.5.4.

4.2.5.2 Durability of reaction to fire against ageing/degradation and high temperature

The reaction to fire performance of PU products does not change with time or when subjected to the declared maximum service temperature.

4.2.5.3 Durability of thermal resistance against ageing/degradation

Any change of the thermal conductivity is covered and considered for declaration by 4.2.1 and Annex C.

4.2.5.4 Durability of thermal resistance against high temperature

This is covered by 4.2.1, 4.2.3, Annex D, 5.3.2, 4.3.2 maximum service temperature (dimensional stability).

4.3 For specific applications

4.3.1 General

If there is no requirement for a property described in 4.3 for a product in use, then that property does not need to be determined and declared by the manufacturer.

4.3.2 Maximum service temperature

The maximum service temperature, ST(+), shall be declared in accordance with EN 14706 for flat specimens and EN 14707 for cylindrical specimens. At the maximum service temperature, ST(+), the relative changes in length, $\Delta\varepsilon_l$, and width, $\Delta\varepsilon_b$, shall not exceed ± 5 % and the relative change in thickness, $\Delta\varepsilon_d$, shall not exceed ± 2 %. The maximum service temperature, ST(+), shall be declared in levels with steps of 10 °C. The rate of increase of temperature shall be 50 °C/h.

Pipe sections and prefabricated ware can be sawed or milled from flat boards or blocks. In this case the maximum service temperature should be determined only on flat boards, in accordance with EN 14706.

4.3.3 Minimum service temperature

The minimum service temperature, ST(-), shall be declared in levels with steps of 10 °C.

The minimum service temperature, ST(-), shall be determined in accordance with Annex B.

If a minimum service temperature is declared by the manufacturer, the following physical properties have to be declared at + 20 °C and at the declared minimum service temperature and shall be confirmed by testing in accordance with European test standards:

a) thermal conductivity as a function of the temperature;

b) coefficient of thermal expansion as a function of the temperature;

c) tensile strength and/or compressive strength and Young's modulus as a function of the temperature.

Using these temperature-dependent physical data, the suitability of any specific insulation can be estimated at a given low operational temperature for industrial installations in relation to application-related design features. A low operational temperature can be below the minimum service temperature.

Minimum service temperature within the scope of the standard, but above 0 °C need not be tested.

At the minimum service temperature, ST(-), the relative changes in length, $\Delta\varepsilon_l$, and width, $\Delta\varepsilon_b$, shall not exceed 2 % and the relative change in thickness, $\Delta\varepsilon_d$, shall not exceed 2 %.

The factor 'f' as defined in B.9 shall be > 1,5 where required (service temperature < - 150 °C, as reported in B.9)

NOTE Factor f qualifies the resistance of the product to cracking due to thermal stress.

4.3.4 Compression resistance properties

4.3.4.1 Compressive stress or compressive strength

Compressive stress at 10 % deformation, σ_{10}, or compressive strength, σ_{m}, shall be determined in accordance with EN 826. No test result for compressive stress at 10 % deformation, σ_{10}, or compressive strength, σ_{m}, shall be less than the value given in Table 3 for the declared level.

Products with a surface facing or natural skin shall be tested without removing them.

Compression behaviour of polyisocyanurate and polyurethane foam is influenced by the direction of foam rise during the manufacturing process. For boards the compressive stress at 10 % deformation, σ_{10}, or compressive strength, σ_{m}, shall be determined in the direction of foam rise and for products in which the direction of loading is not determined, the compressive strength or compressive stress shall be determined in the direction of the foam rise and perpendicular to the foam rise. The less favourable value shall apply.

Table 3 — Levels for compressive stress or compressive strength

Level	Requirement kPa
CS(10\Y) 50	≥ 50
CS(10\Y) 70	≥ 70
CS(10\Y) 100	≥ 100
CS(10\Y) 120	≥ 120
CS(10\Y) 150	≥ 150
CS(10\Y) 175	≥ 175
CS(10\Y) 250	≥ 250
CS(10\Y) 400	≥ 400
CS(10\Y) 800	≥ 800
CS(10\Y) 1600	≥ 1 600
CS(10/Y) 2700	≥ 2 700
CS(10/Y) 5500	≥ 5 500

4.3.4.2 Point load

The effects of point loads shall be assessed by means of the determination of compressive stress or compressive strength in accordance with EN 826 (see 4.3.4.1).

4.3.4.3 Compressive creep

Compressive creep (relative), ε_{ct} and relative deformation, ε_{t} shall be determined after at least 122 days of testing at a declared compressive stress, σ_{c}, given in steps of at least 1 kPa and the results extrapolated 30 times corresponding to at least 10 years to obtain the declared levels in accordance with EN 1606. Compressive creep shall be declared in levels, i_2, and the total thickness reduction shall be declared in levels, i_1, with steps of 0,5 % at the declared stress. No test result shall exceed the declared levels at the declared stress.

NOTE 1 Examples for declaration of levels for compressive creep.

Level	**Test time** days	**Extrapolation time** years	**Declared stress** kPa	**Requirement** **%**
CC ($i_1/i_2/10$) σ_c	122	10	σ_c	i_1, i_2
CC ($i_1/i_2/25$) σ_c	304	25	σ_c	i_1, i_2
CC ($i_1/i_2/50$) σ_c	608	50	σ_c	i_1, i_2

NOTE 2 Referring to the designation code CC($i_1/i_2/y$) σ_c, according to Clause 6, a declared level (CC(3/2/25)40, for example, indicates a value not exceeding 2 % for compressive creep and 3 % for total thickness reduction after extrapolation at 25 years (i.e. 30 times three hundred and four days of testing) under a declared stress of 40 kPa.

4.3.5 Water vapour diffusion resistance

Water vapour transmission properties shall be determined in accordance with EN 12086 and declared as the water vapour diffusion resistance factor, MU, for homogeneous products and the water vapour resistance, *Z*, for faced or non-homogeneous products. No test result shall be less than the declared value for the water vapour diffusion resistance factor, MU, and for the water vapour resistance *Z*.

Alternatively, for the declaration of water vapour transmission properties, the values quoted in EN ISO 10456 may be used.

The manufacturer can declare the water vapour transmission as given in 8.2, 8.3 or 8.5 of EN 12086 instead of the water vapour diffusion resistance factor if needed. In this case the MU shall be replaced by WVT, WVP or WVPE respectively in the designation code as given in Clause 6. If values are declared in accordance with this note the test results shall not be higher than the declared values.

4.3.6 Water absorption

4.3.6.1 Long-Term

Long-term water absorption by total immersion, W_{lt}, shall be determined in accordance with EN 12087. No test result shall exceed the declared value.

4.3.6.2 Short-Term

Short-term water absorption by partial immersion, W_p, shall be determined in accordance with EN 1609. No test result shall exceed the declared value.

4.3.7 Closed cell content

Closed cell content (corrected), ψ_0, shall be determined in accordance with EN ISO 4590. Surface facings or natural skins shall be removed. No test result shall be less than 90 %.

4.3.8 Trace quantities of water soluble ions and the pH-value

Trace quantities of water soluble chloride, fluoride, silicate and sodium ions and the pH-value shall be determined in accordance with EN 13468. The manufacturer shall declare one or more as appropriate as levels in mg per kg of product, and the pH-value as levels in steps of 0,5. For chloride and fluoride no test result shall exceed the declared value. For silicate and sodium, no test result shall be below the declared values. For the pH-value, no test result shall deviate from the declared value by more than 1,0.

4.3.9 Release of 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.

In the absence of European harmonized 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 website on EUROPA accessed through: http://ec.europa.eu/enterprise/construction/cpd-ds/

4.3.10 Continuous glowing combustion

Where subject to regulation a manufacturer shall declare the continuous glowing combustion according to national test method where available.

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

5 Test methods

5.1 Sampling

Flat test specimens shall be taken from the same sample with a total area not less than 1 m^2 and sufficient to cover the needed tests. The shorter side of the sample shall not be less than 300 mm or the full size of the product whichever is smaller.

Pipe sections, segments and prefabricated ware test specimens shall be taken from a sample consisting of at least three full size products.

5.2 Conditioning

Except for the determination of initial thermal conductivity, maximum service temperature and minimum service temperature no special conditioning of the test specimens is needed.

The conditioning required for the determination of initial thermal conductivity is given in 5.3.2, for the determination of maximum service temperature and minimum service temperature in the test methods indicated in Table 4.

In case of dispute, the test specimens shall be stored at (23 ± 2) °C and (50 ± 5) % relative humidity for at least seven days prior to testing.

5.3 Testing

5.3.1 General

Table 4 gives the dimensions of the test specimens, the minimum number of measurements required to get one test result and any specific conditions which are necessary.

For all products, the properties shall be determined on faced or unfaced boards. In the case of pipe sections, segments and prefabricated ware fabricated from blocks or boards the properties shall be determined on the blocks or boards from which they are fabricated except for dimensions, squareness, flatness and pipe section linearity which shall be tested on the fabricated pipe section, segment or prefabricated ware.

Table 4 — Test methods, test specimens and conditions

1		Test method		Test specimen dimensions[a]	Minimum number of measurements to get one test result	Specific conditions
No.	Title	Flat	Cylindrical			
4.2.1	Thermal conductivity	EN 12667 or EN 12939	EN ISO 8497	See EN 12667 or EN 12939	1	[b]
4.2.2 4.2.2.1	Dimensions and tolerances					
	length and width	EN 822	EN 13467	Full size	1	—
	Thickness	EN 823	EN 13467	Full size	1	—
	inside diameter		EN 13467	Full size	1	—
4.2.2.2	Squareness	EN 824	EN 13467	Full size	1	—
4.2.2.3	Flatness	EN 825	—	Full size	1	—
4.2.2.4	Pipe section linearity	—	EN 13467	Full size	1	—
4.2.3	Dimensional stability under specified conditions	EN 1604	—	200 × 200 × 25 or product thickness	3	[b]
4.2.4	Reaction to fire	See EN 13501–1 for mounting and fixing see EN 15715:2009				-
4.3.2	Maximum service temperature	EN 14706	EN 14707	100 × 100 × 50 For pipe sections see EN 14707	1	[b,c]
4.3.3	Minimum service temperature	Annex C	—	Annex C	2[h]	[b,d]
4.3.4.1	Compressive stress or compressive strength	EN 826	—	50 × 50 × 50 or product thickness	3	[b]
			EN 826	50 × 50 × 50 or product thickness	3	[e]
4.3.4.2	Point load	See 4.3.4.2	—	—	—	—
4.3.4.3	Compressive creep	EN 1606	—	50 × 50 or 100 × 100	2	[e]
4.3.5	Water vapour transmission	EN 12086	—	See 6.1 in EN 12086	3	[b]
4.3.6.1	Long Term Water absorption	EN 12087	—	200 × 200		
4.3.6.2	Short-term Water absorption	EN 1609	—	200 × 200		
4.3.7	Closed cell content	EN ISO 4590	—	[g]	3	

1		Test method		Test specimen dimensions[a]	Minimum number of measurements to get one test result	Specific conditions
No.	Title	Flat	Cylindrical			
4.3.8	Trace quantities of water soluble ions and the pH-value	EN 13468	—	—	3	7,5 [g]
4.3.9	Release of dangerous substances[f]					
4.3.10	Continuous glowing combustion	[f]	[f]			

[a] Always full size product thickness unless specified.

[b] Test with specimen thickness in direction of foam rise.

[c] If the manufacturer's declared maximum service temperature is lower than that given by the test, the manufacturer's value shall be used.

[d] If the manufacturer's declared minimum service temperature is higher than that given by the test, the manufacturer's value shall be used.

[e] Test with specimen thickness in direction of right angles to foam rise.

[f] Not yet available.

[g] Size depending on used method of EN ISO 4590.

[h] Number of measurement will be 1 if procedure B.9 applies.

5.3.2 Thermal conductivity

For flat test specimens, thermal conductivity shall be determined in accordance with EN 12667 or EN 12939 for thick products. For cylindrical test specimens, thermal conductivity shall be determined in accordance with EN ISO 8497.

The tests in accordance with EN ISO 8497 may be replaced by tests in accordance with EN 12667 or EN 12939, provided it has been demonstrated that the results give safe (higher) values. (This means that for PUR/PIR products the measurement of the thermal conductivity shall be performed in the rise direction of the product.)

The thermal conductivity shall be determined for the full service temperature range of the product. For factory production control see Annex A.

For PTD, measurements of thermal conductivity made on two internal diameters of pipe sections at the greatest and smallest insulation thickness for each set of the diameters are deemed to be representative of the total product range.

For FPC, one dimension only is used.

For the construction of the thermal conductivity curve from the minimum to the maximum service temperature, the test sample shall be aged and conditioned in accordance with Annex C. An alternative procedure is to calculate the curve using the information contained in C.4 (fixed increments).

Initial measurements at + 10 °C shall be taken for determination of the statistical variation and this statistical variation shall be used over the whole temperature range for the declaration of the thermal conductivity curve.

The thermal conductivity shall be determined directly at the measured thickness. If this is not possible, it shall be determined by measurements on other thicknesses of the product providing that:

— the product is of similar chemical and physical characteristics and is produced on the same production unit/line;

— and 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.

5.3.3 Reaction to Fire

The tests shall be carried out in accordance with the rules given in EN 13501-1.

Rules for mounting and fixing are given in EN 15715:2009.

Annex A of EN 15715:2009 gives tables for product and installation parameters for flat products and pipe insulation products as placed on the market. Installation parameters for standardized assemblies are only given for flat products.

6 Designation code

A designation code for the product shall be given by the manufacturer. The following shall be included except when there is no requirement for a property described in 4.3:

— The polyurethane abbreviated term	PU
— This European Standard number	EN 14308
— Maximum service temperature	ST(+)i
— Minimum service temperature	ST(–)i
— Dimensional stability	DS(TH)i
— Water vapour diffusion resistance factor	MUi
— Compressive stress or compressive strength	CS(10\Y)i
— Compressive creep	CC($i_1/i_1/y$) σ_c
— Water vapour transmission	MUi or Zi
— Closed cell content	CVi
— Trace quantities of water soluble chloride ions	Cli
— Trace quantities of water soluble fluoride ions	Fi
— Trace quantities of water soluble silicate ions	Sii
— Trace quantities of water soluble sodium ions	NAi
— Level of the pH	pHi

where "i" shall be used to indicate the relevant class or level; σ_c, shall be used to indicate the compressive stress and y to indicate the number of years.

The designation code for a polyurethane/polyisocyanurate foam product is illustrated by the following example:

PU – EN 14308 – ST(+) 120 – DS(TH)1 – CS(10\Y) 175 – MU – CV – CL35

7 Assessment and Verification of the Constancy of Performance (AVCP)

7.1 General

The manufacturer or his authorized representative shall be responsible for the conformity of his product with the requirements of this European Standard. The Assessment and Verification of Constancy of Performance (AVCP) shall be carried out in accordance with EN 13172 and shall be based on Product Type Determination (PTD), Factory Production Control (FPC) by the manufacturer, including product assessment and tests on samples taken at the factory.

The compliance of the product with the requirements of this standard and with the stated values (including classes) shall be demonstrated by:

— Product Type Determination (PTD),

— 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.

7.2 Product Type Determination (PTD)

All characteristics defined in 4.2 and those in 4.3 if declared, shall be subject to Product Type Determination (PTD). Product Type Determination (PTD) for the thermal conductivity curve shall be carried out in accordance with EN ISO 13787.

For Product Type Determination (PTD) only one test result is required for the thermal conductivity curve and the maximum and minimum service temperature.

For the relevant characteristics, PTD on products corresponding also to EN 13165 may be used for the purpose of PTD and Declaration of Performance (DoP) according to this standard.

7.3 Factory Production Control (FPC)

The minimum frequencies of tests in the factory production control (FPC) shall be in accordance with Annex A of this standard. When indirect testing is used, the correlation to direct testing shall be established in accordance with EN 13172.

For the relevant characteristics, FPC on products corresponding also to EN 13165 may be used for the purpose of FPC and DoP according to this standard.

8 Marking and labelling

Products conforming with this standard shall be clearly marked, either on the product or on the label or the packaging, with the following information:

— product name or other identifying characteristic;

— name or identifying mark and address of the manufacturer or his authorized representative in the European Economic Area;

— shift or time of production and manufacturing plant or traceability code;

— reaction to fire class; specific test conditions shall be indicated with the marking by reference to manufacturer's literature, where relevant;

— the intended use of the insulation material for Thermal Insulation of Building Equipment and Industrial Installations is given by the abbreviation ThIBEII;

— declared thermal conductivity: reference to Declaration of Performance (DoP), showing thermal conductivity as a function of temperature, given as a table, curve and/or equation;

— declared thickness;

— designation code as given in Clause 6;

— type of facing, if any;

— declared length and declared width or inside diameter, as appropriate;

— number of pieces and area in the package, as appropriate.

NOTE For CE marking and labelling see ZA.3.

Annex A
(normative)

Factory production control

Table A.1 — Minimum product testing frequencies

Clause		Minimum testing frequency [a]
No.	**Title**	
4.2.1	Thermal conductivity [b] — at 10 °C (initial value) — full service temperature range	 1 per 24 h 1 per 5 years
4.2.2.1	Dimensions and tolerances — boards	
	Length, width and thickness	1 per 24 h
	Dimensions and tolerances — pipe sections	
	Length, thickness and inside diameter	1 per 24 h
	Dimensions and tolerances — segments	
	Length, width, thickness and inside diameter	1 per 24 h
	Dimensions and tolerances — prefabricated ware	
	Length and thickness	1 per 24 h
4.2.2.2	Squareness	1 per 24 h
4.2.2.3	Flatness	1 per 24 h
4.2.2.4	Pipe section linearity	1 per 24 h
4.2.3	Dimensional stability	1 per 5 years
4.2.4	Reaction to fire	See Table A.2
4.3.2	Maximum service temperature	1 per 5 years Indirect: 1 per 24 h
4.3.3	Minimum service temperature	1 per 5 years
4.3.4.1	Compressive stress or compressive strength	1 per 24 h
4.3.4.2	Point load	See 4.3.4.2
4.3.4.3	Compressive creep	1 per 5 years
4.3.5	Water vapour transmission	1 per year
4.3.6	Water absorption	1 per 5 years
4.3.7	Closed cell content	1 per 180 days
4.3.8	Trace quantities of water soluble ions and the pH-value	1 per 5 years
4.3.9	Release of dangerous substances	c

4.3.10	Continuous glowing combustion	c

[a] The minimum testing frequencies, expressed in number of test results required per period, shall be understood as the minimum for each production unit/line under stable conditions. In addition to the testing frequencies given above, testing of relevant properties of the product shall be repeated when changes or modifications are made that are likely to affect the conformity of the product. For PTD and FPC, units using the same process in one factory are considered together (as one production line).

For mechanical properties, the testing frequencies given are independent of the change of product. In addition, the manufacturer shall establish internal rules for process adjustments related to these properties when changing the product.

[b] For factory production control purposes, the initial thermal conductivity shall be determined at a reference mean temperature of 10 °C or at different mean temperatures following EN ISO 13787, depending on the frequency.

[c] Frequencies are not given.

Table A.2 — Minimum product testing frequencies for the reaction to fire characteristics

Clause No.	Minimum testing frequency [a]								
	Title	Direct testing [b]		Indirect testing [c]					
	Reaction to fire class			Product		Components [d]			
						Substantial		Non-substantial (like facing)	
		Test Method	Frequency	Test Method	Frequency	Test Method	Frequency	Test Method	Frequency
4.2.4	B C D	EN 13823	1 per 2 years and indirect testing	manufacturer's method	1 per week	check of raw material formulation and density	1 per day	manufacturer's method	1 per week
		and EN ISO 11925-2	1 per 2 years and indirect testing	-	-	check of raw material formulation and density	1 per day	manufacturer's method	1 per week
4.2.4	E	EN ISO 11925-2	1 per 2 years and indirect testing	-	-	check of raw material formulation and density	1 per day	manufacturer's method	1 per week
NOTE Not all Euroclasses may apply for the products conforming to this standard.									

[a] The minimum testing frequencies, expressed in test results required per period, shall be understood as the minimum for a product or product group for each production unit/line under stable conditions. In addition to the testing frequencies given above, testing of relevant properties of the product shall be repeated when changes or modifications are made that are likely to affect the conformity of the product.

[b] Direct testing may be conducted either by a third party or by the manufacturer.

[c] Indirect testing may be conducted by a third party or by the manufacturer on the product or on its components.

[d] Definition as given in the Euroclasses Decision 2000/147/EC:

– Substantial component: A material that constitutes a significant part of a non-homogeneous product. A layer with a mass per unit area ≥ 1,0 kg/m^2 or a thickness ≥ 1,0 mm is considered to be a substantial component.

– Non-substantial component: A material that does not constitute a significant part of a non-homogeneous product. A layer with a mass per unit area < 1,0 kg/m^2 and a thickness < 1,0 mm is considered to be a non-substantial component.

– In case of certified component, the frequency is once per delivery of the component.

Annex B(normative)

Determination of minimum service temperature

B.1 Definitions

For the purpose of this annex, the following definition applies:

minimum service temperature

lowest temperature to which a thermal insulation product may be exposed at a given thickness and at which it will continue to function within specified limits of performance

NOTE 1 The required performance may be in the areas of dimensional stability, thermal properties, and mechanical properties.

NOTE 2 In the present test procedure, which is used as a reference, the test specimen is exposed to a temperature difference going from ambient to the minimum service temperature. This may not reflect the actual application conditions when products are exposed to different temperatures on the two main faces, e.g. in multilayer systems.

B.2 Principle

Determine the dimensional variation of the test specimen in contact with the coldest plate for the determination of the thermal conductivity by the guarded hot plate by measuring its length, width and thickness before the cooling down and after the apparatus has been returned to ambient temperature. Record the lowest temperature of the coldest plate during the measurement.

NOTE The procedure may be an iterative process.

Additional requirements for assessing the minimum service temperature of specific materials are described in B.9.

B.3 Apparatus

B.3.1 Guarded hot plate apparatus, to measure the thermal conductivity.

The apparatus shall be capable of functioning with a coldest plate as cold as the expected minimum service temperature of the test product.

The test specimen dimensions shall correspond to the requirements of this annex.

B.3.2 Square pressure plate, with the same dimensions as the test specimen exerting the requested load on the test specimen.

B.3.3 Micrometer, permitting thickness reading to at least 0,05 mm.

B.3.4 Sliding caliper, permitting reading to at least 0,1 mm.

B.4 Test specimens

B.4.1 Dimensions of test specimens

The test specimens shall be square cut with dimensions corresponding to those foreseen for the used guarded hot plate apparatus.

They shall not be less than 200 mm × 200 mm × 25 mm or exceed 500 mm × 500 mm × 50 mm.

The length, width and thickness shall be as specified in this standard, complying with the requirements of this Annex.

NOTE Testing may be performed on one layer of a multilayer system with the corresponding difference of temperature between the two main faces to simulate the conditions existing in the application.

B.4.2 Number of test specimens

At least two test specimens shall be used.

B.4.3 Conditioning of the test specimens

The test specimens shall be stored in the conditions foreseen for the thermal conductivity measurement. In the absence of such conditions, they shall be stored for at least 6 h at (23 ± 5) °C or in case of dispute, at (23 ± 2) °C and (50 ± 5) % relative humidity for the time specified in 5.2.

B.5 Procedure

B.5.1 Test conditions

The initial conditions for the test shall be (23 ± 5) °C.

B.5.2 Test procedure

Measure the length and width of the test specimen, l_1, b_1, in accordance with EN 12085, read to the nearest 0,1 mm.

Measure the thickness of the test specimen, d_1, in accordance with EN 823, read to the nearest 0,05 mm.

Install the test specimen in the guarded hot plate apparatus, one plate of which shall be cooled down to the minimum service temperature.

Carry out the thermal conductivity measurement recording the lowest temperature of the coldest plate and the temperature of the less cold plate at the same time.

After the measurement – usually consisting of several points – let the apparatus and the test specimen heat up progressively to ambient temperature.

Take the test specimen from the apparatus and remeasure its length l_2, and its width, b_2, in accordance with EN 12085, to the nearest 0,1 mm.

Remeasure the thickness of the test specimen, d_2, in accordance with EN 823 using the load specified in Table 3, read to the nearest 0,05 mm.

B.6 Calculation and expression of results

B.6.1 Dimensional changes

Calculate the dimensional changes of length, width and thickness, in percentage, using the following formulas:

$$\Delta\varepsilon_{\mathrm{l}} = 100 \times \frac{l_2 - l_1}{l_1} \quad \text{(B.1)}$$

$$\Delta\varepsilon_{\mathrm{b}} = 100 \times \frac{b_2 - b_1}{b_1} \quad \text{(B.2)}$$

$$\Delta\varepsilon_{\mathrm{d}} = 100 \times \frac{d_2 - d_1}{d_1} \quad \text{(B.3)}$$

where

l_1, b_1 and d_1 are respectively the length, width and thickness of the test specimen before the measurement of the thermal conductivity;

l_2, b_2 and d_2 are respectively the length, width and thickness of the test specimen after the measurement of the thermal conductivity.

Calculate the mean values of dimensional changes, $\overline{\Delta\varepsilon_{\mathrm{l}}}$, $\overline{\Delta\varepsilon_{\mathrm{b}}}$, and $\overline{\Delta\varepsilon_{\mathrm{d}}}$, as a percentage rounded to the nearest 0,5 % of the individual results.

If the change in the mean value for any of the dimensions exceeds the value specified in 4.3.3 of this standard, the test shall be repeated at least at a less cold temperature of the coldest plate until the dimensional changes are smaller than or equal to the specified value. This temperature is then considered as the minimum service temperature, providing that the requirements given in B.6.2 are also fulfilled.

B.6.2 Additional tests and/or observation

The result of the visual examination of the test specimen shall be noted.

B.7 Accuracy of measurements

NOTE It has not been possible to include a statement on the accuracy of the method in this edition of the standard, but it is intended to include such a statement when the standard is next revised.

B.8 Test report

The test report shall include the following information:

a) reference to this European Standard;

b) product identification:

1) product name, factory, manufacturer or supplier;

2) production code number;

3) type of product;

4) packaging;

5) form in which the product arrived at the laboratory;

6) other information as appropriate, e.g. declared dimensions, declared density;

c) test procedure:

1) pre-test history and sampling, e.g. who sampled and where;

2) conditioning;

3) if any deviation from B.4 and B.5;

4) date of testing;

5) dimensions and number of test specimens;

6) the chosen temperature decrease rate;

7) general information relating to the test;

8) events which may have affected the results;

Information about the apparatus and identity of the technician should be available in the laboratory but it need not be recorded in the report.

d) results.

All individual deformation and temperature. All individual values and the mean values of the dimensional changes. Note if dimensional changes are shrinkage or expansion. All individual values and the mean value of the minimum service temperature. Note the visual evaluation. Additional results as specified in the relevant clauses of this Annex or the relevant product standard or any other European technical specification.

B.9 Modifications of and additions to the general test method for polyurethane and polyisocyanurate foam

B.9.1 General

For polyurethane and polyisocyanurate foams with a substantially closed cell structure aimed at temperature applications lower than - 150 °C, the following additional tests shall be carried out to determine the *f* factor which shall be compared to the required value imposed in the relevant product standard.

NOTE The factor *f* qualifies the resistance of the product against cracking due to thermal stresses.

B.9.2 Test specimens

B.9.2.1 Dimensions of test specimens

The test specimens shall have dimensions, as indicated in Figure B.1.

NOTE The reduced dimensions are needed to control the temperature homogeneity.

B.9.2.2 Number of test specimens

Five test specimens shall be used.

B.9.3 Procedure

Cool down the test specimen to the expected minimum service temperature and stabilize them for at least 3 h.

Measure the tensile strength of the product at the expected minimum service temperature in accordance with EN 1608 choosing a constant speed of crosshead, such that rupture shall occur in from 3 min to 6 min.

Measure the dimensional change in relation to the tensile force at the expected minimum service temperature in accordance with EN 1608.

Use at least five test specimens.

Determine the coefficient of thermal linear contraction from (23 ± 2) °C to the expected minimum service temperature, in the same foam-rise direction in which the tensile strength has been measured, in accordance with EN 13471. Other methods may be applied to determine the linear contraction under the condition that at least the same accuracy as given in EN 13171 is achieved.

Use at least three test specimens.

B.9.4 Calculation and expression of results

For each test specimen used for the tensile strength test, calculate the modulus of elasticity at the minimum service temperature by dividing the tensile strength by the dimensional change.

Calculate the factor f using the following formula:

$$f = \frac{\sigma(1-\delta)}{\sum \alpha \cdot \Delta T} \tag{B.4}$$

where

σ is the average tensile strength of the material at the minimum service temperature (MPa);

δ is the Poisson's ratio at the minimum service temperature; for polyisocyanurate foams, it shall be estimated to be 0,4;

NOTE Other values may be used if substantiated by experimental data.

Σ is the average tensile modulus of elasticity at the minimum service temperature (MPa);

α is the average linear contraction coefficient at the minimum service temperature (mm/mmK);

ΔT is the temperature difference between the minimum service temperature and + 23 °C.

If the calculated *f* factor is lower than the value specified in the relevant product standard, the test and the calculation shall be repeated at a less cold temperature until the factor *f* is equal to or greater than the specified value. This temperature is then considered as the minimum service temperature, provided that the requirements corresponding to B.1 to B.8 of this annex are also met at this temperature.

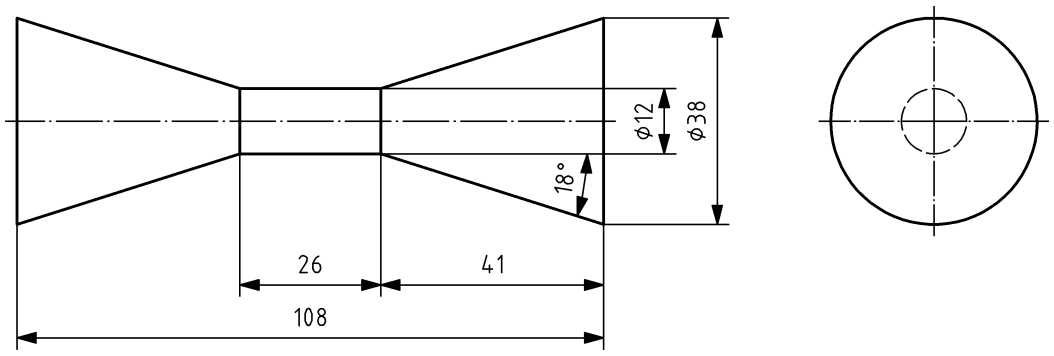

Figure B.1 — Dimensions of test specimens

Annex C(normative)

Determination of the aged value of thermal conductivity and thermal resistance

C.1 General

This annex describes methods which are used to take account of the ageing effect, which when it occurs is due to changes in the cell gas composition with time. These methods give a prediction of the 'time averaged' aged value over 25 years.

The determination of the aged value shall be made by a combination of the normality test and the calculation method (fixed increment procedure, C.4) or by the direct measurement method (accelerated ageing procedure, C.5). The sampling and test specimen preparation procedure shall be as described in C.2.

NOTE See Figure C.1 for a flow chart of the alternative ageing procedures.

The ageing methods are valid for closed cell PUR/PIR products produced by using high molecular weight blowing agents such as hydro fluorocarbons (e.g. HFC365mfc, HFC134a, HFC245fa, 227ea) and hydrocarbons (e.g. pentanes), which substantially stay in the products for time periods well in excess of those required for an economically reasonable life. These blowing agents are therefore called 'permanent'. They can be used mixed together with carbon dioxide (CO_2). CO_2 is a 'non-permanent' blowing agent, which may readily diffuse out of the product. Ageing of the thermal properties of PUR/PIR products is therefore predominantly caused by the inward diffusion of air into the product and outward diffusion of CO_2, if diffusion tight facings do not prevent both.

PUR/PIR products blown only with CO_2 are also covered by these ageing methods.

For mixtures of permanent blowing agents the following procedures shall be followed:

— If the accelerated ageing procedure of C.5 is used, the safety increment in accordance with Table C.5 for that blowing agent in the mixture with the highest value shall be used.

— If the fixed increment method of C.4 is used, the normality test shall be performed first. The result from the normality test will give the decision, which increment shall be taken. If the result is not higher than the required limit value in C.4.2 for a certain blowing agent in the mixture, the increment in accordance with Tables C.1, C.2, C.3 and C.4 for this blowing agent shall be taken to determine the aged value of thermal conductivity.

If new blowing agents are shown to be 'permanent types' (meaning having diffusion coefficients similar to the established values for pentane, hydro chlorofluorocarbons and hydro fluorocarbons), the ageing methods defined in this Annex can be used. New limit values for the fixed increment procedure (C.4) and different safety increments for the accelerated ageing procedure (C.5) may be required.

C.2 Sampling and test specimen preparation

Select a product sample such that the area dimensions of the product sample shall not be less than those specified in Table A.1 of EN 12667:2001 which correspond to the product thickness, or shall be equal to the maximum product dimensions.

Condition the product sample at (23 ± 3) °C and (50 ± 10) % relative humidity for at least 16 h before cutting the test specimen.

Cut the test specimen from the central area of the product sample. The test specimens shall conform to those specified in Table A.1 of EN 12667:2001.

If a facing is included in a product, the facing shall remain on the product during measurement provided they do not interfere with the thermal resistance measurements.

C.3 Determination of the initial value of thermal conductivity

The initial value of the thermal conductivity shall be derived from the measurement of the thermal resistance made one day to eight days after manufacture.

Prepare the test specimen for thermal resistance measurements in accordance with C.2.

Measure the thermal resistance of the test specimen in accordance with EN 12667 and EN 12939 and 5.3.2 of this standard. Calculate and report at least two initial values of thermal conductivity to the nearest 0,000 1 W/(m·K).

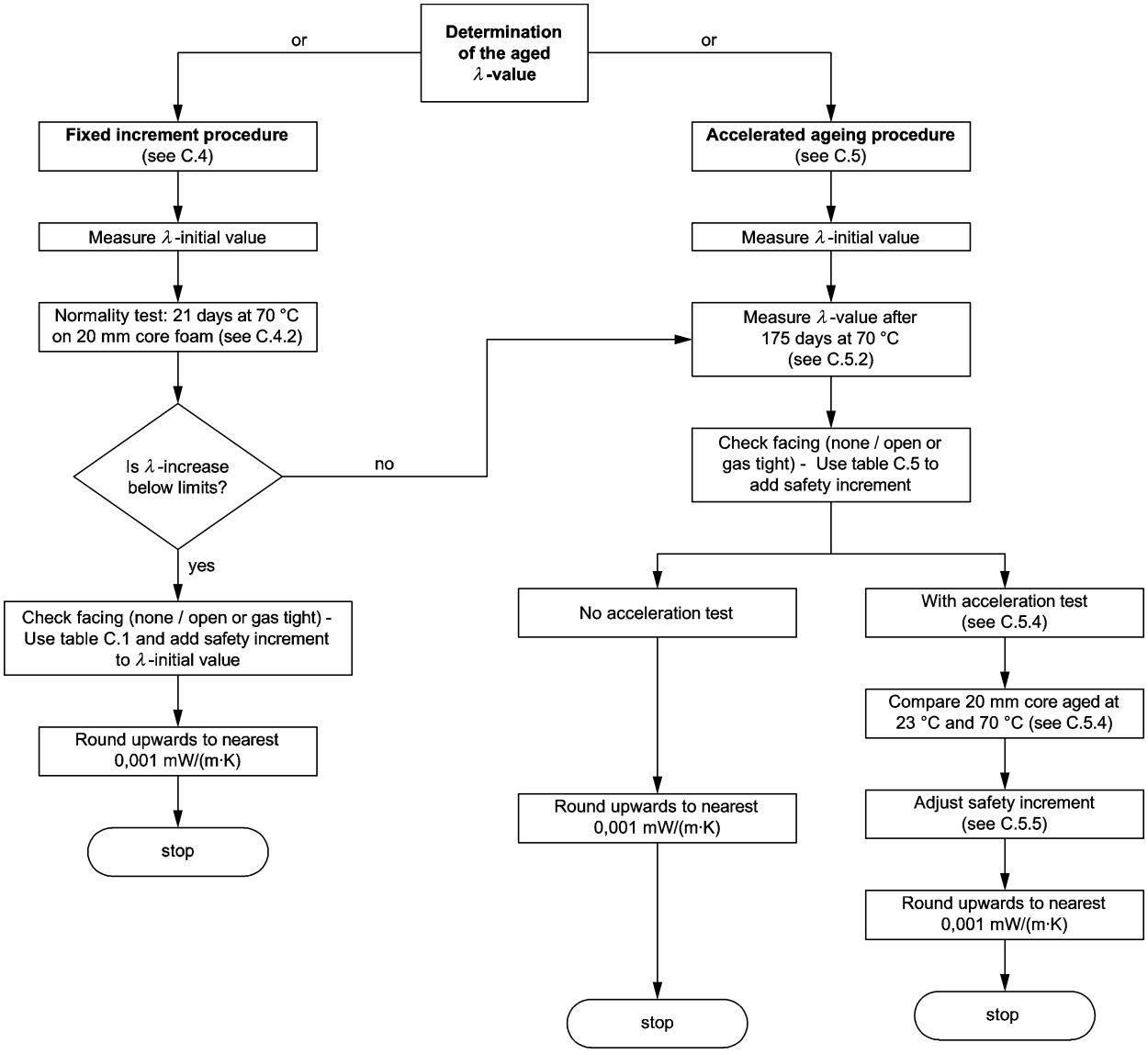

Figure C.1 — Flow chart of the alternative ageing procedures

C.4 Fixed increments procedure

C.4.1 Conditions

The fixed increment procedure described below shall only be used if:

— the product has fulfilled the requirements of the normality test given in C.4.2, except for CO_2 blown only products;

— CO_2 blown only products have a closed cell content, determined according to EN ISO 4590, of not less than 90 %;

— the product contains any of the blowing agents such as pentanes and/or hydro fluorocarbons or a mixture of any of these with CO_2, or only CO_2;

— for products with diffusion tight facings, these facings shall consist of a metal sheet with thickness not less than 50 µm or the facings shall show an equivalent performance. Faced products, which do not show an increase of the thermal conductivity of more than 0,001 W/m·K when tested for (175 ± 5) days at (70 ± 2) °C are considered to be covered with diffusion tight facings (maximum size of the sample 800 mm × 800 mm and maximum thickness 50 mm).

NOTE The diffusion tight property of a facing can also be proven, if the oxygen diffusion level is less than 4,5 cm^3 per 24 h per m^2 when measured at 20 °C in accordance with ASTM 3985, Standard test method for oxygen gas transmission rate through plastic film and sheeting using a coulometric sensor.

— The dimensions of rectangular products which have diffusion tight facings are not less than 600 mm × 800 mm.

For products with diffusion tight facings which have smaller dimensions than these limits values, either the procedure given in C.5 should be followed or the fixed increments for diffusion open facings given in Tables C.1, C.2, C.3 and C.4.

C.4.2 Normality test

Products blown with permanent blowing agents shall fulfil the requirements of the following procedure:

— select a product sample (one to eight days after manufacture) and condition it for 16 h at (23 ± 3) °C and (50 ± 10) % relative humidity;

— cut a test specimen of minimum dimensions 200 mm length and width × 20 (+ 2/- 0) mm thickness from the central area of the product sample;

— determine the initial value of thermal conductivity of the test specimen in accordance with C.3;

— store the test specimen at (70 ± 2) °C for (21 ± 1) days;

— after reconditioning for 16 h at (23 ± 3) °C and (50 ± 10) % relative humidity determine the aged value of thermal conductivity of the test specimen in accordance with EN 12667 and EN 12939 and 5.3.2 of this standard.

The difference between the aged and the initial values of thermal conductivity shall not be more than

— 0,007 5 W/(m·K) for HFC134a blown products;

— 0,006 W/(m·K) for HFC365mfc,227 ea or HFC245fa blown products;

— 0,006 W/(m·K) for pentane blown products.

If the difference is more than the values stated herein, the fixed increment method cannot be used and the thermal conductivity shall be determined in accordance with C.5.

C.4.3 Calculation of the aged value of thermal conductivity

The aged values of thermal conductivity shall be determined by adding fixed increments to all initial values of thermal conductivity. As mentioned earlier, initial values need to be measured at least at two mean temperatures.

Determine the initial value of thermal conductivity in accordance with C.3.

Depending on the mean temperature of lambda measurement, add the relevant increment to the initial value, following Table C.1.

Report at least two calculated aged value of thermal conductivity to the nearest 0,000 1 W/(m·K).

Table C.1 — Increments for calculating the aged value of thermal conductivity

Mean temperature of λ measurement (°C)	**Fixed increment to apply**
Lower than - 120 °C	No increment
- 120 °C	Apply increment Table C.2
Between - 120 °C and 10 °C	Linear extrapolation Table C.2 and C.3
10 °C	Apply increment Table C.3
Between 10 °C and 120 °C	Linear extrapolation Table C.3 and C.4
120 °C	Apply increment Table C.4

Table C.2 — Increments for calculating the aged value of thermal conductivity T_{mean} = - 120 °C

Blowing agent	**λ increment** W/(m·K)						
	Facing type						
	None or two sides diffusion open			**One side diffusion open**			**Two sides diffusion tight**
	Declared thickness			**Declared thickness**			
	d_D < 80 mm	80 mm ≤ d_D > 120 mm	d_D ≥ 120 mm	d_D < 40 mm	40 mm ≤ d_D < 60 mm	d_D ≥ 60 mm	
Pentane	0,001 5	0,001 0	0,000 5	0,001 5	0,001 0	0,000 5	0,000 5
HFC365mfc HFC245fa,227 ea	0,001 5	0,001 0	0,000 5	0,001 5	0,001 0	0,000 5	0,000 5
HFC134a	0,001 5	0,001 0	0,000 5	0,001 5	0,001 0	0,000 5	0,000 5
CO_2	0,002 0	0,001 5	0,001 0	0,002 0	0,001 5	0,001 0	0,001 0

Table C.3 — Increments for calculating the aged value of thermal conductivity T_{mean} = + 10 °C

Blowing agent	λ **increment** W/(m·K)						
	Facing type						
	None or two sides diffusion open			**One side diffusion open**			**Two sides diffusion tight**
	Declared thickness			**Declared thickness**			
	d_D < 80 mm	80 mm ≤ d_D > 120 mm	d_D ≥ 120 mm	d_D < 40 mm	40 mm ≤ d_D < 60 mm	d_D ≥ 60 mm	
Pentane[a]	0,005 8	0,004 8	0,003 8	0,005 8	0,004 8	0,003 8	0,001 5
HFC365mfc HFC245fa, 227ea [a]	0,006 0	0,004 8	0,003 8	0,006 0	0,004 8	0,003 8	0,001 5
HFC134a	0,007 5	0,006 5	0,005 5	0,007 5	0,006 5	0,005 6	0,002 5
CO_2	0,010 0	0,010 0	0,010 0	0,010 0	0,010 0	0,010 0	0,006 0

[a] If in a blowing agent mixture pentane is used together with HFC 245fa or/and 227ea or/and 365 mfc, the increment of 0,006 W/m·K for these HFC for d_D < 80 mm shall be used for such a blowing agent mixture.

Table C.4 — Increments for calculating the aged value of thermal conductivity T_{mean} = + 120 °C

Blowing agent	λ **increment** W/(m·K)						
	Facing type						
	None or two sides diffusion open			**One side diffusion open**			**Two sides diffusion tight**
	Declared thickness			**Declared thickness**			
	d_D < 80 mm	80 mm ≤ d_D > 120 mm	d_D ≥ 120 mm	d_D < 40 mm	40 mm ≤ d_D < 60 mm	d_D ≥ 60 mm	
Pentane	0,006 8	0,005 8	0,004 8	0,006 8	0,005 8	0,004 8	0,002 5
HFC365mfc HFC245fa, 227ea	0,006 8	0,005 8	0,004 8	0,006 8	0,005 8	0,004 8	0,002 5
HFC134a	0,008 5	0,007 5	0,006 5	0,008 5	0,007 5	0,006 5	0,005 5
CO_2	0,010 0	0,010 0	0,010 0	0,010 0	0,010 0	0,010 0	0,006 0

Example of linear extrapolation of λ increments

Pentane blown foam of 5 cm thickness, one side diffusion open, λ_l measurement at mean T of - 80 °C

Table C.2. (- 120 °C) reads 0,001 0 W/m·K

Table C.3. (+ 10 °C) reads 0,004 8 W/m·K

Linear extrapolation yields 0,002 2 W/m·K

C.5 Determination of the accelerated aged value of thermal conductivity

C.5.1 Procedure

The accelerated aged value of thermal conductivity shall be determined according to the following procedure:

— measure the accelerated aged value in accordance with C.5.2;

— add safety increment in accordance with C.5.3.

For diffusion open products it is allowed to carry out an acceleration test in accordance with C.5.4. Depending on the outcome of this acceleration test the safety increments of C.5.3 may be reduced in accordance with C.5.5.

NOTE This acceleration does not simulate a real ageing effect at low temperature (<0 °C) and therefore will not reflect the real ageing in the application.

C.5.2 Measurement of the accelerated aged value of thermal conductivity

The full product, including any facings, shall be tested. The area dimensions of the product sample shall not be less than those specified in Table A.1 of EN 12667:2001 which correspond to the product thickness, or shall be equal to the product dimensions. For products with diffusion tight facings the maximum size of the product sample shall be 800 mm × 800 mm.

The measured accelerated aged value of thermal conductivity shall be derived from the aged thermal resistance obtained after subjecting the product sample to the accelerated ageing treatment.

This ageing treatment shall begin not earlier than one day after manufacture and preferably not later than 50 days after manufacture.

Store the product sample at (70 ± 2) °C for (175 ± 5) days.

Prepare the test specimen for thermal resistance measurement in accordance with C.2. Measure the thermal resistance of the test specimens in accordance with EN 12667 and EN 12939 and 5.3.2.

Calculate and report the measured accelerated aged thermal conductivity value to the nearest 0,000 1 W/(m·K).

C.5.3 Addition of the safety increments (to be used with the accelerated ageing procedure only)

The value obtained under C.5.2 shall be increased with the safety increments as shown in the Table C.5.

Table C.5 — Safety increments to be added to the measured accelerated aged value of thermal conductivity

Type of product / facing	**Blowing agent technology** [a]	**Safety increment in** W/(m·K) **for products with declared thickness** $d_D \leq 80$ mm	**Safety increment in** W/(m·K) **for products with declared thickness** $d_D > 80$ mm
Cut foam without facing	Pentane, HFC 245fa, 227 ea, 365 mfc	0,001 0	0,002 0
	HFA 134a	0,001 5	0,002 5
Faced with diffusion open facings	Pentane, HFC 245fa, 227 ea, 365 mfc	0,001 0	0,001 5
	HFA 134a	0,001 5	0,002 0
Faced with diffusion tight facings [b]	Pentane, HFC 134 a, 245 fa, 227 ea, 365 mfc	0,001 0	0,001 0

[a] Safety increments for 100 % CO_2 - blown products will be determined when sufficient information is available.

[b] See C.4.1 for the definition of diffusion tight facings.

When requested the manufacturer shall state the type of blowing agent used for the product.

Report the value to the nearest 0,000 1 W/(m·K). This value shall be used to determine the aged value of thermal conductivity, if no acceleration test data are providing additional information (see C.5.4 and C.5.5).

C.5.4 Acceleration test (optional and for diffusion open products only, in combination with the accelerated ageing procedure)

Select a product sample (one to eight days after manufacture) and condition it for 16 h at (23 ± 3) °C and (50 ± 10) % relative humidity.

Cut two test specimens adjacent to each other of minimum dimensions 200 mm length and width × 20 (+2/-0) mm thickness from the central area of the product sample.

Determine the initial values of thermal conductivity of the two test specimens in accordance with C.3. The determined initial values of thermal conductivity shall not differ by more than 0,000 5 W/(m·K). In case of larger differences new test specimens shall be sampled.

Store one test specimen at (70 ± 2) °C and the other test specimen at (23 ± 3) °C for such a time that the increase of the value of thermal conductivity has reached in both cases 0,003 W/(m·K) to 0,004 W/(m·K) and determine at least six values of thermal conductivity of each specimen within this range of thermal conductivity increase.

If the test specimen is reconditioned at room temperature for measurement of the value of thermal conductivity between subsequent accelerated ageing treatment at 70 °C, the time of conditioning shall be between 1 h to 2 h. The actual time of accelerated ageing at 70 °C shall be recorded.

Make plots of the values of thermal conductivity with time for ageing at 70 °C and at 23 °C and shift the time axis with a factor such that the two curves overlap. The time shift factor used to ensure best overlap of the curves is the acceleration factor. This factor shall be reported to the first decimal digit.

NOTE A software tool will be made available which will do this correlation automatically and thus mathematically derive the acceleration factor.

C.5.5 Determination of the accelerated aged value of thermal conductivity considering the acceleration factor (optional method and for diffusion open products only, in combination with the accelerated ageing procedure)

If a manufacturer chooses to carry out the acceleration test given in C.5.4 then the thermal conductivity determined for a product in C.5.3 may be amended as follows:

— if an acceleration factor of greater than 12 has been found the appropriate safety increment derived from Table C.5 shall be removed;

— if an acceleration factor of 8 to 12 inclusive has been found the value of thermal conductivity obtained in C.5.3 shall be reduced by 0,001 W/(m·K);

— in all other cases the value from C.5.3 shall remain unchanged.

Report the aged value of thermal conductivity to the nearest 0,000 1 W/(m·K).

C.6 Declaration of the aged value of thermal resistance and thermal conductivity

C.6.1 General

The statistical variation as required in Annex A for the declaration of thermal resistance and/or thermal conductivity shall be calculated using either the initial or the aged values of thermal conductivity.

The initial values shall be determined in accordance with C.3 and the aged values in accordance with C.4 or C.5.

C.6.2 Product grouping

The manufacturer shall declare either

— separate thermal values for each single product and each single thickness and then determine the $\lambda_{90/90}$ value on each thickness for each product

or

— a thermal value for a product group including all or a range of thicknesses using the $\lambda_{90/90}$ value of this product group for the corresponding thickness range. Separate product groups shall be established for products without facing, for products with diffusion open facing and for products with diffusion tight facing.

The manufacturer shall decide whether to create groups and the size of the groups the determined thermal values of thin, medium and thick products shall be included in the statistics of a product group which covers all thicknesses or a range of thicknesses.

A minimum of 10 initial values shall be determined for each product group.

Annex D(informative)

Additional properties

D.1 General

The manufacturer may choose to give information on the following additional properties (see Table D.1).

This information, where appropriate for the product and the application, should be given as limit values for each test result obtained from the referenced test method, sampling and conditioning, as given in Table D.1.

D.2 Coefficient of thermal expansion

The coefficient of thermal expansion, α_{m}, if voluntarily declared, will be determined in accordance with EN 13471. If the coefficient of thermal expansion is declared, no test result should be greater than the declared value, TE.

D.3 Water vapour transmission of preformed pipe insulation

Water vapour transmission of preformed pipe sections, if voluntarily declared, will be determined in accordance with EN 13469, and expressed as the water vapour diffusion resistance factor, μ, for homogeneous products or the water vapour resistance, Z, for faced or non homogeneous. If the water vapour transmission of preformed pipe insulation is declared, no test result of the water vapour diffusion resistance, μ, or the water vapour resistance, Z, should be less than the declared value.

D.4 Tensile strength perpendicular to faces

Tensile strength perpendicular to faces, σ_{mt}, if voluntarily declared, will be determined in accordance with EN 1607. If the tensile strength perpendicular to faces is declared, no test result should be less than the declared value, TR.

D.5 Shear strength

Shear strength of boards, τ, if voluntarily declared, will be determined in accordance with EN 12090. If the shear strength is declared, no test result should be less than the declared value, SS.

D.6 Bending strength

Bending strength of boards, σ_{b}, if voluntarily declared, will be determined in accordance with EN 12089, *Thermal insulating products for building applications — Determination of bending behaviour*. If the bending strength is declared, no test result should be less than the declared value, BS.

D.7 Cell gas composition

Cell gas composition should be determined with gas chromatograph.

D.8 Cryogenic application

Because of the dangers of exploding organic substances in the presence of liquid oxygen, it is recommended to consult the manufacturer if PUR/PIR products are to be used below - 180 °C.

D.9 Density

Apparent density of blocks and boards is a useful parameter, among others, for the identification but it should not be used as a basis for the quality assessment of rigid polyisocyanurate and rigid polyurethane foam products.

Apparent density of boards, if voluntarily declared by the manufacturer, will be determined in accordance with EN 1602.

Apparent density of pipe sections, segments and prefabricated ware, if voluntarily declared by the manufacturer, will be determined in accordance with EN 13470.

Table D.1 — Test methods, test specimens, conditions and minimum testing frequencies

Dimensions in millimetres

Clause		Test method	Test specimens dimensions[a]	Minimum number of measurements to get one test result	Specific conditions	Factory production control[b]
No.	Title					Minimum product testing frequencies[b]
D.2	Coefficient of thermal expansion	EN 13471	50 × 10 × 10	1	—	1 per 5 years
D.3	Water vapour transmission of preformed pipe insulation	EN 13469	As per test method	2	—	1 per 5 years
D.4	Tensile strength perpendicular to faces	EN 1607	50 × 50	3	—	1 per 5 years
D.5	Shear strength	EN 12090	250 × 50	3	—	1 per 5 years
D.6	Bending strength	EN 12089	300 × 150	—	Method B	1 per 5 years
D.7	Cell gas composition	Gas chromatograph[c]	—	—	—	1 per 5 years

[a] Full size product thickness, unless otherwise stated.

[b] Only relevant in case of declaration of the property.

[c] Literature reference – S. Lohmeyer, G. Müller, *Determination of the cell gas amount and composition in polyurethane foams,* Journal of cooling technic and air conditioning (Kältetechnik Klimatisierung), 22nd year, volume 3 (1970), pages 291–295.

Annex ZA
(informative)

Clauses of this European Standard addressing the provisions of the EU Construction Products Regulation

ZA.1 Scope and relevant characteristics

This European Standard has been prepared under Mandate M/103[1)] "Thermal insulation products" given to CEN by the European Commission and the European Free Trade Association.

If this European standard is cited in the Official Journal of the European Union (OJEU), the clauses of this standard, shown in this annex, are considered to meet the provisions of the relevant mandate, under the Regulation (EU) No. 305/2011.

This annex deals with the CE marking of the factory made rigid polyurethane foam (PUR) and polyisocyanurate foam (PIR) intended for the use indicated in Table ZA.1 and shows the relevant clauses applicable.

This annex has the same scope as Clause 1 of this standard related to the aspects covered by the mandate and is defined by Table ZA.1.

Table ZA.1 — Relevant clauses for factory made rigid polyurethane foam (PUR) and polyisocyanurate foam (PIR) products and intended use

Product:	Factory made rigid polyurethane foam (PUR) and polyisocyanurate foam (PIR) products		
Intended use:	Thermal insulation for Building Equipment and Industrial Installations (ThIBEII)		
Essential Characteristics	**Clauses in this and other European standard(s) related to essential characteristics**[d]	**Regulatory classes**	**Notes**
Thermal resistance	4.2.1 Thermal conductivity	—	Declared λ_D curve or table vs. temperature
	4.2.2 Dimensions and tolerances	—	Flat products: Declared thickness d_D Linear products: Inner diameter D_i, thickness d_D
Reaction to fire	4.2.4 Reaction to fire	Euroclasses	Flat products: Euroclass for flat products Linear products with outer diameter ≤ 300 mm: Euroclass for linear products Linear products outer diameter ≥ 300 mm: Euroclass for flat products

1) As amended by mandates M126, M130 and M367

Product:	Factory made rigid polyurethane foam (PUR) and polyisocyanurate foam (PIR) products
Intended use:	Thermal insulation for Building Equipment and Industrial Installations (ThIBEII)

Essential Characteristics	**Clauses in this and other European standard(s) related to essential characteristics**[d]	**Regulatory classes**	**Notes**
Durability of thermal resistance against high temperature	4.2.1 Thermal conductivity	—	Declared λ_D curve or table vs. temperature
	4.3.2 Maximum service temperature	—	Declared ST(+)
Durability of thermal resistance against ageing/degradation	4.2.1 Thermal conductivity	—	Declared λ_D curve or table vs. temperature
	4.2.2 Dimension and tolerances	—	—
	4.2.3 Dimensional stability under specified conditions	—	Declared DS(TH) [b]
	4.2.5 Durability characteristics	—	—
	4.3.2 Maximum service temperature	—	Declared ST(+)
	4.3.3 Minimum service temperature	—	Declared ST(-)
	4.3.7 Closed cell content	—	Declared CV
Durability of reaction to fire against ageing/degradation	4.2.5 Durability characteristics	Euroclasses	[a]
Compressive strength	4.3.4 Compressive resistance	—	Declared CS
Water permeability	4.3.6 Water absorption	—	Declared W_{lt} or W_p
Water vapour permeability	4.3.5 Water vapour diffusion resistance	—	Declared MU, Z, WVT, WVP or WVPE
	4.3.7 Closed cell content		Declared CV
Rate of release of corrosive substances	4.3.8 Trace quantities of water-soluble ions and the pH-value	—	Declared Cl, F, Si, Na or pH
Release of dangerous substances to the indoor environment	4.3.9 Release of dangerous substances	—	[c]
Continuous glowing combustion	4.3.10 Continuous glowing combustion	—	[c]

[a] No change in reaction to fire properties for polyurethane foam (PUR) and polyisocyanurate foam (PIR) products. The fire performance of polyurethane foam (PUR) and polyisocyanurate foam (PIR) does not deteriorate with time. The Euroclass classification of the product is related to the organic content, which cannot increase with time.

[b] For thickness only

[c] European test methods are under development.

[d] Also valid and applicable for multilayers

The declaration of the product performance related to certain essential characteristics is not required in those Member States (MS) where there are no regulatory requirements on these essential characteristics for the intended use of the product. In this case, manufacturers placing their products on the market of these MS are not obliged to determine nor declare the performance of their products with regard to these essential characteristics and the option "No performance determined" (NPD) in the information accompanying the CE marking and in the declaration of performance (see ZA.3) may be used for those essential characteristics.

ZA.2 Procedures for AVCP of factory made rigid polyurethane foam (PUR) and polyisocyanurate foam (PIR) products

ZA.2.1 Systems of AVCP

The AVCP systems of factory made rigid polyurethane foam (PUR) and polyisocyanurate foam (PIR) products indicated in Table ZA.1, established by EC Decision 95/204/EC of 31.05.95 (OJ L 129) revised by decision 99/91/EC of 25.01.99 (OJ L 29) amended by the decision 01/596/EC of 08.01.01 (OJ L 209) is shown in Table ZA.2 for the indicated intended use and relevant level(s) or class(es) of performance.

Table ZA.2 — Systems of AVCP

Product(s)	Intended use(s)	Level(s) or class(es) (reaction to fire)	AVCP system(s)
Thermal insulation products (Factory made products)	For uses subject to regulations on reaction to fire	(A1, A2, B, C)[a]	1
		(A1, A2, B, C)[b], D, E	3
		(A1 to E)[c], F	4
	Any	—	3
System 1: See Regulation (EU) No. 305/2011 (CPR) Annex V, 1.2 System 3: See Regulation (EU) No. 305/2011 (CPR) Annex V, 1.4 System 4: See Regulation (EU) No. 305/2011 (CPR) Annex V, 1.5			

[a] Products/materials for which a clearly identifiable stage in the production process results in an improvement of the reaction to fire classification (e.g. an addition of fire retardants or a limiting of organic material).

[b] Products/materials not covered by footnote ([a]).

[c] Products/materials that do not require to be tested for reaction to fire (e.g. products/materials of classes A1 according to Commission Decision 96/603/EC, as amended).

The AVCP of the factory made rigid polyurethane foam (PUR) and polyisocyanurate foam (PIR) products in Table ZA.1 shall be according to the AVCP procedures indicated in Tables ZA.3.1 to ZA.3.3 resulting from application of the clauses of this or other European Standard indicated therein. The content of tasks of the notified body shall be limited to those essential characteristics as provided for, if any, in Annex III of the relevant mandate and to those that the manufacturer intends to declare.

Table ZA.3.1 — Assignment of AVCP tasks for factory made rigid polyurethane foam (PUR) and polyisocyanurate foam (PIR) products under system 1 for reaction to fire and system 3 (see Table ZA.2)

Tasks		Content of the task	AVCP clauses to apply
Tasks for the manufacturer	Factory Production Control (FPC)	Parameters related to essential characteristics of Table ZA.1 relevant for the intended use which are declared.	Clause 5, Annexes B and C of EN 13172:2012 and 7.3 of this standard
	Further testing of samples taken at factory according to the prescribed test plan	Essential characteristics of Table ZA.1 relevant for the intended use which are declared	Annex A of this standard
	Determination of the product-type on the basis of type testing (including sampling), type calculation, tabulated values or descriptive documentation of the product	Essential characteristics of Table ZA.1 relevant for the intended use which are declared and not tested by the notified testing laboratory and by the product certification body involved with reaction to fire	Clause 6 of EN 13172:2012 and 7.2 of this standard
Tasks for notified testing laboratory	Determination of the product-type on the basis of type testing (including sampling carried out by the manufacturer), type calculation, tabulated values or descriptive documentation of the product	— Thermal resistance; — Release of dangerous substances[a]; — Compressive strength (for load bearing applications); — Water permeability*;* — Release of corrosive substances *(if relevant).*	Clause 6 of EN 13172:2012 and 7.2 of this standard
Tasks for the notified product certification body	Determination of the product-type on the basis of type testing (including sampling), type calculation, tabulated values or descriptive documentation of the product [b]	— Reaction to fire	Clause 6 of EN 13172:2012 and 7.2 of this standard
	Initial inspection of manufacturing plant and of FPC	Parameters related to essential characteristics of Table ZA.1, relevant for the intended use which are declared, namely reaction to fire. Documentation of the FPC.	Annex B and C of EN 13172:2012 and 7.3 of this standard
	Continuous surveillance, assessment and evaluation of FPC	Parameters related to essential characteristics of Table ZA.1, relevant for the intended use which are declared, namely reaction to fire. Documentation of the FPC.	Annex B and C of EN 13172:2012 and 7.3 of this standard

[a] No test method available yet.

[b] Sampling shall be carried out as defined in 5.1

Table ZA.3.2 — Assignment of AVCP tasks for factory made rigid polyurethane foam (PUR) and polyisocyanurate foam (PIR) products under system 3 (see Table ZA.2)

Tasks		Content of the task	AVCP clauses to apply
Tasks for the manufacturer	Factory Production Control (FPC)	Parameters related to essential characteristics of Table ZA.1 relevant for the intended use which are declared	Clause 5, Annexes C and D of EN 13172:2012 and 7.3 of this standard
	Determination of the product-type on the basis of type testing (including sampling), type calculation, tabulated values or descriptive documentation of the product	Essential characteristics of Table ZA.1 relevant for the intended use which are declared and not tested by the notified testing laboratory	Clause 6 of EN 13172:2012 and 7.2 of this standard
Tasks for a notified testing laboratory	Determination of the product type on the basis of type testing (based on sampling carried out by the manufacturer) or tabulated values	— Reaction to fire; — Thermal resistance; — Release of dangerous substances[a]; — Compressive strength (for load bearing applications); — Water permeability; — Release of corrosive substances *(if relevant).*	Clause 6 of EN 13172:2012 and 7.2 of this standard

[a] No test method available yet.

Table ZA.3.3 — Assignment of AVCP tasks for factory made rigid polyurethane foam (PUR) and polyisocyanurate foam (PIR) products under combined system 4 for reaction to fire and system 3 (see Table ZA.2)

Tasks		Content of the task	AVCP clauses to apply
Tasks for the manufacturer	Factory Production Control (FPC)	Parameters related to essential characteristics of Table ZA.1 relevant for the intended use which is declared	Clause 5, Annexes C and D of EN 13172:2012 and 7.3 of this standard
	Determination of the product-type on the basis of type testing (including sampling), type calculation, tabulated values or descriptive documentation of the product	Essential characteristics of Table ZA.1 relevant for the intended use which are declared and not tested by the notified testing laboratory	Clause 6 of EN 13172:2012 and 7.2 of this standard
Tasks for a notified testing laboratory	Determination of the product type on the basis of type testing (based on sampling carried out by the manufacturer) or tabulated values	— Thermal resistance; — Release of dangerous substances [a]; — Compressive strength (for load bearing applications); — Water permeability; — Release of corrosive substances *(if relevant).*	Clause 6 of EN 13172:2012 and 7.2 of this standard
[a] No test method available yet.			

ZA.2.2 Declaration of Performance (DoP)

ZA.2.2.1 General

The manufacturer draws up the DoP and affixes the CE marking on the basis of the different AVCP systems set out in Annex V of the Regulation (EU) No 305/2011:

In case of products under system 1

— the factory production control and further testing of samples taken at the factory according to the prescribed test plan, carried out by the manufacturer; and

— the certificate of constancy of performance issued by the notified product certification body on the basis of determination of the product type on the basis of type testing (including sampling), type calculation, tabulated values or descriptive documentation of the product; initial inspection of the manufacturing plant and of factory production control and continuous surveillance, assessment and evaluation of factory production control.

In case of products under system 3

— the factory production control carried out by the manufacturer; and

— the determination of the product-type on the basis of type testing (based on sampling carried out by the manufacturer), type calculation, tabulated values or descriptive documentation of the carried out by the notified testing laboratory.

In case of products under system 4

— the factory production control carried out by the manufacturer; and

— the determination by the manufacturer of the product-type on the basis of type testing, type calculation, tabulated values or descriptive documentation of the product.

ZA.2.2.2 Content

The model of the DoP is provided in Annex III of the Regulation (EU) No 305/2011.

According to this Regulation, the DoP shall contain, in particular, the following information:

— the reference of the product-type for which the declaration of performance has been drawn up;

— the AVCP system or systems of the construction product, as set out in Annex V of the CPR;

— the reference number and date of issue of the harmonized standard which has been used for the assessment of each essential characteristic;

— where applicable, the reference number of the Specific Technical Documentation used and the requirements with which the manufacturer claims the product complies.

The DoP shall in addition contain:

a) the intended use or uses for the construction product, in accordance with the applicable harmonized technical specification;

b) the list of essential characteristics, as determined in the harmonized technical specification for the declared intended use or uses;

c) the performance of at least one of the essential characteristics of the construction product, relevant for the declared intended use or uses;

d) where applicable, the performance of the construction product, by levels or classes, or in a description, if necessary based on a calculation in relation to its essential characteristics determined in accordance with the Commission determination regarding those essential characteristics for which the manufacturer shall declare the performance of the product when it is placed on the market or the Commission determination regarding threshold levels for the performance in relation to the essential characteristics to be declared;

e) the performance of those essential characteristics of the construction product which are related to the intended use or uses, taking into consideration the provisions in relation to the intended use or uses where the manufacturer intends the product to be made available on the market;

f) for the listed essential characteristics for which no performance is declared, the letters “NPD” (No Performance Determined).

Regarding the supply of the DoP, article 7 of the Regulation (EU) No 305/2011 applies.

The information referred to in Article 31 or, as the case may be, in Article 33 of Regulation (EC) No 1907/2006, (REACH) shall be provided together with the DOP.

ZA.2.2.3 Example of DoP

The following gives an example of a filled-in DoP for factory made rigid polyurethane foam (PUR) and polyisocyanurate foam (PIR) products for EN 14308

DECLARATION OF PERFORMANCE

No 0123-DoP-2013/10/07

1. Unique identification code of the product-type:

ABCD Rigid polyisocyanurate foam (PIR) pipe section

2. Type, batch or serial number or any other element allowing identification of the construction product as required under Article 11(4) of the CPR:

see product label

3. Intended use or uses of the construction product, in accordance with the applicable harmonized technical specification, as foreseen by the manufacturer:

Thermal Insulation for Building Equipment and Industrial Installations (ThIBEII)

4. Name, registered trade name or registered trade mark and contact address of the manufacturer as required under Article 11(5):

Any Co Ltd, PO Box 21, B-1050

5. Where applicable, name and contact address of the authorized representative whose mandate covers the tasks specified in Article 12(2):

not relevant

6. System or systems of assessment and verification of constancy of performance of the construction product as set out in CPR, Annex V:

Systems 1 and 3

7. In case of the declaration of performance concerning a construction product covered by a harmonized standard:

Notified certification body No. 4567 performed, carried out the determination of the product type, the initial inspection of the manufacturing plant and of factory production control and the continuous surveillance, assessment and evaluation of factory production control and issued the certificate of constancy of performance for reaction to fire. Notified testing laboratory No. 7456 performed the test reports for the other relevant declared characteristics

8. Declared performance

<table>
<tr><th colspan="2">Essential characteristics</th><th colspan="6">Performance</th><th>Harmonized technical specification</th></tr>
<tr><td rowspan="3">Thermal resistance</td><td rowspan="2">Thermal conductivity</td><td>ϑ_m °C</td><td>−75</td><td>−30</td><td>10</td><td>40</td><td>80</td><td rowspan="15">EN 14308:2015</td></tr>
<tr><td>λ_D W/(m·K)</td><td>0,019</td><td>0,024</td><td>0,026</td><td>0,031</td><td>0,037</td></tr>
<tr><td>Dimensions</td><td colspan="6">d_D = 15 mm and above
D_i = 17 - 508 mm</td></tr>
<tr><td colspan="2">Reaction to fire</td><td colspan="6">Outer diameter ≤ 300 mm: C_L-s_2, d_0
Outer diameter > 300 mm: C-s_2, d_0</td></tr>
<tr><td colspan="2">Durability of thermal resistance against high temperature</td><td colspan="6">Maximum service temperature ST(+)120 (=120°C)</td></tr>
<tr><td colspan="2" rowspan="4">Durability of thermal resistance against ageing/degradation</td><td colspan="6">Maximum service temperature ST(+)120 (=120°C)</td></tr>
<tr><td colspan="6">Minimum service temperature ST(-)-170 (=-170°C)</td></tr>
<tr><td colspan="6">Dimensional Stability at specified temperature: DS(TH)3</td></tr>
<tr><td colspan="6">Closed cell content: CV90</td></tr>
<tr><td colspan="2">Durability of reaction to fire against ageing/degradation</td><td colspan="6">Outer diameter ≤ 300 mm: C_L-s_2, d_0
Outer diameter > 300 mm: C-s_2, d_0</td></tr>
<tr><td colspan="2">Compressive strength</td><td colspan="6">Compressive stress at 10 % deformation or yield: CS(10\Y)175 (≥175 kPa)</td></tr>
<tr><td colspan="2">Water permeability</td><td colspan="6">Water absorption W_p 0,25 (≤ 0,25 kg/m^2)</td></tr>
<tr><td colspan="2">Water vapour permeability</td><td colspan="6">WVT 0.1 (≤0,1 g/m^2/d)</td></tr>
<tr><td colspan="2">Rate of release of corrosive substances</td><td colspan="6">Trace quantities of water-soluble chloride ions CL35 (≤35 ppm)
pH-value pH7</td></tr>
<tr><td colspan="2">Release of dangerous substances</td><td colspan="6">NPD</td></tr>
<tr><td colspan="2">Continuous glowing combustion</td><td colspan="6">NPD</td></tr>
<tr><td colspan="9">NPD No Performance Determined, ϑm Mean Temperature</td></tr>
</table>

9. The performance of the product identified in points 1 and 2 is in conformity with the declared performance in point 8. This declaration of performance is issued under the sole responsibility of the manufacturer identified in point 4.

   Signed for and on behalf of the manufacturer by:

   ……

   (Name and function)

   ……..…… ……..……...

   (Place and date of issue) (Signature)

NOTE For characteristics where e.g. the declaration is different for different thickness a Table is needed instead of a single value in the Table above

ZA.3 CE Marking and labelling

The CE marking symbol shall be in accordance with the general principles set out in Article 30 of Regulation (EC) No 765/2008 and shall be affixed visibly, legibly and indelibly:

— to the factory made rigid polyurethane foam (PUR) and polyisocyanurate foam (PIR) product

or

— to a label attached to it.

Where this is not possible or not warranted on account of the nature of the product, it shall be affixed to the packaging or to the accompanying documents.

The CE marking shall be followed by:

— the last two digits of the year in which it was first affixed;

— the name and the registered address of the manufacturer, or the identifying mark allowing identification of the name and address of the manufacturer easily and without any ambiguity;

— the unique identification code of the product-type;

— the reference number of the declaration of performance;

— the level or class of the performance declared;

— the dated reference to the harmonized technical specification applied;

— the identification number of the notified body [only for products under systems 1 and 3];

— the intended use as laid down in the harmonized technical specification applied.

The CE marking shall be affixed before the construction product is placed on the market. It may be followed by a pictogram or any other mark notably indicating a special risk or use.

Figure ZA.1 gives an example of the information related to products subject to AVCP systems 1 and 3 to be given on the product or to a label attached to it.

CE 4567 7456	*CE marking, consisting of the "CE"-symbol* *Identification number of the product certification body* *Identification number of the notified test laboratory/ laboratories*
AnyCo Ltd, PO Box 21, B-1050 13 0123 – DoP – 2013/10/07	*name and the registered address of the manufacturer, or identifying mark* *Last two digits of the year in which the marking was first affixed* *reference number of the DoP*
EN 14308:2015 ABCD Rigid polyisocyanurate foam (PIR) pipe section ThIBEII λ_D DoP RtF C_L-$s2$, d_0 d_D 20 mm PU – EN 14308 – ST(+)120 – ST(-)-170 – DS(TH)3 – CS(10\Y)175 – CL35 – CV90	*No. of European standard applied, as referenced in OJEU* *Unique identification code of the product-type* *Intended use of the product as laid down in the European standard applied* *Declared thermal conductivity* *Reaction to fire – Euroclass* *Declared Thickness* *Designation code (in accordance with Clause 6 of this standard for the relevant characteristics according to Table ZA.1)* *Level or class of the performance declared*

Figure ZA.1 — Example CE marking information of products under AVCP system 1 and system 3

Bibliography

[1] ASTM 3985, *Standard test method for oxygen gas transmission rate trough plastic film and sheeting using a coulometric sensor*

[2] EN 1602, *Thermal insulating products for building applications - Determination of the apparent density*

[3] EN 1607, *Thermal insulating products for building applications - Determination of tensile strength perpendicular to faces*

[4] EN 12089, *Thermal insulating products for building applications - Determination of bending behaviour*

[5] EN 12090, *Thermal insulating products for building applications - Determination of shear behaviour*

[6] EN 12429, *Thermal insulating products for building applications - Conditioning to moisture equilibrium under specified temperature and humidity conditions*

[7] EN 13238, *Reaction to fire tests for building products - Conditioning procedures and general rules for selection of substrates*

[8] EN 13469, *Thermal insulating products for building equipment and industrial installations - Determination of water vapour transmission properties of preformed pipe insulation*

[9] EN 13470, *Thermal insulating products for building equipment and industrial installations - Determination of the apparent density of preformed pipe insulation*

[10] EN 13471, *Thermal insulating products for building equipment and industrial installations - Determination of the coefficient of thermal expansion*

[11] ISO 65, *Carbon steel tubes suitable for screwing in accordance with ISO 7-1*

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