BS EN 14320-1:2013

BSI Standards Publication

Thermal insulating products for building equipment and industrial installations — In-situ formed sprayed rigid polyurethane (PUR) and polyisocyanurate foam (PIR) products

Part 1: Specification for the rigid foam spray system before installation

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National foreword

This British Standard is the UK implementation of EN 14320-1:2013.

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

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Thermal insulating products for building equipment and industrial installations - In-situ formed sprayed rigid polyurethane (PUR) and polyisocyanurate foam (PIR) products - Part 1: Specification for the rigid foam spray system before installation

Produits isolants thermiques pour l'équipement du bâtiment et les installations industrielles - Produits en mousse rigide de polyuréthanne (PUR) ou de polyisocyanurate (PIR) projetée, formés en place - Partie 1 : Spécifications relatives aux systèmes de projection de la mousse rigide avant mise en œuvre

Wärmedämmstoffe für die technische Gebäudeausrüstung und für betriebstechnische Anlagen in der Industrie - An der Verwendungsstelle hergestellter Wärmedämmstoff aus Polyurethan (PUR)- und Polyisocyanurat (PIR)-Spritzschaum - Teil 1: Spezifikation für das Schaumsystem vor dem Einbau

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Foreword

This document (EN 14320-1:2013) has been prepared by Technical Committee CEN/TC 88 “Thermal insulating materials and products”, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by July 2013, and conflicting national standards shall be withdrawn at the latest by July 2013.

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

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

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

This European Standard consists of two parts which form a package. The first part is the harmonised part satisfying the mandate and the CPD and is the basis for the CE marking covering the products, which are placed on the market. The second part, which is the non-harmonised part, covers the specification for the installed products. Both parts need to be used for the application of the insulation products in the end-use applications covered by the EN 14320.

This European Standard is one of a series for expanded perlite, exfoliated vermiculite and polyurethane/polyisocyanurate in-situ formed insulation products used in building equipment and industrial installations, but this standard may be used in other areas where appropriate.

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

This document is one of a series of standards as listed below:

EN 14320, *Thermal insulating products for building equipment and industrial installations — In-situ formed sprayed rigid polyurethane (PUR) and polyisocyanurate foam (PIR) products consists of the following parts:*

— *Part 1: Specification for the rigid foam dispensed system before installation* (the present document)

— *Part 2: Specification for the installed insulation products*

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

1 Scope

This European Standard specifies requirements for in-situ formed sprayed rigid polyurethane (PUR) and polyisocyanurate (PIR) foam products for the insulation of building equipment and industrial installations, for example storage vessels, pipes and ducts used for the supply of fuels, oil, other liquids, hot and cold water, air and other gases.

Depending on the type of foam products complying with this standard, they may have service temperature ranges which lie within the limits of ± 200 °C.

This Part 1 of this European Standard is a specification for the rigid foam system before installation.

Part 1 of this European Standard describes the product characteristics and it includes procedures for testing, marking and labelling and the rules for evaluation of conformity.

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

This European Standard does not cover factory made rigid polyurethane or polyisocyanurate foam insulation products or in-situ products intended to be used for the insulation of buildings.

This standard does not specify performance requirements for direct airborne sound insulation and acoustic absorption applications.

NOTE Foam products are either called flexible or rigid. The flexible products are used in upholstery and mattresses and are characterised by their ability to deflect, support and recover to their original thickness continually during their in-use phase. Those that are not flexible are termed rigid and do not possess these flexible characteristics. They are mostly used for thermal insulation purposes and vary widely in their compression strength values. Once the cell structure is crushed in a rigid foam, it does not recover its thickness fully. Some of these rigid foams are very low in density with very low compression strengths and are sometimes described “commercially” as “soft foams” or “semi-rigid” foams. This note has been included to clarify that all foams with such descriptions are covered by this standard’s used of the term rigid foam.

2 Normative references

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

EN 312, *Particleboards — Specifications*

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

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

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

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

EN 1602, *Thermal insulating products for building applications — Determination of the apparent density*

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

EN 1607:1996, *Thermal insulating products for building applications — Determination of tensile strength perpendicular to faces*

EN 1609:1996, *Thermal insulating products for building applications — Determination of short term water absorption by partial immersion*

EN 12086:1997, *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 13172:2012, *Thermal insulation products — Evaluation of conformity*

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

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

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

EN 14308:2009, *Thermal insulation products for building equipment and industrial installations — Factory made rigid polyurethane foam (PUR) and polyisocyanurate foam (PIR) products — Specification*

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

EN ISO 1182*, Reaction to fire tests for products — Non-combustibility test (ISO 1182)*

EN ISO 1716*, Reaction to fire tests for products — Determination of the gross heat of combustion (calorific value) (ISO 1716)*

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

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

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

ISO 4590, *Rigid cellular plastics — Determination of the volume percentage of open cells and of closed cells*

3 Terms, definitions, symbols and abbreviations

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in EN ISO 9229:2007 and the following apply.

3.1.1
polyurethane foam PUR
(in-situ formed products)
rigid cellular plastics insulation material or product with a structure based on polymers mainly of the polyurethane type

3.1.2
polyisocyanurate foam PIR
(in-situ formed products)
rigid cellular plastics insulation material or product with a structure based on polymers mainly of the polyisocyanurate type

3.1.3
polyurethane foam PU
rigid cellular plastics insulation materials or products including both polymer types based mainly on polyurethane (PUR) or mainly on polyisocyanurate (PIR) groups

3.1.4
rigid foam spray system
kit of constituent components which when sprayed generates the rigid polyurethane (PUR) or the rigid polyisocyanurate foam (PIR) characterised by the specified properties of the foam generated

3.1.5
isocyanate component
liquid isocyanate material which is one of the components of the rigid foam system

3.1.6
polyol component
liquid polyhydroxyl compound containing an expanding agent, catalysts and other additives which is one of the components of the foam system

3.1.7
cream time
time which has elapsed between the time at which the stirring procedure was started and the moment when the foam is observed as starting to rise (usually measured in seconds)

3.1.8
gel time
time which has elapsed between the time at which the stirring procedure was started and the moment when, by means rod (or a match) applied into the surface of the foam, a polymeric string can be drawn from the foam surface (usually measured in seconds)

3.1.9
tack-free time
time which has elapsed between the time at which the stirring procedure was started and the moment when the middle of the top surface of the foam is no longer tacky to the touch

3.1.10
free-rise density
density of the unfaced cut test specimen taken from the reaction profile test sample (see D.4 and D.5)

3.1.11
mixing ratio
proportions of the components of the rigid foam spray system specified by the manufacturer to be sprayed to generate the rigid polyurethane or polyisocyanurate foam

Note 1 to entry: This can be expressed either as weight or volume ratio or both.

3.1.12
industrial storage vessels
storage vessels used as building equipment or located in industrial installations

3.1.13
service temperature range
temperature range between the minimum and maximum service temperatures (see 4.3.6 and 4.3.7)

3.1.14
production batch
amount of a component produced discontinuously in a single period of time of a rigid foam system

3.1.15
level
given value which is the upper or lower limit of a requirement, where the level is given by the declared value of the characteristic concerned

3.1.16
class
combination of two levels of the same property between which the performance falls, where the level is given by the declared value of the characteristic concerned

3.2 Symbols and abbreviations

3.2.1 Symbols used in this standard

d	is the thickness	mm
$\Delta\varepsilon_l$	is the relative change in length	%
$\Delta\varepsilon_b$	is the relative change in width	%
$\Delta\varepsilon_d$	is the relative change in thickness	%
λ_I	is one test result of thermal conductivity	W/(m·K)
$\Delta\lambda_a$	is the ageing increment from measured aged values of thermal conductivity	W/(m·K)
$\Delta\lambda_f$	is the fixed ageing increment	W/(m·K)
λ_D	is the declared thermal conductivity	W/(m·K)
μ	is the water vapour diffusion resistance factor	-
n	is the number of test results	-
σ_{10}	is the compressive stress at 10 % deformation	kPa
σ_m	is the compressive strength	kPa
σ_a	is the substrate adhesion strength perpendicular to faces	kPa
W_p	is the short term water absorption by partial immersion	kg/m^2
w	is the soluble chloride ion content	mg/kg

3.2.2 Designation codes used in this standard

DS (TH) is the symbol for the declared level for dimensional stability under specified temperature and humidity

CC (x,y) is the symbol for the declared level for compressive creep with x for the extrapolated deformation and y for the corresponding time in years

CCC is the symbol for the declared closed cell content

CS(10\Y) is the symbol for the declared value for compressive stress or strength

CT is the symbol for the declared cream time

GT is the symbol for the declared gel time

TFT is the symbol for the declared tack-free time

TL is the symbol for the declared minimum service temperature

TU is the symbol for the declared maximum service temperature

W is the symbol for the declared short term water absorption by partial immersion

MU is the symbol for the declared water vapour diffusion resistance factor

WC is the symbol for the declared soluble chloride content

FRB is the symbol for the declared beaker free-rise density

FRC is the symbol for the declared core free-rise density

MU is the symbol for the declared value for water vapour resistance factor

A is the substrate adhesion strength perpendicular to faces

3.2.3 Abbreviations used in this standard

PUR is **R**igid **P**oly**U**rethane Foam

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

PIR is **R**igid **P**oly**I**socyanurate foam

ITT is **I**nitial **T**ype **T**est

4 Requirements

4.1 General

The foam properties shall be assessed in accordance with Clause 5. To conform with this standard, foam systems shall meet the requirements of 4.2 and 4.3 as appropriate.

NOTE The range of properties exhibited by PUR products is very wide. The same is true for PIR products and these two ranges often overlap. Though not in every case, generally PIR products have a higher upper service temperature and can perform better in reaction to fire tests. In all cases, for both PIR and PUR products, their individual performance claimed by the manufacturer is described by the levels of properties obtained. Accordingly, therefore, all the declaration clauses will be completed using the term PU to include both PUR and PIR products (see 3.1.3).

One test result for a product property is the average of the measured values on the number of test specimens given in Table 5.

4.2 For all applications

4.2.1 Thickness measurements

Unless otherwise specified by the test method, in all the other test methods involving the measurement of thickness, this shall be carried out using the method given in EN 823.

4.2.2 Thermal conductivity

The thermal conductivity shall be based upon measurements carried out in accordance with EN 12667 or EN 12939 for thick products.

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 and measured using the details given in 5.3.2;

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

— the lowest reference 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 curve, it shall be rounded upwards to the next 0,001 W/(m.K) for the full range of the thermal conductivities.

NOTE The declaration of declared installed thickness for an installed sprayed rigid PU foam is described in EN 14320-2.

4.2.3 Reaction to fire of the products

4.2.3.1 General

The reaction to fire classification of the products not taking into account the end-use application shall be determined in accordance with EN 13501-1 and using data obtained from tests carried out according to procedures in EN ISO 11925-2 and EN 13823 and utilising test specimens conforming to 4.2.3.2 and mounting and fixing procedures in accordance with 4.2.3.3.

The PUR or PIR product may be qualified as one for which the Reaction to Fire classification is not susceptible to change during production of the system, provided that it can be demonstrated (for example with a production control system) that the characteristics responsible for change are within a range where no change of the declared classification for the product occurs.

4.2.3.2 Test specimens

4.2.3.2.1 EN ISO 11925-2

Cut six test specimens 250^{0}_{-1} mm long and 90^{0}_{-1} mm wide and using the product thickness up to a maximum of 60^{0}_{-1} mm thick including the internal facing in accordance with 5.2 of EN ISO 11925-2:2010 from a sample prepared in accordance with B.2 and complying with the requirements of G.3.1.1.

4.2.3.2.2 EN 13823

Prepare five specimens in accordance with G.3.2.1.

4.2.3.3 Mounting and fixing procedures

4.2.3.3.1 EN ISO 11925-2

Test specimens prepared in accordance with 4.2.3.2.1 shall be mounted in the EN ISO 11925-2 test apparatus as specified in G.3.1.

4.2.3.3.2 EN 13823

Test specimens prepared in accordance with 4.2.3.2.2 shall be mounted so that the inner face of the test specimen which is typical of the end use application is in contact with the flame source. In all other respects, the products shall be mounted as specified in G.3.2.

4.2.3.4 Procedures

4.2.3.4.1 EN ISO 11925-2

Apply the test flame to the natural skin of the test specimen as specified in G.3.1.1.

4.2.3.4.2 EN 13823

Expose the internal surface of the test specimen to the test flame (see G.3.2.1 and G.3.2.2).

4.2.4 Reaction profile and free-rise density

The appropriate values for the foam system shall be stated, having been determined in accordance with the procedures given in Annex D.

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 to 4.2.5.7.

4.2.5.2 Durability of reaction to fire against ageing/degradation

The reaction to fire performance of PUR and PIR products does not decrease with time, in the applications covered by this standard.

4.2.5.3 Durability of reaction to fire against high temperature

The reaction to fire performance of PUR/PIR products does not decrease with time for temperatures within the claimed service temperature range.

4.2.5.4 Durability of reaction to fire against biological agents

The reaction to fire performance of PUR/PIR products are not subject to change due to biological agents.

4.2.5.5 Durability of thermal resistance against ageing/degradation

This is covered by 4.2.1, 5.3.2 and Annex C which contains an ageing procedure used to determine the values of the declared aged thermal resistance.

4.2.5.6 Durability of thermal resistance against high temperature

This is covered by 4.2.1, 5.3.2 and Annex C.

4.2.5.7 Durability of thermal resistance against biological agents

The thermal performance of PUR/PIR products is not subject to change due to biological agents.

4.2.6 Closed cell content

The closed cell content shall be determined using the ISO 4590 method and classified as shown in Table 1.

Table 1 — Classes for closed cell content

Class	Closed cell content
CCC1	< 20 %
CCC2	20 % to 80 %
CCC3	> 80 % to 89 %
CCC4	$\geq$ 90 %

4.3 For specific applications

4.3.1 General

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

4.3.2 Water vapour transmission

Water vapour transmission properties shall be determined in accordance with EN 12086, Method B (23 °C, 85 % R.H.). The water vapour resistance shall be declared as the water vapour resistance factor, μ under the symbol MU. No test result shall be lower than the declared value.

4.3.3 Short-term water absorption by partial immersion

The short-term water absorption by partial immersion, W_p, in kg/m^2, shall be declared using with EN 1609:1996, Method B. No test result shall be higher than the declared value.

4.3.4 Compressive stress or compressive strength

Compressive stress at 10 % deformation σ_{10} or the compressive strength, σ_m shall be determined in accordance with EN 826. No test result for either the compressive stress at 10 % deformation, σ_{10} or the compressive strength, σ_m whichever is the smaller, shall be lower than the value, given in Table 2, for the declared level.

Table 2 — Levels for compressive stress or compressive strength

Level	Requirement kPa
CS(10\Y)100	≥ 100
CS(10\Y)150	≥ 150
CS(10\Y)200	≥ 200
CS(10\Y)300	≥ 300
CS(10\Y)400	≥ 400
CS(10\Y)500	≥ 500

For PUR/PIR products the effects of traffic shall be assessed by means of determination of the compressive stress or compressive strength in accordance with EN 826.

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

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

4.3.6 Maximum service temperature

The maximum service temperature, TU, in °C, shall be taken as either the value determined using the method given in EN 14706 or the value declared by the manufacturer, whichever is the lower.

4.3.7 Minimum service temperature

The minimum service temperature, TL, in °C, shall be taken as either the value determined using the method given in 4.3.3 of EN 14308:2009 or the value declared by the manufacturer, whichever is the higher.

4.3.8 Rate of release of corrosive substances

The amount of water soluble chloride shall be determined in accordance with EN 13468 (leaching time of 0,5 h at (100 ± 1) °C), with the soluble chloride content, w, given as the value in ppm of chloride ion per kg.

4.3.9 Substrate adhesion strength perpendicular to faces

The substrate adhesion strength perpendicular to faces, shall be determined in accordance with the procedure given in Annex E. No test result shall be lower than the value given in Table 3 for the labelled level.

Table 3 — Levels for substrate adhesion strength perpendicular to faces

Level	A0	A1	A2	A3	A4
Requirement, kPa	No value determined	≥ 50	≥ 100	≥ 150	≥ 200

4.3.10 Testing for reaction to fire of the products in standardised assemblies simulating end-use application(s)

4.3.10.1 General

The reaction to fire classification taking into account the end-use application(s) should be determined in accordance with Annex G using EN 13501-1 and using data obtained from tests carried out according to the procedures EN ISO 11925-2 and G.3.1 and EN 13823 and using test specimens conforming to G.3.2.1 and mounting and fixing procedures in accordance with G.3.2.8.

NOTE The ignitability procedure using EN ISO 11925-2 in Annex G is identical to the procedure given under F.3.1 and therefore need not be repeated. Accordingly, 4.3.11 contains only information relevant to testing carried out according to EN 13823 in Annex G.

4.3.10.2 Test specimens for the EN 13823 test

Prepare five test specimens in accordance with G.3.2.1.

4.3.10.3 Mounting and fixing procedure

Test specimens prepared in accordance with 4.3.10.2 shall be mounted and fixed according to G.3.2.7 and G.3.2.8.

4.3.11 Continuous glowing combustion

Where subject to regulations, the manufacturer shall declare the continuous glowing combustion of the product. In the absence of a European test method, the compliance with the requirement shall be made on the basis of any existing national test method.

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

4.3.12 Dimensional stability under specified temperature and humidity 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 for (48 ± 1) h at both (-20 ± 3) °C and at (70 ± 2) °C and a relative humidity of (90 ± 5) %.

The relative changes in length, $\Delta\varepsilon_l$, with $\Delta\varepsilon_b$ and thickness $\Delta\varepsilon_d$, shall not exceed the values given in Table 4 for the labelled class.

Table 4 — Levels for dimensional stability under specified temperature and humidity conditions

Test condition	Dimensional changes		Level DS(TH)			
			1	2	3	4
1 (70 ± 2) °C and (90 ± 5) % r.h.	$\Delta\varepsilon_l$ $\Delta\varepsilon_b$	%	≤ 15	≤ 9	≤ 6	≤ 4
	$\Delta\varepsilon_d$	%	≤ 10	≤ 5	≤ 2	≤ 1
2 (-20 ± 3) °C	$\Delta\varepsilon_l$ $\Delta\varepsilon_b$	%	≤ 3	≤ 2	≤ 2	≤ 2
	$\Delta\varepsilon_d$	%	≤ 3	≤ 1	≤ 0,5	≤ 0,5

5 Test methods

5.1 Sampling

Prepare a test sample of thickness not less than 50 mm in accordance with the procedure given in Annex B. Select from this the test specimens required to evaluate the characteristics given in 4.2 and 4.3 in accordance with the details given in Table 5.

5.2 Conditioning

No special conditioning of the test specimens to be used for determining thermal conductivity shall be used. Neither shall they be used for the other properties unless otherwise specified in the test standards. In case of dispute, the test specimens shall be stored at (23 ± 2) °C and (50 ± 5) % relative humidity for at least 16 h prior to testing.

5.3 Testing

5.3.1 General

Table 5 gives the dimensions of the test specimens, the minimum number of test specimens required to get one test result and any specific conditions which are necessary.

5.3.2 Thermal conductivity

Thermal conductivity shall be determined in accordance with EN 12667 or EN 12939 for thick products.

The thermal conductivity shall be determined for the full service temperature range of the product. For factory production control and initial type testing requirements, see Annex A.

For the construction of the thermal conductivity curve from the minimum to the maximum service temperature, the test specimen shall be aged and conditioned in accordance with C.4.2 or C.5.2.

The aged thermal conductivity, λ_D, shall be determined using an aged product in accordance with EN 12667 or EN 12939 for thick products.

Accordingly, the aged thermal conductivity shall be determined under the following conditions:

— A curve of thermal conductivity against temperature shall be constructed, similar to those derived by the EN ISO 13787 procedure, for the claimed service temperature range (3.1.13) appropriate to the product. This is best achieved by using measurements at a minimum of five temperatures distributed throughout this claimed service temperature range as follows. One should be taken close to the maximum service temperature limit. A second one shall be taken close to the minimum service temperature limit. A third one shall be measured at +10 °C and a fourth one close to -30 °C. At least one further additional

measurement shall be chosen by the manufacturer in order to characterise the unique thermal conductivity temperature relationships associated with some of these products in the most appropriate way.

— after conditioning in accordance with C.5.2;

— using a test specimen prepared from the sample prepared according to its end-use application which either has been aged in accordance with C.4.2 or, if a 20 mm thick cut faced test specimen is used, aged according to the normality test procedure given in C.5.2 and tested by the procedure given in C.6.

Aged thermal conductivity values shall be measured directly at the specified temperatures at a measured thickness.

Table 5 — Test methods, specimens and conditions

Dimensions in mm

Clause	Property	Test method	Test specimen		Specific conditions
				Number to get one test result	
4.2.1	Thickness measurements	EN 823	Unless otherwise specified see EN 823	See 4.2.1 of the standard	
4.2.2	Thermal conductivity	EN 12667 EN 12939	See Annex C	1	See Annex C
4.2.3	Reaction to fire of the products	EN 13501-1	See EN 13501-1		
4.2.4	Reaction profile and free-rise density	Annex D	See Annex D	2	
4.2.6	Closed cell content	ISO 4590	See ISO 4590	3 sets	
4.3.2	Water vapour transmission	EN 12086	See EN 12086:1997 (6.1) < 500 cm^2 × 50 or > 500cm^2 × 50	5 3	
4.3.3	Water absorption by partial immersion	EN 1609	200 x 200 × 50	4	
4.3.4	Compressive stress or compressive strength	EN 826	d ≤ 50 : 50 × 50 50 < d ≤100: 100 × 100	3 3	[b]
4.3.5	Release of dangerous substances [b]	-	-	-	-
4.3.6	Maximum service temperature	EN 14706	100 × 100 × 50 [c] 100 × 100 × 100 [d]	1 1	
4.3.7	Minimum service temperature	4.3.3 of EN 14308:2009	1	1	
4.3.8	Rate of release of corrosive substances	EN 13468	10 g of product per test specimen	3	Tested at 100 °C for 0,5 h
4.3.9	Substrate adhesion strength perpendicular to faces	Annex E	100 × 100 × 20 or 50 × 50 × 20	3 5	[e]
4.3.10	Reaction to fire of products in standardised assemblies simulating end-use applications	EN 13501-1	See EN 13501-1		
4.3.11	Continuous glowing combustion	-	-	-	[a]
4.3.12	Dimensional stability under specified temperature and humidity conditions	EN 1604	200 × 200 × 25	3	

[a] Not yet available.
[b] Each individual value shall meet the requirement.
[c] For building equipment products.
[d] For industrial installation products.
[e] No individual value may be more than 25 % below the average value which corresponds to the fixed level.

6 Designation code

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

— PU

— This European Standard number

— Dimensional stability under specified temperature and humidity conditions DS(TH)i

— Reaction profile and free-rise density

  — cream time CTi(*)

  — gel time GTi(*)

  — tack-free time TFTi(*)

  — free-rise density by the core (or beaker) methods FRCi(*) (or FRBi) (*)

— Maximum service temperature TUi

— Minimum service temperature TLi

— Closed cell content CCCi

— Compressive stress or compressive strength CS(10\Y)i

— Rate of release of corrosive substances WCi

— Water vapour transmission MUi

— Short term water absorption by partial immersion Wi

— Substrate adhesion strength perpendicular to faces Ai

where "i" shall be used to indicate the relevant level or value.

Inside (*) replace the * by the temperature of measurement in °C.

The designation code for a PUR/PIR product is illustrated by the following example:

EXAMPLE PU EN 14320-1 - DS(TH)3 - CT5(*) - GT15(*) - TFT25(*) - CCC4 - TU100 - CS(10\Y)2 - FRC32 - W0.06 - WC1-TS0.

7 Evaluation of conformity

7.1 General

The manufacturer or his authorised representative established in the EEA shall be responsible for the conformity of his products with the requirements of this European Standard. The evaluation of conformity shall be carried out in accordance with EN 13172 and shall be demonstrated by:

— initial type testing (ITT);

— factory production control by the manufacturer, including product assessment and tests on samples taken at the factory.

If a manufacturer decides to group his products, it shall be done in accordance with EN 13172.

7.2 Initial type testing

ITT shall be carried out in accordance with EN 13172 for the relevant characteristics declared in accordance with Annex A. ITT for thermal conductivity curves shall be carried out in accordance with EN ISO 13787.

ITT for the λ limit curve shall be obtained by applying the procedures given in 4.2.1 and 5.3.2.

7.3 Factory production control

Factory production control characteristics shall be made for the characteristics in Annex A. The minimum frequencies of test in the factory production control shall be in accordance with Annex A. When indirect testing is used, the correlation to direct testing shall be established in accordance with EN 13172. For thermal conductivity only the initial (unaged) values shall be checked.

8 Marking, labelling and technical information

8.1 Marking and labelling

Foam systems complying with this standard shall be clearly marked either on the delivery note and on a label on the packaging with at least the following information:

— product name or other identifying characteristic;

— name or identifying mark and address of the manufacturer or his authorised representative established in the EEA;

— year of manufacture (the last two digits);

— time of production or traceability code;

— reaction to fire;

— declared thermal conductivity graph versus temperature;

— designation code (as given in Clause 6).

NOTE For CE marking, see Annex ZA.

8.2 Technical information

The foam system supplier shall provide technical Information. This technical information shall consist of at least the following:

— product name or other identifying characteristic;

— name or identifying mark and address of the manufacturer or his authorised representative established in the EEA;

— intended application(s);

— a range of component temperatures and spraying conditions; at least the range of ambient temperature, range of substrate temperature, maximum ambient humidity, maximum substrate moisture content and range of layer thickness;

— temperature limits for substrates;

— suitable substrates;

— storage conditions;

— shelf life;

— mixing ratio;

— additives needed;

— foam system specifications;

— foam properties;

— handling instructions.

Annex A
(normative)

Initial Type Testing (ITT) and Factory Production Control (FPC)

Table A.1 — Minimum product testing frequencies *(1 of 2)*

Clause		ITT [a, b, d] Minimum number of tests	FPC [a] Minimum testing frequency
No.	**Title**		
4.2.2	Thermal conductivity - at 10 °C	4	Every batch tested [g]
	- full service temperature range	1 [e]	1 per 5 years
4.2.3	Reaction to fire of products	1	See Table B.2
4.2.4	Reaction profile and free rise density	4	1 per batch
4.2.6	Closed cell content	4	4 per year or if less than 4 batches per year 1 per batch
4.3.2	Water vapour transmission	4	1 per 5 years
4.3.3	Short term water absorption	4	1 per 5 years
4.3.4	Compressive stress or compressive strength	4	4 per year or if less than 4 batches per year 1 per batch
4.3.5	Release of dangerous substances	[c]	[c]
4.3.6	Maximum service temperature	1	1 per 5 years [f]
4.3.7	Minimum service temperature	1	1 per 5 years
4.3.8	Rate of release of corrosive substances	4	1 per 5 years
4.3.9	Substrate adhesion strength perpendicular to faces	4	1 per 5 years
4.3.10	Reaction to fire of products in standardised assemblies simulating end-use applications	1	1 per 5 years
4.3.11	Continuous glowing combustion	[c]	[c]
4.3.12	Dimensional stability	4	1 per 5 years
Annex C	Accelerated aged value of thermal conductivity in accordance with C.4.2	4	1 per 2 years
	Acceleration test in accordance with C.4.4	4	
	Diffusion tightness of facing in accordance with C.5.1	4	
	Normality test in accordance with C.5.2	4	

Table A.1 — Minimum product testing frequencies *(2 of 2)*

[a] In line with EN 13172, the minimum testing frequencies, expressed in test results, shall be understood as the minimum for each batch. In addition to the testing frequencies given above, testing of relevant properties of the product shall be repeated when changed or modifications are made that are likely to affect the conformity of the product.

[b] ITT, see EN 13172 and is only relevant when properties are declared.

[c] Frequencies are not given. When drafting this standard, no European harmonised test method was available.

[d] Minimum number of tests may be reduced according to EN 13172. For initial type testing of long term thermal and mechanical properties, test results of similar products produced at different plants will be recognised until testing for a new plant is complete.

[e] As a thermal conductivity versus temperature curve.

[f] Indirect testing, one per batch.

[g] Although all batches will be tested either by initial testing or indirect testing, the testing regime will be as follows:

If the number of batches $\leq$ 4 – Every batch shall be tested by direct and indirect testing;

If the number of batches > 4 – Every batch shall be tested by indirect testing and at least four batches by direct testing.

The frequency of producing batches varies with the product producer but the method of control can also vary with the manufacturer, with most favouring close control of the composition of the products.

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, d]	
4.2.3	**Reaction to fire Euroclass**	**Test method**	**Frequency**	**Test method**	**Frequency**
	B	EN 13823	1 per 2 years and indirect testing	Check of raw material formulation and density	1 per batch
	C D	and EN ISO 11925-2	1 per week or 1 per 2 years and indirect testing		
	E	EN ISO 11925-2	4 per year or 1 per 2 years and indirect testing	Check of raw material formulation and density	1 per batch
	F	-	-	-	-

[a] The minimum testing frequencies shall be understood for a product for each production batch 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 third party or by the manufacturer.

[c] Indirect testing is only possible in the case of products falling within the system 1 for attestation for conformity of reaction to fire or by having a notified body verifying the direct testing.

[d] Indirect testing may be either on the product or of its components.

Annex B
(normative)

Preparation of the test sample

B.1 Principle

To prepare a sprayed foam sample which is indicative of the method of end-use application of the foam.

B.2 Procedure for thermal conductivity samples

Prepare a flat sheet not less than 1 000 mm × 600 mm. Apply a release agent if necessary. Spray the foam onto the horizontal sheet to give a sample not less than 50 mm thick. It shall contain at least one bond line between separately sprayed layers. After curing for not less than 16 h remove the flat sheet from the sample and cut the edges to produce a sample with sides 900 mm × 500 mm.

NOTE Normal application of sprayed foam uses a technique of building up layer upon layer of foam. For this reason the sample used for testing will include at least one inter laminar bond line between two layers. Occasionally in some applications, the foam is applied in a single layer and for these the test sample need not include a bond line.

If it is intended to simulate an end-use application where air diffusion into the test specimen is possible from both sides, test specimens with cut surfaces need to be prepared. If one face is a diffusion tight face then spraying onto a metal sheet, without release agent is appropriate. For a two diffusion tight faced application, a one-sided diffusion tight specimen shall be so treated on the open face to render it diffusion tight.

B.3 Procedure for samples to be used for other test specimens

Repeat the procedure in B.2 using a release agent.

NOTE The procedure for preparing the test specimens for determining the substrate adhesion strength is contained in E.3.

Annex C
(normative)

Determination of the aged values of thermal resistance and thermal conductivity

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 over time. These methods give a prediction of the time averaged' aged value over 25 years.

The ageing methods given in C.4 and C.5 of this standard were designed primarily for generating aged values at 10 °C for factory made PUR/PIR products with closed cell contents greater than or equal to 90 %, produced by using high molecular weight blowing agents such as hydrofluorocarbons (namely: HFC 134a, 245fa, 227ea, 365mfc), which substantially stay in the products cells for time periods well in excess of those required for a reasonable economic life. These blowing agents are therefore called 'permanent'. They can be used mixed together with each other and 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 such PUR/PIR products is therefore predominantly caused by the inward diffusion of air into the product cells and outward diffusion of CO_2, if diffusion tight facings do not prevent both.

In this standard, the end-use applications require not only aged values at 10 °C but that a thermal conductivity versus temperature curve of aged values be presented to the market for the products, by measuring a sufficient number of aged values within the manufacturer's declared service temperature range for the products.

Accordingly, the determination of the temperature thermal conductivity values for the chosen temperatures for CCC4 products shall be made either by a combination of the normality test and the fixed increment procedure given in C.5 or by using the application of the accelerated ageing procedure given in C.4 prior to direct measurement at the chosen temperatures. For these methods, 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.

For products with closed cell content less than 90 %, namely those in classes CCC1, CCC2 and CCC3, the fixed increment procedure in C.5 cannot be applied and therefore, the only methods that can be used for these products are the ones given in C.4.1 to C.4.5.

For all product types covered by this standard, an alternative simplified procedure given in C.6 may be used at the manufacturer's discretion to generate the "safe values" ageing curves, i.e. a curve with values always higher than would be obtained by the application of the methods, as appropriate, in C.4 and C.5.

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.4 is used, the safety increment in accordance with Table C.1 for that blowing agent in the mixture with the highest value shall be used.

— If the fixed increment procedure of C.5 is used, the result from the normality test will give the decision, which increment shall be taken. If the test result is below the required limit value for a particular blowing agent in the mixture, the increment in accordance with Table C.2 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 that they have diffusion coefficients similar to the established values for hydrofluorocarbons), the ageing methods defined in this annex can be used. New limit values for the fixed increment procedure (C.5) and different safety increments for the accelerated ageing procedure (C.4) may be required.

C.2 Sampling and test specimen preparation

Prepare a product sample including any product facings 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. Any facings shall be left in position 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 conductivity made one to eight days after manufacture.

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

Measure the thermal conductivity of the test specimen in accordance with EN 12667 and EN 12939 and 5.3.2 of this standard.

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

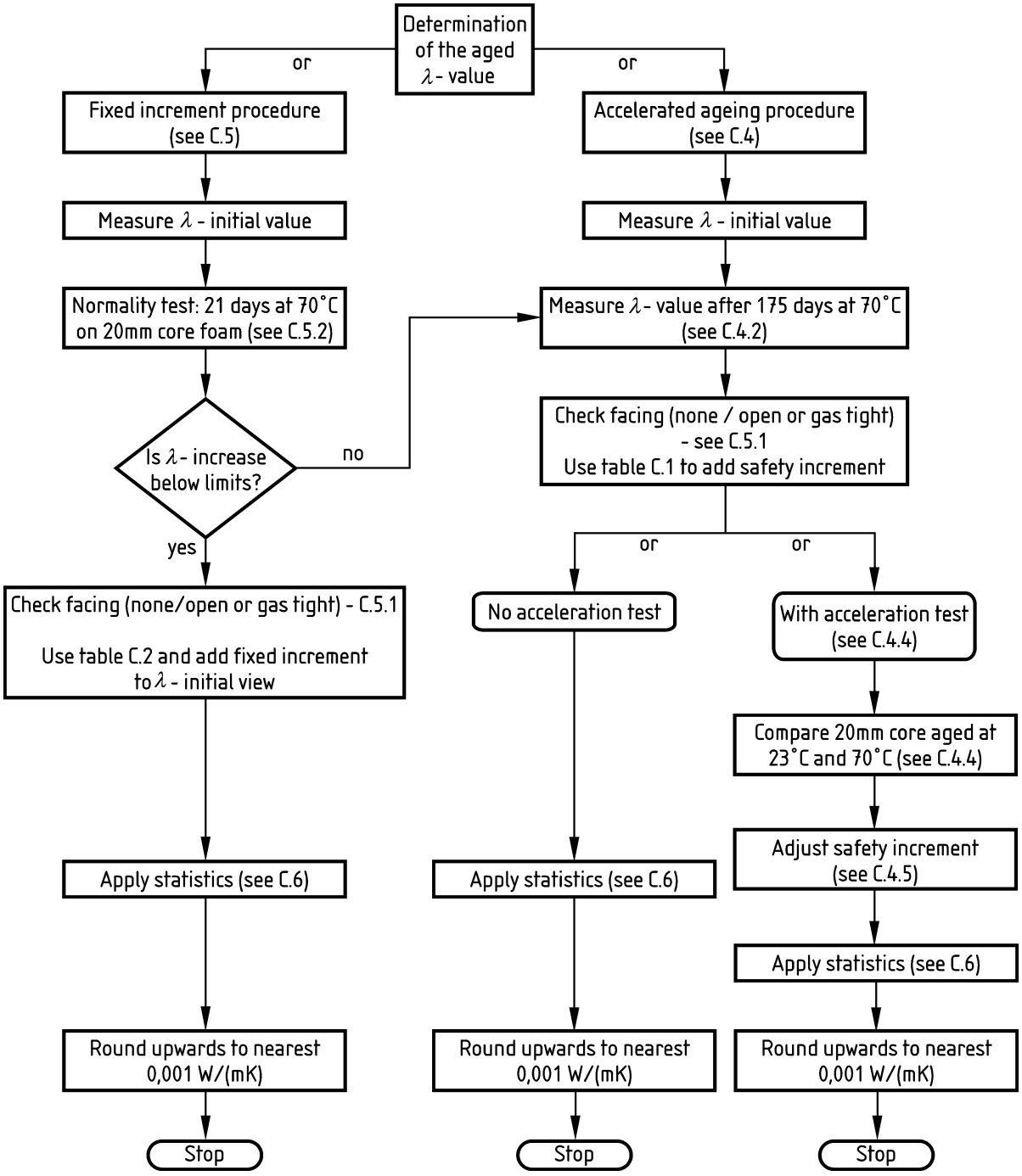


Figure C.1 — Flow chart of the alternative ageing procedures

C.4 Determination of the accelerated aged value of thermal conductivity

C.4.1 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.4.2;

— add safety increment in accordance with C.4.3.

For diffusion open products, it is allowed to carry out an acceleration test in accordance with C.4.4. Depending on the outcome of this acceleration test, the safety increments of C.4.3 may be reduced in accordance with C.4.5.

C.4.2 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 any 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 of this standard.

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

C.4.3 Addition of the safety increments (to be used with the accelerated ageing procedure only)

The value obtained under C.4.2 shall be increased with the safety increments as shown in Table C.1.

Table C.1 — Safety increments to be added to the measured accelerated aged value of thermal conductivity

Type of foam/ facing	Blowing agent technology [a]	Safety increment in W/(m·K) for products with thickness $d \leq 80$ mm	Safety increment in W/(m·K) for products with thickness $d > 80$ mm
Cut foam without facing	HFC 245fa, 365mfc and 227ea	0,001 0	0,002 0
	HFC 134a	0,001 5	0,002 5
Faced with diffusion open facings	HFC 245fa, 365mfc and 227ea	0,001 0	0,001 5
	HFC 134a	0,001 5	0,002 0
Faced with diffusion tight facings [b]	HFC 134a, 245fa, 365mfc and 227ea	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.5.1 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 is providing additional information (see C.4.4 and C.4.5).

C.4.4 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 preparation) 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 for 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.

C.4.5 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.4.4 then the thermal conductivity determined for a product in C.4.3 may be amended as follows:

— if an acceleration factor of greater than 12 has been found the appropriate safety increment derived from Table C.1 shall be removed;

— if an acceleration factor of 8 to 12 inclusive has been found the value of thermal conductivity obtained in C.4.3 shall be reduced by 0,001 W/(m·K);

— in all other cases the value from C.4.3 shall remain unchanged.

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

C.5 Fixed increment procedure

C.5.1 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.5.2, except for CO_2 blown only products;

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

— the product contains any of the blowing agents such as hydrofluorocarbons or a mixture 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 ml per 24 h per m^2 when measured at 20 °C in accordance with ASTM 3985.

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

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

C.5.2 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 preparation) 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.

The difference between the aged and the initial values of thermal conductivity shall not be more than 0,006 0 W/(m·K) for 245fa, 227ea, 365mfc blown products and 0,007 5 W/(m·K) for 134a blown products.

If the difference is more than the values stated herein, the fixed increment method cannot be used and the aged thermal conductivity shall be obtained in accordance with C.4.

C.5.3 Calculation of the aged value of thermal conductivity

The aged value of thermal conductivity shall be determined by adding fixed increments to the initial value of thermal conductivity.

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

Depending on the temperature of the lambda measurement, add the relevant increments given in Tables C.2, C.3, C.4 and C.5 to the initial value.

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

Table C.2 — Increments for calculating the aged value of thermal conductivity

temperature of λ measurement (°C)	**Fixed increment to apply**
Lower than – 120 °C	No increment
- 120 °C	Apply increment Table C.3
Between – 120 °C and 10 °C	Linear interpolation Table C.3 and C.4
10 °C	Apply increment Table C.4
Between 10 °C and 120 °C	Linear interpolation Table C.4 and C.5
120 °C	Apply increment Table C.5

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

Table C.3 — Increments for calculating the aged value of thermal conductivity θ = - 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**
	Thickness			**Thickness**			
	d < 80 mm	80 mm ≤ d > 120 mm	d ≥ 120 mm	d < 40 mm	40 mm ≤ d < 60 mm	d ≥ 60 mm	
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
100 % 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.4 — Increments for calculating the aged value of thermal conductivity θ = + 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**
	Thickness			**Thickness**			
	d < 80 mm	80 mm ≤ d > 120 mm	d ≥ 120 mm	d < 40 mm	40 mm ≤ d < 60 mm	d ≥ 60 mm	
HFC365mfc HFC245fa, 227ea	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
100 % CO_2	0,010 0	0,010 0	0,010 0	0,010 0	0,010 0	0,010 0	0,006 0

Table C.5 — Increments for calculating the aged value of thermal conductivity θ = + 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**
	Thickness			**Thickness**			
	d < 80 mm	80 mm ≤ d > 120 mm	d ≥ 120 mm	d < 40 mm	40 mm ≤ d < 60 mm	d ≥ 60 mm	
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
100 % CO_2	0,010 0	0,010 0	0,010 0	0,010 0	0,010 0	0,010 0	0,006 0

C.6 “Safe values” curve of aged thermal conductivity values versus temperature

C.6.1 Principle

A thin fully aged test specimen is prepared to enable the required aged temperature measurements to be made.

C.6.2 Procedure

Prepare a 20 mm cut faced test specimen and measure the initial values by the procedure given in C.3 before ageing it by the procedure given in C.5.2. Measure then the aged thermal conductivity values at the chosen temperatures using this aged specimen, to develop the aged thermal conductivity versus temperature curve.

NOTE Ageing a cut faced 20 mm thick specimen at 70 °C according to the procedure given in C.5.2 is known to produce complete ageing at that temperature in a closed cell product, i.e. air has fully diffused into the product to dilute the retained blowing agent. Such a test specimen will therefore, when tested, always give higher values than would be obtained for those test specimens typical of the end-use applications where the speed of the inward air diffusion is retarded by either the presence of impeding barriers, greater thickness specimens or temperatures less than 70 °C. For temperatures higher than 70 °C, fully aged closed cell products will contain a lower mass of air in the closed cells to dilute the “permanent” blowing agent present in those cells. Therefore, the measured aged values will again be higher than those obtained if ageing had been carried out at temperatures greater than 70 °C.

In addition, it should be noted that most of the end-use applications involve one side of the installed product being at 20 °C whilst the other side is at low or high temperatures within the manufacturer's declared service temperature range of the product.

Accordingly, for example if an insulated pipe has a temperature on the inside of 110 °C together with an external temperature of 20 °C, the temperature for the insulated product is 65 °C, comparable to the test specimen aged at 70 °C.

Annex D
(normative)

Determination of the reaction profile and free-rise density

D.1 Introduction

This method is used to measure the reactivity and the beaker free-rise density of PUR or PIR systems.

D.2 Principle

The polyol and isocyanate components of the foam system are mixed according to the manufacturer's recommendations to produce a particular small-scale laboratory foam which allows the determination of the reaction profile characteristics and free-rise density.

D.3 Apparatus

D.3.1 Motorised stirrer with a speed between 1 500 rpm and 3 500 rpm.

D.3.2 Weighing scales, to give an accuracy of 0,1 g.

D.3.3 Stopwatch, accurate to 0,5 s.

D.3.4 Paper or plastic beakers 0,3 l to 1 l capacity .

D.3.5 Thermometer, accurate to 0,5 °C.

D.4 Procedure

D.4.1 Pre-treatment of polyol component

Insert into the 1 l beaker (D.3.4), more of the polyol component than will be subsequently required to create the test foam. Condition the components at (20 ± 1) °C or in accordance with the manufacturer's technical information while stirring.

D.4.2 Making the foam

Weigh the amount polyol component specified by the manufacturer into a beaker between 0,3 l and 0,8 l capacity and add the specified amount of the isocyanate component. Stir immediately using the motorised stirrer (D.3.1) equal to half the expected cream time or in accordance with the manufacturer's technical information. If required, pour the contents into a beaker between 0,5 l and 1 l capacity and subsequently determine the cream time (3.1.7), gel time (3.1.8) and tack-free time (3.1.9).

D.4.3 Presentation of reaction profile data

These shall be presented with the following symbols followed in each case by the appropriate value in seconds and the temperature of measurement in °C. Precise conditions used to obtain these results shall be declared (refer to E.4).

CT (*) = cream time (in seconds), e.g. CT5(20)

GT (*) = gel time (in seconds), e.g. GT15(20)

TFT (*) - tack free time (in seconds), e.g. TFT25(20)

D.5 Free-rise density

D.5.1 General

The free-rise density shall be determined by either the core free-rise density method given in D.5.2 or the beaker free-rise density method given in D.5.3, according to the manufacturer's recommendation.

D.5.2 Core free-rise density

Cut a test specimen measuring 50 mm × 50 mm × 100 mm centrally from the foam sample created in the 1 l beaker, and measure the density according to EN 1602.

D.5.3 Beaker free-rise density

For the determination of this value, cut off the foam that stands above the rim of the beaker. Take the quotient between the weight of the foam contained in the beaker and its volume to obtain the beaker free-rise density.

D.5.4 Presentation of free-rise density result

The free-rise density shall be presented as either FRC (see D.5.2) or FRB (see D.5.3) as appropriate, followed by the appropriate free-rise density value in kg/m^3. Precise conditions used to obtain these results shall be declared (refer to D.3 and D.4).

Annex E
(normative)

Determination of substrate adhesion strength perpendicular to faces

E.1 Principle

This test is used to determine the adhesion of a PUR or PIR foam to a substrate, whereby either the adhesion strength of the bond between the foam and the substrate or the tensile cohesion strength of the foam is determined.

E.2 Apparatus

E.2.1 Fibre cement board substrate, with dimensions larger than 300 mm × 300 mm.

E.2.2 Adhesive, with an adhesion strength higher than the expected adhesion strength or the tensile cohesion strength of the foam.

E.2.3 Saw, capable of cutting the substrate.

E.2.4 Tensile strength testing machine.

E.3 Sample preparation and conditioning

Condition the substrate (E.2.1) at a temperature of (20 ± 2) °C. Spray the foam onto the substrate in accordance with the manufacturer's recommendations to create a sample with a foam thickness not less than 30 mm. Condition the sample at (20 ± 2) °C and (50 ± 5) % R.H. for at least for 24 h.

E.4 Preparation of test specimens

Cut from the sample five test specimens 50 mm x 50 mm or 100 mm x 100 mm and reduce their foam thickness to (20 ± 2) mm.

E.5 Testing procedure

Using the adhesive (E.2.2), fix the test pieces to the places of the tensile strength testing machine (E.2.4) so that the substrate is fixed onto one plate and the foam to the other. For each test specimen, follow the procedure described in Clause 7 of EN 1607:1996, recording the force when the sample breaks, noting whether the break occurs at the bond in the foam. In both cases present the results as σ_a.

E.6 Presentation of results

Present the substrate adhesion strength as the value, σ_a, with a statement whether this is calculated from the bond strength failure or the cohesive failure of the foam.

— Substrate adhesion strength, σ_a, (in kPa);

— Breakage area (bond between foam and substrate or within the foam).

Annex F
(normative)

Testing for reaction to fire of the products

F.1Scope

This annex gives basic rules for reaction to fire testing of products as placed on the market (product itself) including instructions for mounting and fixing taking into account the product tested in isolation and not related to any end-use applications and instructions for the field of application of the test results.

The following is related to 4.2 in the main body of the product standard.

F.2Product and installation parameters

The test specimens shall be stored for at least six hours at (23 ± 5) °C. In case of dispute, they shall be stored at (23 ± 2) °C and (50 ± 5) % RH for 14 days.

Tables F.1 and F.2 give the parameters that have to be taken into account when determining a product's reaction to fire performance and the field of application of the test results.

Table F.1 — Product parameters

Product parameter	EN ISO 1182 (Euroclass A1 and A2)	EN ISO 1716 (Euroclass A1 and A2)	EN 13823 (Euroclass A1 to D)	EN ISO 11925-2 (Euroclass B to E)
All products				
Thickness			X	X
Density	X		X	X
Type of product	X	X	X	X

NOTE Ageing or washing procedures are not applicable for the test specimens.

Table F.2 — Installation parameters

Installation parameter	EN 13823	EN ISO 11925-2
Exposure to thermal attack	X	X
Substrate	X	-
Air gaps/cavities	X	_
Joints/edges	_	_
Size and positioning of test specimen	X	_
Product orientation and geometry	_	_
Fixing of the test specimen	X	_

F.3 Mounting and fixing

F.3.1 Ignitability (EN ISO 11925-2)

F.3.1.1 Exposure to thermal attack

The product shall be tested directly exposed to the thermal attack. The test specimen is submitted to direct flame exposure only on the natural skin. As only one face is exposed to fire in the works, that exposed face shall be tested.

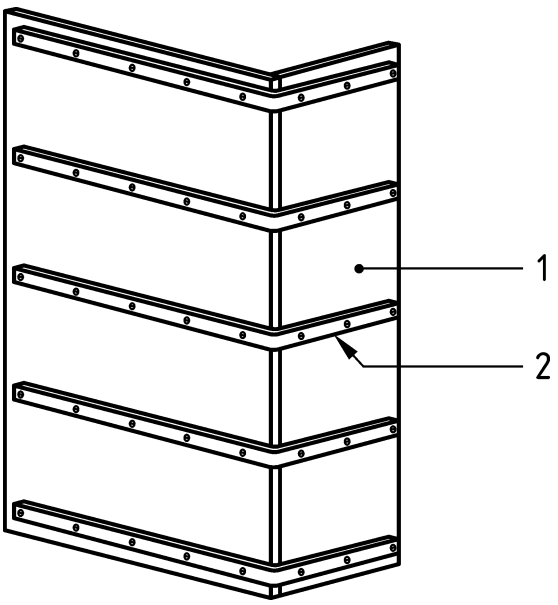
F.3.1.2 Substrate

The test specimens, cut from the product sample including their natural skin, shall be mounted in the test apparatus without a substrate.

F.3.2 Single Burning Item [SBI] (EN 13823)

F.3.2.1 Preparation of the test specimens

A test specimen shall be prepared by spraying onto the internal face of an L-shaped substrate which is prepared by adding externally at least five L-shaped steel brackets to the back of the substrate as shown in Figure F.1.



Key

1 substrate

2 steel brackets (width 30 mm, thickness 5 mm)

Figure F.1 — Preparation of the test specimen: external surface of the substrate

F.3.2.2 Exposure to thermal attack

The product shall be tested directly exposed to the thermal attack.

F.3.2.3 Substrate

The type of the substrate is defined in EN 13238.

The general substrate to be used to test the product as placed on the market is made of calcium silicate.

Gypsum plaster board and wooden particle board substrates such as defined in EN 13238 are permitted to be used instead.

For A1 classification, a calcium silicate substrate is compulsory.

The test conditions and field of application of the classification shall be given in the declaration of conformity, in the classification report and is requested to be included in the manufacturer's technical literature.

F.3.2.4 Air gaps/cavities

Air gaps/cavities are not considered relevant for the reaction to fire behaviour of the product.

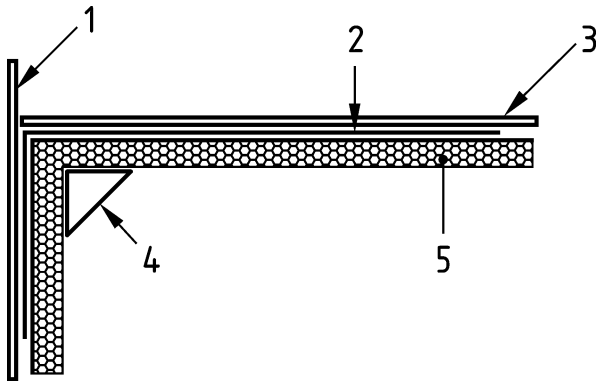
The test specimen (product itself) shall be mounted in the test apparatus without an air gap/cavity (neither between the product and substrate nor between substrate and backing board, except for the small space needed to accommodate the test specimen brackets [see Figure F.2]).

F.3.2.5 Size and positioning of test specimen

The size of the test specimens is given in EN 13823:2010, 5.1. Positioning of the test specimens shall meet the following specification:

The maximum thickness of the test specimen including the substrate that can be installed in the SBI is 200 mm.

The test specimen shall be positioned as shown in Figure F.2.



Key
1 backing boards
2 brackets
3 substrate
4 burner
5 test specimen natural skin surface

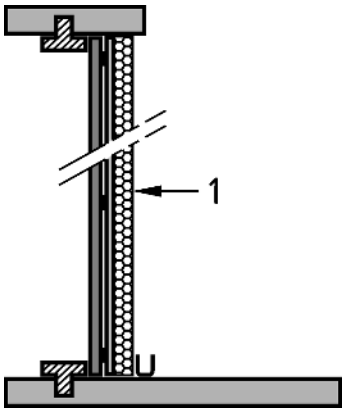
Figure F.2 — Installation of the test specimen (top view)

F.3.2.6 Fixing of the test specimen

The specimen with its substrate shall be fixed in the test apparatus by clamping and maintained between the backing boards and the U profile at the bottom part of the frame, and the calcium silicate support at the top of the frame (see Figure F.3).

If necessary, the natural skin surface may be removed in places to create a flatter surface so that the test specimen will fit snugly against the U-profile section at the base of the apparatus adjacent to the burner. It

may be necessary for example to remove sufficient foam internally at the corner to again allow a snug fit of the test specimen at the corner.



Key

1 test specimen

Figure F.3 — Principle for clamping the test specimen (cross section)

F.4Field of application

The manufacturer is responsible for the grouping of his products following the rules described in EN 13172 and this standard. The validity of the test results and the field of application for a product group are determined by the product parameters and the installation parameters with the requirements given in Tables F.3 and F.4.

Table F.3 — Validity of test results: Product parameters

Product parameter	**Validity of test results**			
	EN ISO 1182	**EN ISO 1716**	**EN 13823 (SBI)**	**EN ISO 11925-2 (Ignitability)**
	Not relevant	Not relevant		
Thickness			Test results are valid for equal or lower thickness.	
			Test results on a 180 mm thickness are also valid for higher thickness.	Test results on 60 mm thickness are also valid for higher thickness.
Density			Product density ± 15 %	
Type of			For the tested type only	
Product (e.g. PUR or PIR				

Table F.4 — Validity of test results: Installation parameters

Installation parameter	Validity of test results	
	EN 13823 (SBI)	**EN ISO 11925-2 (Ignitability)**
Exposure to thermal attack	Test result is valid for product as placed on the market	See G.3.1.1
Substrate	The standard wooden particle board substrate represents wood and all A1 and A2 substrates. The standard gypsum plaster board represents all A1 and A2 substrates.	Not relevant
Air gaps/cavities	Test result valid for product applied with and without an air gap.	Not relevant
Size and positioning of test specimen	Test result is valid for all product sizes.	Not relevant
Fixing of test specimen	Test result is valid for all product fixings.	Not relevant

Annex G
(normative)

Testing for reaction to fire of products in standardised assemblies simulating end-use application(s)

G.1 Scope

This annex gives basic rules for an additional reaction to fire testing of the products in standardised assemblies simulating end-use applications including the thermal insulation product and provides instructions for mounting and fixing and for the field of application of the test results.

In this annex, the term “standard test configuration of assemblies” is used.

The following is related to 4.3 of the product standard.

This annex gives the manufacturer the opportunity to give a complementary and optional declaration (where required) on reaction to fire for a standardised end-use application/assembled system including the insulation product.

The Euroclass classification of the product as placed on the market shall always be declared (see Annex F).

G.2 Product and installation parameters

Tables G.1 and G.2 give the parameters that have to be taken into account when determining the reaction to fire performance of standardised assemblies simulating end-use applications (assembled systems) including the thermal insulation product and the field of application of the test results.

The test specimens shall be stored for at least six hours at (23 ± 5) °C. In case of dispute, they shall be stored at (23 ± 2) °C and (50 ± 5) % RH for 14 days.

Table G.1 — Product parameters

Product parameter	**EN ISO 1182 (Euroclass A1 and A2)**	**EN ISO 1716 (Euroclass A1 and A2)**	**EN 13823 (Euroclass A1 to D)**	**EN ISO 11925-2 (Euroclass B to E)**
All products				
Thickness			X	X
Density	X		X	X
Type of product	X	X	X	X

NOTE Ageing or washing procedures are not applicable for the test specimens.

Table G.2 — Installation parameters

Installation parameter	EN 13823	EN ISO 11925-2
Exposure to thermal attack	X	X
Standardised surface products	X	_
Substrate	X	_
Air gaps/cavities	X	_
Joints/edges of the insulation product	_	_
Joints/edges of the surface product	X	_
Size and positioning of the insulation product	X	_
Product orientation and geometry	_	_
Fixing of the insulation product to the substrate	X	_
Fixing of the insulation product to the surface product	X	_

G.3 Mounting and fixing

G.3.1 Ignitability (EN ISO 11925-2)

G.3.1.1 Exposure to thermal attack

The thermal insulation product shall be tested directly exposed to the thermal attack. The test specimen is submitted to direct flame exposure on the natural skin. If only one face is exposed to fire in the works, that exposed face shall be tested.

If in the end-use application a surface product is subsequently to be bonded to the natural skin or placed in front of the sprayed product then this test shall not be carried out.

G.3.1.2 Substrate

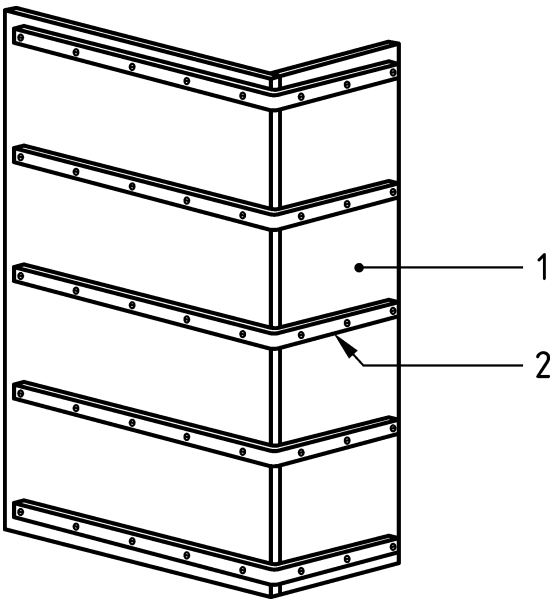
The test specimens, cut from the product sample including their natural skin shall be mounted in the test apparatus without a substrate.

G.3.2 Single Burning Item [SBI] (EN 13823)

G.3.2.1 Preparation of the test specimens

For products with surface products, if any, subsequently bonded to the natural skin or placed in front of the natural skin, a test specimen shall be prepared by spraying onto the internal face of an L-shaped substrate (see Figure G.1) which is prepared by adding externally at least five L-shaped steel brackets to the back of the substrate as shown in Figure G.1. Before testing, bond in place or place in front of the test specimen any surface product.

For test products in which the end-use application requires the surface product to be directly bonded to the sprayed product during its formation, spray the foam product directly onto the back of the surface product already prepared in an L-shape with a suitable internal bracket simulating the joint cover plate used in the end-use application.



Key

1 substrate

2 steel brackets (width 30 mm, thickness 5 mm)

Figure G.1 — L-shaped substrate support for the preparation of the test specimen: view of the external surface of the substrate

G.3.2.2 Exposure to thermal attack

Most thermal insulation products will be incorporated into an assembled building system (end-use application) and the thermal insulation product is not directly exposed to a heat or fire source. In the case of a standard test configuration of assemblies where the thermal insulation product is directly exposed to a heat or fire source, the standard test configuration of assembly 1 in Table G.3 shall be followed.

When the product is not directly exposed in end-use application, another product immediately in front, shall be applied so as to simulate the performance of the combination of these products in their end-use application. This product in front is designated as the surface product. Standardised surface products, such as particleboard, steel or aluminium sheet and plasterboard shall be used (see G.3.2.3).

Table G.3 — Standard test configurations of assemblies

Number	Substrate\ (see G.3.2.4)	air gap between Substrate and Insulation Product	Insulation product	surface product (see G.3.2.3)	application examples
1	plasterboard	no	X	none	uncovered
2	plasterboard	no	X	plasterboard	cool-storage rooms, protected vessels, pipes or ducts
3	none	yes 40 mm	X	corrugated steel or aluminium sheet	inside insulated vessels or ducts
4	particle board	no	X	particle board	cool-storage rooms

G.3.2.3 Surface products

For testing of the assembled systems given in Table G.3, the following products shall be used as surface products:

— Paper faced gypsum plaster board according to EN 520 with a thickness of 9,5 mm, density 600 kg/m^3 and a paper grammage of not more than 220 g/m^2 (CWFT Euroclass A2).

— Particle board non-fire retardant treated according to EN 312 with a thickness of 9 mm to 10 mm and a density of (650 ± 50) kg/m^3 (CWFT Euroclass D).

— Steel sheet with polyester coating (if any) according to EN 508-1 with corrugated profile of 100 mm to 110 mm depth and 250 mm to 275 mm pitch (for example 106/250) and a thickness of (0,75 ± 0,1) mm (CWFT Euroclass A1). The maximum nominal thickness of polyester coating on the exposed face shall be 25 μm with a maximum mass/unit area of 70 g/m^2 and with a maximum PCS of 1,0 MJ/m^2. On the non exposed face, the maximum nominal thickness shall be 15 μm with a maximum PCS of 1,0 MJ/m^2.

— Aluminium sheet with a density of (2 700 ± 50) kg/m^3 and the thickness of (1,0 ± 0,2) mm (Euroclass A1).

G.3.2.4 Substrate

Test specimens are tested using the standard mounting (see EN 13238 and EN 13823) with paper-faced plasterboard representing all end-use non-wood based substrates and non-fire retardant treated particleboard representing all end-use wood based substrates.

The test conditions and field of application of the classification shall be given in the declaration of conformity, in the classification report and in the manufacturer's technical literature.

G.3.2.5 Air gaps/cavities

There shall be no air gap between a surface product and the thermal insulation product.

The presence of an air gap between the thermal insulation product and the substrate may have an influence on the reaction to fire performance.

If in the end-use application an air gap is used, then an air gap of 40 mm shall be left between the thermal insulation product and the substrate. The air gap shall be ventilated.

No air gap shall be left behind the thermal insulation product, if the thermal insulation product is tested behind a surface product of plasterboard or particle board (see Table G.3).

G.3.2.6 Joints/edges

G.3.2.6.1 Joints in surface products

Joints shall be considered as described for fixing of the surface products (see G.3.2.8.2).

The butt corner joint (if any) shall not be covered with a flashing or a sealant, except for corrugated steel where a flashing is needed.

G.3.2.7 Size and positioning of test specimen

The configuration of the test specimen is given in Table G.3.

G.3.2.8 Mounting and fixing of the test specimen

G.3.2.8.1 Reporting

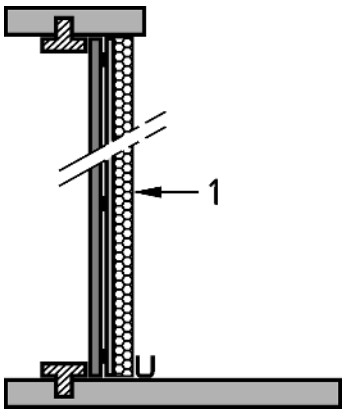
The test conditions and field of application of the classification shall be given in the declaration of conformity, in the classification report and in the manufacturer's technical literature.

G.3.2.8.2 Fixing of the thermal insulation product to the substrate

Fixing of the products and test specimens shall be carried out in accordance with the standard test configuration of the assembly.

The specimen with its substrate shall be fixed in the test apparatus by clamping and maintained between the backing boards and the U profile at the bottom part of the frame, and the calcium silicate support at the top of the frame (see Figure G.2).

If necessary, the natural skin surface may be removed in places to create a flatter surface so that the test specimen will fit snugly against the U-profile section at the base of the apparatus adjacent to the burner. It may be necessary for example to remove sufficient foam internally at the corner to again allow a snug fit of the test specimen at the corner.



Key

1 test specimen

Figure G.2 — Principle for clamping the test specimen (cross section)

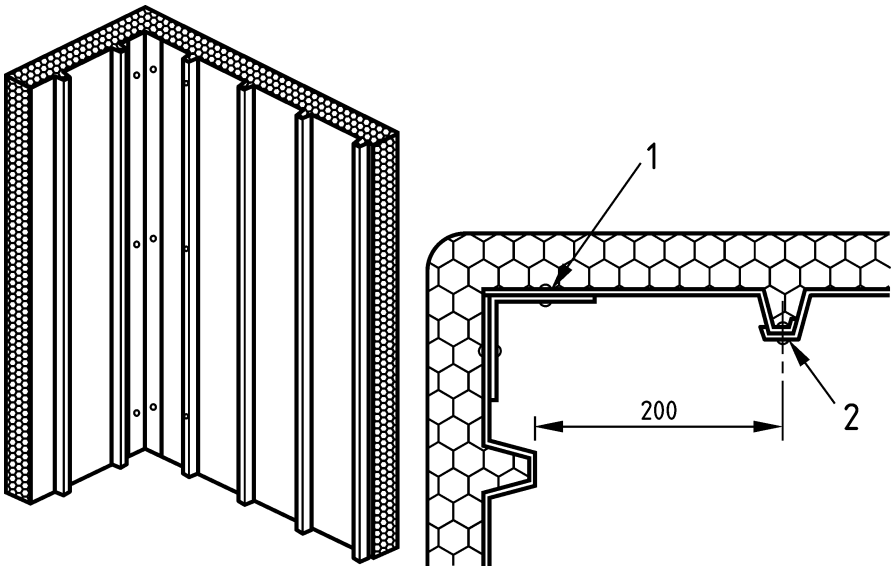
G.3.2.8.3 Fixing of the surface product to the thermal insulation product

Surface products such as the paper-faced plasterboards and the wooden particle boards shall be fixed through the thermal insulation product without air gap using screws, taking into account the position of joints in the surface products in accordance with 5.2.2.e of EN 13823:2010.

For testing with the corrugated steel or aluminium sheet as surface product, fixing of the steel or aluminium sheet shall be done in the configuration as given in Figure G.3.

The vertical joint(s) shall be made in the steel or aluminium sheet in accordance with EN 13823:2010, 5.2.2.e. and fastened according to the end-use conditions (e.g. three rivets for corrugated steel or aluminium sheets).

Dimensions in mm



Key

1 fixing with L-profile and 2 x 3 rivets

2 fixing with 3 rivets

Figure G.3 — Fixing corrugated steel or aluminium sheet type 106/250

G.4 Field of application

The manufacturer is responsible for the grouping of his products following the rules described in EN 13172 and this standard. The validity of the test results and the field of application for a product group is determined by the product parameters and the installation parameters, which have been taken into account in the testing (see Tables G.4 and G.5).

Table G.4 — Validity of test results: Product parameters

Product parameter	**Validity of test results**			
	EN ISO 1182	**EN ISO 1716**	**EN 13823 (SBI)**	**EN ISO 11925-2 (Ignitability)**
	Not relevant	Not relevant		
Thickness			Test results are valid for equal or lower thickness.	
			Test results on maximum possible thickness are also valid for higher thickness.	Test results on 60 mm thickness are also valid for higher thickness.
Density			Product density ± 15 %	
Type of product, e.g. PUR or PIR			For the tested type only	

Table G.5 — Validity of test results: Installation parameters

Installation parameter	Validity of test results	
	EN 13823 (SBI)	EN ISO 11925-2 (Ignitability)
Exposure to thermal attack	**Without surface product (no.1 of Table G.3):** Test result is valid for product applied without surface product (s). The classification obtained is also valid for assemblies when a covering or protecting layer having Euroclass A1 and A2 is placed in front of the thermal insulation product in the end-use. **Plasterboard surface product (no.2 of Table G.3)**: Test results are valid for all non-combustible mineral surface products of Euroclasses A1 and A2 with equal or higher thickness and with equal or higher densities. Corrugated steel sheet or aluminium sheet surface product (no.3 of Table G.3): Test results are valid for all corrugated steel sheets or aluminium sheet such as defined in G.3.2.3 and for steel or aluminium sheets without corrugation or with other type of corrugation and with equal or higher steel or aluminium thickness. Test results are valid also for other type of organic coating of the steel sheet with equal or lower PCS value and with equal or lower thickness of the coating. Particle board surface product (no.4 of Table G.3): Test results are valid for all types of wooden boards of Euroclass D or higher and with equal or higher thickness and with equal or higher densities.	See G.3.1.1
Substrate	Test results only valid for product applied with the substrate used in the test. For insulation product thickness min. 80 mm or higher when testing without surface product or with steel sheet surface product and for any product thickness when testing with plasterboard or particle board as surface product, test result with any substrate is valid for all types of substrate (incl. combustible types, e.g. particle board).	Not relevant
Air gap / cavities	Test results are also valid for larger air gaps. Test results from a test where an air gap has been included are also valid for assemblies without an air gap; for products tested behind the standardised surface products and for products tested without surface products having thickness of min. 80 mm or higher, test result without air gap is also valid for assemblies with air gap.	Not relevant
Joints of surface product	Test results are valid also for setups without joints.	Not relevant
Edges of-surface product	If tested butt jointed with square edges, then valid for all profiled edge finishing.	Not relevant
Fixing of test specimen and surface product	Test results using clamping are valid also for mechanical fixing.	Not relevant

Annex ZA
(informative)

Clause of this European Standard addressing the provisions of the EU Construction Products Directive

ZA.1 Scope and relevant characteristics

This European Standard has been prepared under a mandate M103[1)] "Thermal insulation products" given to CEN by the European Commission and the European Free Trade Association.

The clauses of this European Standard shown in this annex meet the requirements of the mandate given under the EU Construction Products Directive (89/106/EEC).

Compliance with these clauses confers a presumption of fitness of the in-situ formed sprayed rigid polyurethane (PUR) and polyisocyanurate (PIR) foam products covered by this annex for the intended uses indicated herein; reference shall be made to the information accompanying the CE marking.

This annex establishes the conditions for the CE marking of the in-situ formed sprayed rigid polyurethane (PUR) and polyisocyanurate (PIR) foam products intended for the uses indicated in Table ZA.1 and shows the relevant clauses applicable.

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

1) As amended.

Table ZA.1 — Relevant clauses

Construction Products: **In-situ thermal formed sprayed rigid polyurethane (PUR) and polyisocyanurate (PIR) foam products as covered by the scope of this standard** Intended uses: **Thermal insulation of building equipment and industrial**			
Requirement/Characteristic from the mandate	**Requirement clauses in this European standard**	**Levels and/or classes**	**Notes**
Reaction to fire	4.2.3 Reaction to fire	Euroclasses	-
Water vapour permeability	4.3.2 Water vapour transmission	-	-
Release of dangerous substances to the indoor environment	4.3.5 Release of dangerous substances	-	-
Thermal resistance	4.2.2 Thermal conductivity	-	Levels of λ
Durability of reaction to fire against ageing/degradation	4.2.5.2 Durability characteristics	-	-
Durability of reaction to fire against high temperature	4.2.5.3 Durability characteristics		
Durability of reaction to fire against biological agents	4.2.5.4 Durability characteristics		
Durability of thermal resistance against ageing/degradation	4.2.5.5 Durability characteristics	-	Levels
Durability of thermal resistance against high temperature	4.2.5.6 Durability characteristics		
Durability of thermal resistance against biological agents	4.2.5.7 Durability characteristics		
Continuous glowing combustion	4.3.11 [a] Continuous glowing combustion	-	-
[a] The test method is under development.			

The requirement on a certain characteristic is not applicable in those Member States (MSs) where there are no regulatory requirements on that characteristic for the intended use of the product. In this case, manufacturers placing their products on the market of these MSs are not obliged to determine nor declare the performance of their products with regard to this characteristic and the option “No performance determined” (NPD) in the information accompanying the CE marking (see ZA.3) may be used. The NPD option may not be used, however, for durability of essential characteristics that have been declared and where the characteristic is subject to a threshold level.

ZA.2 Procedure for attestation of conformity of in-situ formed sprayed rigid polyurethane (PUR) and rigid polyisocyanurate foam (PIR) products

ZA.2.1 Systems of attestation of conformity

The systems of attestation of conformity of in-situ formed sprayed rigid polyurethane (PUR) and rigid polyisocyanurate foam (PIR) products, indicated in Table ZA.1 in accordance with the decision of the European Commission 95/204/EC of 30.04.95 revised by decision 99/91/EC of 25.01.99 and by the

Commission Decision 2001/596/EEC and as given in Annex III of the mandate M103 for thermal insulation as amended by mandates M126, M130 and M367 is shown in Table ZA.2 for the indicated intended use(s) and relevant level(s) or class(es).

Table ZA.2 — System(s) of attestation of conformity

Product(s)	Intended use(s)	Level(s) or class(es)	Attestation of conformity system(s)
Thermal insulating products (products intended to be formed in-situ)	For uses subject to regulations on reaction to fire	A1[(1)] ,A2[(1)] ,B[(1)] ,C[(1)] A1[(2)],A2[(2)],B[(2)],C[(2)],D,E (A1 to E)[(3)],F	1 3 4
	Any	-	3
System 1: See Directive 89/106/EEC (CPD) Annex III.2.(i), without audit testing of samples. System 3: See Directive 89/106/EEC (CPD) Annex III.2.(ii), Second possibility. System 4: See Directive 89/106/EEC (CPD) Annex III.2.(ii), Third possibility.			

(1) 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 retarders or a limiting of organic material).

(2) Products/materials not covered by footnote (1).

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

The attestation of conformity of the in-situ formed sprayed rigid polyurethane (PUR) and rigid polyisocyanurate foam (PIR) products in Table ZA.1 shall be according to the evaluation of conformity procedures indicated in Tables ZA.3.1 to ZA.3.2 resulting from application of the clauses of this or other European Standards indicated therein.

Table ZA.3.1 — Assignment of evaluation of conformity tasks for in-situ formed sprayed rigid polyurethane (PUR) and rigid polyisocyanurate foam (PIR) products under system 1 for products of reaction to fire classes A1[(1)] ,A2[(1)] ,B[(1)] ,C[(1)] and system 3

Tasks		Content of the task	Evaluation of conformity Relevant clauses of EN 13172 and of this standard
Tasks under the responsibility of the manufacturer	Factory production control (FPC)	Parameters related to essential characteristic of Table ZA.1 relevant for the intended use which are declared	Clauses 1 to 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 characteristic of Table ZA.1 relevant for the intended use which are declared	Annex B of this standard
	Initial type testing	Those relevant characteristics of Table ZA.1 not tested by the notified laboratory and notified certification body	Clause 6 of EN 13172:2012 and 7.2, Annex B of this standard
Tasks under responsibility of a notified laboratory	Initial type testing	Thermal resistance Release of dangerous substances Water vapour permeability	Clause 6 of EN 13172:2012 and 7.2, Annex B of this standard
Tasks under the responsibility of the notified certification body	Initial type testing	Reaction to fire	Clause 6 of EN 13172:2012 and 7.2, Annex B of this standard
	Initial inspection of factory and of FPC	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 approval of FPC	Reaction to fire	Annex B and C of EN 13172:2012 and 7.3 of this standard

Table ZA.3.2 — Assignment of evaluation of conformity tasks for in-situ sprayed rigid polyurethane (PUR) and rigid polyisocyanurate foam (PIR) products for products under system 3 and 3 (with 4 for RtF)

Tasks		Content of the task	Evaluation of conformity Relevant clauses of EN 13172 and of this standard
Tasks under the responsibility of the manufacturer	Factory production control (FPC)	Parameters related to EC of Table ZA.1 relevant for the intended use which are declared	7.3 of this standard and Clauses 1 to 5 of EN 13172 and: For system 3, Annex C of EN 13172:2012 For system 3 (with 4 for RtF), Annex C and D of EN 13172:2012
	Initial type testing	Those relevant characteristics of Table ZA.1 not tested by the notified body including reaction to fire for systems 3 and 4[a)]	Clause 6 of EN 13172:2012 and 7.2, Annex B of this standard
Tasks under responsibility of a notified laboratory	Initial type testing	- Reaction to fire (system 3)[b)] - Thermal resistance - Release of dangerous substances - Water vapour permeability	Clause 6 of EN 13172:2012 and 7.2, Annex B of this standard

a) For classes (A1 to E)[(3)],F.

b) For classes A1[(2)],A2[(2)],B[(2)],C[(2)],D,E.

ZA.2.2 EC certificate and declaration of conformity

(In case of products under system 1 for reaction to fire and system 3 for other characteristics): When compliance with the conditions of this annex is achieved, the certification body shall draw up a certificate of conformity (EC Certificate of conformity), which entitles the manufacturer to affix of the CE marking. The certificate shall include:

— name, address and identification number of the certification body;

— name and address of the manufacturer, or his authorised representative established in the EEA, and place of production;

NOTE 1 The manufacturer may also be the person responsible for placing the product onto the EEA market, if he takes responsibility for the CE marking.

— description of the product (type, identification, use, …);

— provisions to which the product conforms (e.g. Annex ZA of this European Standard);

— particular conditions applicable to the use of the product (e.g. provisions for use under certain conditions, etc.);

— the number of the certificate;

— conditions and period of validity of the certificate, where applicable;

— name of, and position held by, the person empowered to sign the certificate.

In addition, the manufacturer shall draw up a declaration of conformity (EC Certificate of conformity) including the following:

— name and address of the manufacturer, or his authorised representative established in the EEA;

— name and address of the certification body;

— description of the product (type, identification, use, …) and a copy of the information accompanying the CE marking;

NOTE 2 Where some of the information required for the Declaration is already given in the CE marking it does not need to be repeated.

— provisions to which the product conforms (e.g. Annex ZA of this European Standard);

— particular conditions applicable to the use of the product (e.g. provisions for use under certain conditions, etc.);

— the number of the EC Certificate of conformity;

— name of, and position held by, the person empowered to sign the certificate on behalf of the manufacturer or his authorised representative.

(In case of products under system 3 or (3 (with 4 for RtF))): When compliance with the conditions of this annex is achieved, the manufacturer, or his agent established in the EEA shall prepare and retain a certificate of conformity (EC Certificate of conformity), which entitles the manufacturer to affix of the CE marking. The declaration shall include:

— name and address of the manufacturer, or his authorised representative established in the EEA, and place of production;

NOTE 3 The manufacturer may also be the person responsible for placing the product onto the EEA market, if he takes responsibility for the CE marking.

— description of the product (type, identification, use, …) and a copy of the information accompanying the CE marking;

NOTE 4 Where some of the information required for the Declaration is already given in the CE marking it does not need to be repeated.

— provisions to which the product conforms (e.g. Annex ZA of this European Standard);

— particular conditions applicable to the use of the product (e.g. provisions for use under certain conditions, etc.);

— name and address of the notified laboratory(ies);

— name of, and position held by, the person empowered to sign the certificate on behalf of the manufacturer or his authorised representative.

The above mentioned declaration and certificate shall be presented in the official language or languages of the Member State in which the product is to be used.

The validity of the declaration/certificate shall be verified at least once a year.

ZA.3 CE Marking and labelling

The manufacturer or his authorised representative established within the EEA is responsible for the affixing of the CE marking. The CE marking symbol to affix shall be in accordance with Directive 93/68/EEC and shall be shown on the product itself, on the accompanying label or on the packaging.

The following information shall accompany the CE marking symbol:

a) identification number of the certification body (only for products under system 1);

b) name or identifying mark of the manufacturer (see Note 1 in ZA.2.2);

c) the last two digits of the year in which the marking is affixed;

d) number of the EC Certificate of conformity or factory production control certificate (if relevant);

e) reference to this European Standard;

f) description of the product;

g) information on those relevant essential characteristics listed in Table ZA.1 which are to be declared presented as:

   — standard designation(s) in combination with declared values as described in Clause 6.

NOTE Care will be taken that using standard designation does not bring information on non-harmonised characteristics into the CE marking.

The “No performance determined” (NPD) option may not be used for durability and where the characteristic is subject to a threshold level. Otherwise, the NPD option may be used when and where the characteristic, for a given intended use, is not subject to regulatory requirements in the Member State of destination.

Figure ZA.1 gives an example of the information to be given on the product, label, packaging and/or commercial documents.

CE 0123	*CE marking, consisting of the "CE"-symbol given in Directive 93/68/EEC.* *Identification number of the certification body (for products under system 1)*
AnyCo Ltd, PO Box 21, B-1050 **13** 0123-CPD-00234	*Name or identifying mark and registered address of the producer* *Last two digits of the year in which the marking was affixed* *Certificate number (for products under system 1)*
EN 14320–1 Product – Sprayed PU foam, intended to be used in industrial applications Reaction to fire – E Thermal conductivity – (See performance charts) Water vapour transmission (expressed as water vapour resistance factor μ)60 Continuous glowing combustion: NPD PU EN 14320-1-MU60	*No. of dated version of European Standard Description of product Information on Essential Characteristics* Reaction to fire-Euroclass Designation code (in accordance with Clause 6 of this standard for the relevant characteristics according to Table ZA.1)

Figure ZA.1 — Example CE marking information for industrial applications

Bibliography

[1] EN 14320-2, *Thermal insulation products for building equipment and industrial installations — In-situ formed sprayed rigid polyurethane (PUR) and polyisocyanurate foam (PIR) products — Part 2: Specification for the installed insulation products*

[2] ASTM 3985, *Standard Test Method for Oxygen Gas Transmission Rate Through Plastic Film and Sheeting Using a Coulometric Sensor*

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