

Thermal insulation products for buildings — Factory made products of extruded polystyrene foam (XPS) — Specification

The European Standard EN 13164:2001, with the incorporation of amendment A1:2004, has the status of a British Standard

ICS 91.100.60

National foreword

This British Standard is the official English language version of EN 13164:2001, including amendment A1:2004 and corrigendum December 2005.

EN 13164 is a “harmonized” European Standard and fully takes into account the requirements of the European Commission mandate M/103, *Thermal insulating materials and products*, given under the EU Construction Products Directive (89/106/EEC), and is intended to lead to CE marking. The date of applicability of EN 13164 as a “harmonized” European Standard, i.e. the date after which this standard may be used for CE marking purposes, is subject to an announcement in the *Official Journal of the European Communities*.

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

EN 13164 is the subject of transitional arrangements agreed under the European Commission mandate. The Member States have agreed a nominal transition period for the co-existence of EN 13164 and their corresponding national standard(s). It is intended that this period will comprise a nominal nine month period during which any required changes to national regulations are to be made, followed by a further nominal 12 month period for the implementation of CE marking. By the end of this co-existence period, any conflicting national standards will be withdrawn or amended to remove conflicts. In the UK, the corresponding national standard is:

— BS 3837-2:1990, *Expanded polystyrene boards — Part 2: Specification for extruded boards*;

and based on this nominal transition period of 21 months, BS 3837-2:1990 will be withdrawn or amended at the latest by March 2003.

The UK participation in the preparation of EN 13164:2001 was entrusted to Technical Committee PRI/72, Rigid cellular materials, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible European committee any enquiries on the interpretation, or proposals for change, and keep UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

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

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the *BSI Catalogue* under the section entitled “International Standards Correspondence Index”, or by using the “Search” facility of the *BSI Electronic Catalogue* or of British Standards Online.

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Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 36, an inside back cover and a back cover.

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Amendments issued since publication

Amd. No.	Date	Comments
15259	15 July 2004	See national foreword
16204	31 March 2006	Changes to Clauses 4, 6, 8 and Annex ZA

This British Standard, having been prepared under the direction of the Sector Committee for Materials and Chemicals, was published under the authority of the Standards Committee and comes into effect on 15 August 2001

English version

**Thermal insulation products for buildings — Factory made
products of extruded polystyrene foam (XPS) — Specification**
(includes amendment A1:2004)

Produits isolants thermiques pour le bâtiment — Produits
manufacturés en mousse de polystyrène extrudé (XPS) —
Spécification
(inclut l'amendement A1:2004)

Wärmedämmstoffe für Gebäude — Werkmäßig hergestellte
Produkte aus extrudiertem Polystyrolschaum (XPS) —
Spezifikation
(enthält Änderung A1:2004)

This European Standard was approved by CEN on 16 April 2001, and amendment A1 was approved by CEN on 12 February 2004.

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

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.



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Foreword

This European Standard 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 November 2001, and conflicting national standards shall be withdrawn at the latest by March 2003.

This European Standard 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 standard.

This European Standard contains six annexes.

Annex A (normative)	Determination of the declared values of thermal resistance and thermal conductivity.
Annex B (normative)	Factory production control.
Annex C (normative)	Determination of aged values of thermal resistance and thermal conductivity.
Annex D (informative)	Additional properties.
Annex E (informative)	Plan for cutting test specimen.
Annex ZA (informative)	Clauses of this European Standard addressing the provisions of the EU Construction Products Directive.

This European Standard is one of a series of standards for insulating products used in buildings, but this standard may be used in other areas where appropriate.

In pursuance of resolution BT 20/1993 revised, CEN/TC88 have proposed defining the standards listed below as a package of European Standards, setting (21 months after availability) as the date of withdrawal (dow) of national standards which conflict with the European Standards of this package.

The package of standards comprises the following group of interrelated standards for the specifications of factory made thermal insulation products, all of which come within the scope of CEN/TC88.

EN 13162, *Thermal insulation products for buildings — Factory made mineral wool (MW) products — Specification.*

EN 13163, *Thermal insulation products for buildings — Factory made products of expanded polystyrene (EPS) — Specification.*

EN 13164, *Thermal insulation products for buildings — Factory made products of extruded polystyrene foam (XPS) — Specification.*

EN 13165, *Thermal insulation products for buildings — Factory made rigid polyurethane foam (PUR) products — Specification.*

EN 13166, *Thermal insulation products for buildings — Factory made products of phenolic foam (PF) — Specification.*

EN 13167, *Thermal insulation products for buildings — Factory made cellular glass (CG) products — Specification.*

EN 13168, *Thermal insulation products for buildings — Factory made wood wool (WW) products — Specification.*

EN 13169, *Thermal insulation products for buildings — Factory made products of expanded perlite (EPB) — Specification.*

EN 13170, *Thermal insulation products for buildings — Factory made products of expanded cork (ICB) — Specification.*

EN 13171, *Thermal insulation products for buildings — Factory made wood fibre (WF) products — Specification.*

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

Foreword to amendment A1

This document (EN 13164:2001/A1:2004) 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 November 2004, and conflicting national standards shall be withdrawn at the latest by November 2004.

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1 Scope

This European Standard specifies the requirements for factory made products of extruded polystyrene foam, with or without facings or coatings, which are used for thermal insulation of buildings. The products are manufactured in the form of boards, which are also available with special edge and surface treatment (tongue and grooves, shiplap etc.).

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

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

The standard does not specify the required level of a given property to be achieved by a product to demonstrate fitness for purpose in a particular application. The levels required for a given application are to be found in regulations or non-conflicting standards.

Products with a declared thermal resistance lower than $0,25 \text{ m}^2\text{-K/W}$ or a declared thermal conductivity greater than $0,060 \text{ W/(m-K)}$ at 10°C are not covered by this standard.

This standard does not cover *in situ* insulation products and products intended to be used for the insulation of building equipment and industrial installations or products intended for acoustic insulation.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 822, *Thermal insulating products for building applications — Determination of length and width.*

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

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

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

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

prEN ISO 1182, *Reaction to fire tests for building products — Non-combustibility test (ISO/DIS 1182:1998).*

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

EN 1605, *Thermal insulating products for building applications — Determination of deformation under specified compressive load and temperature condition.*

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

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

prEN ISO 1716, *Reaction to fire tests for building products — Determination of calorific value (ISO/DIS 1716:1998).*

prEN ISO 9229, *Thermal insulation — Definitions of terms (ISO/DIS 9229:1997).*

prEN ISO 11925-2, *Reaction to fire tests for building products — Part 2: Ignitability when subjected to direct impingement of flame (ISO/DIS 11925-2:1998).*

EN 12086:1997, *Thermal insulating products for building applications — Determination of water vapour transmission properties.*

EN 12087, *Thermal insulating products for building applications — Determination of long term water absorption by immersion.*

EN 12088, *Thermal insulating products for building applications — Determination of long term water absorption by diffusion.*

EN 12091, *Thermal insulating products for building applications — Determination of freeze-thaw resistance.*

prEN 12667, *Thermal performance of building materials and products — Determination of thermal resistance by means of guarded hotplate 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 A1, *Thermal insulating products — Evaluation of conformity.*

EN 13501 A1, *Fire classification of construction products and building elements — Part 1: Classification using test data from reaction to fire test.*

prEN 13820, *Thermal insulating products for building applications — Determination of organic content.*

EN 13823 A1, *Reaction to fire tests for building products — Building products excluding floorings exposed to the thermal attack by a single burning item.*

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

3 Terms, definitions, symbols, units, abbreviated terms

3.1 Terms and definitions

For the purposes of this standard, the following definitions apply.

3.1.1 Terms and definitions as given in prEN ISO 9229

3.1.1.1

extruded polystyrene foam

rigid cellular plastics insulation material expanded and extruded with or without a skin, from polystyrene or one of its copolymers and which has a closed cell structure

3.1.1.2

board

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

3.1.2 Additional definitions

3.1.2.1

level

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

The level is given by the declared value of the characteristic concerned.

3.1.2.2

class

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

3.2 Symbols, units and abbreviated terms

Symbols and units used in this standard:

b	is the width	mm
d	is the thickness	mm
d_N	is the nominal thickness of the product	mm
d_S	is the thickness of test specimen	mm
$\Delta \varepsilon_b$	is the relative change in width	%
$\Delta \varepsilon_d$	is the relative change in thickness	%
$\Delta \varepsilon_l$	is the relative change in length	%
ε_{ct}	is the compressive creep	%
ε_t	is the total relative thickness reduction	%
ε_1	is the relative deformation after step A	%
ε_2	is the relative deformation after step B	%
k	is a factor related to the number of test results available	—
l	is the length	mm
$\lambda_{90/90}$	is the 90 % fractile with a confidence level of 90 % for the thermal conductivity	W/(m·K)



$\lambda_{90/90, 60d}$	is the 90 % fractile with a confidence level of 90 % for the thermal conductivity of foam at 60 days	W/(m·K)
$\lambda_{90/90>60d}$	is the 90 % fractile with a confidence level of 90 % for the thermal conductivity of foam older than 60 days	W/(m·K)
λ_D	is the declared thermal conductivity	W/(m·K)
λ_i	is one test result of thermal conductivity	W/(m·K)
λ_{mean}	is the mean thermal conductivity	W/(m·K)
$\lambda_{mean, a}$	is the mean thermal conductivity of aged values	W/(m·K)
$\lambda_{mean, 60d}$	is the mean thermal conductivity of values for 60 days old foam	W/(m·K)
$\lambda_{> 60d}$	is the measured value of the thermal conductivity of foam older than 60 days	W/(m·K)
μ	is the water vapour diffusion resistance factor	—
n	is the number of test results	—
$R_{90/90}$	is the 90 % fractile with a confidence level of 90 % for the thermal resistance	m ² ·K/W
$R_{90/90, 60d}$	is the 90 % fractile with a confidence level of 90 % for the thermal resistance of foam at 60 days	m ² ·K/W
$R_{90/90>60d}$	is the 90 % fractile with a confidence level of 90 % for the thermal resistance of foam older than 60 days	m ² ·K/W
R_D	is the declared thermal resistance	m ² ·K/W
R_i	is one test result of thermal resistance	m ² ·K/W
R_{mean}	is the mean thermal resistance	m ² ·K/W
S_b	is the deviation from squareness on width or length	mm/m
S_{max}	is the deviation from flatness	mm
s_R	is the estimate of the standard deviation of the thermal resistance	m ² ·K/W
s_λ	is the estimate of the standard deviation of the thermal conductivity	W/(m·K)
$s_{\lambda,a}$	is the estimate of the standard deviation of the aged thermal conductivity	W/(m·K)
$s_{\lambda,i}$	is the estimate of the standard deviation of the initial thermal conductivity within 90 days of production	W/(m·K)
σ_{10}	is the compressive stress at 10% deformation	kPa
σ_c	is the declared compressive stress	kPa
σ_m	is the compressive strength	kPa
σ_{mt}	is the tensile strength perpendicular to faces	kPa
W_{dV}	is the water absorption by diffusion	%
W_{lt}	is the long term water pick up by total immersion	%
W_V	is the water absorption by diffusion and by freeze-thaw	%
Z	is the water vapour resistance	m ² ·h·Pa/mg

CC(i ₁ /i ₂ /y)σ _c	is the symbol of the declared level for compressive creep
CS(10\Y)x	is the symbol of the declared level for compressive stress or strength
DLT(1)5	is the symbol of the declared level of deformation under specified compressive load and temperature at conditions set 1 with a maximum of 5 % deformation
DLT(2)5	is the symbol of the declared level of deformation under specified compressive load and temperature at conditions set 2 with a maximum of 5 % deformation
DS(T+)	is the symbol of the declared value for dimensional stability at specified temperature
DS(TH)	is the symbol of the declared value for dimensional stability under specified temperature and humidity
FT	is the symbol of the declared level for freeze thaw resistance
MU	is the symbol of the declared level for water vapour diffusion resistance factor
T	is the symbol of the declared class for thickness tolerances
TR	is the symbol of the declared level for tensile strength perpendicular to faces
WD(V)	is the symbol of the declared level for water absorption by diffusion
WL(T)	is the symbol of the declared level for long term water absorption by total immersion
Z	is the symbol of the declared value for water vapour resistance

Abbreviated terms used in this standard:

XPS	is extruded polystyrene foam;
ITT	is initial type testing.

4 Requirements

4.1 General

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

NOTE Information on additional properties is given in annex D.

One test result for a product property is the average of the measured values on the number of test specimens given in Table 9.

4.2 For all applications

4.2.1 Thermal resistance and thermal conductivity

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

The thermal resistance and thermal conductivity shall be determined in accordance with annex A and annex C and declared by the manufacturer according to the following:

- the reference mean temperature shall be 10 °C;
- the measured values shall be expressed with three significant figures;
- for products of uniform thickness, the thermal resistance, R_D , shall always be declared. The thermal conductivity, λ_D , shall be declared where possible. Where appropriate, for products of non-uniform thickness (i.e. sloped and tapered products) only the thermal conductivity, λ_D shall be declared.
- the declared thermal resistance, R_D , and the declared thermal conductivity, λ_D , shall be given as limit values representing at least 90 % of the production, determined with a confidence level of 90 %;
- the value of thermal conductivity, $\lambda_{90/90}$, shall be rounded upwards to the nearest 0,001 W/(m·K) and declared as λ_D in levels with steps of 0,001 W/(m·K);
- the declared thermal resistance, R_D , shall be calculated from the nominal thickness, d_N , and the corresponding declared thermal conductivity value, $\lambda_{90/90}$;
- the value of thermal resistance, $R_{90/90}$, when calculated from the nominal thickness, d_N , and the corresponding thermal conductivity, $\lambda_{90/90}$, shall be rounded downwards to the nearest 0,05 m²·K/W, and declared as R_D in levels with steps of 0,05 m²·K/W;
- the value of $R_{90/90}$ for those products for which only the thermal resistance is measured directly, shall be rounded downwards to the nearest 0,05 m²·K/W and declared as R_D in levels with steps of 0,05 m²·K/W.

4.2.2 Length, width, squareness, flatness

Length, l , and width, b , shall be determined in accordance with EN 822, the squarenesses on length and width, S_b , in accordance with EN 824, and the flatness, S_{max} , in accordance with EN 825. No test result shall deviate from the nominal values by more than the tolerances given in Table 1.

Table 1 — Tolerances of length, width, squareness and flatness

Nominal length or width	Tolerances		
	Length or width	Squareness on length and width	Flatness
mm	mm	S_b mm/m	S_{max} mm
less than 1 000	±8	5	7,0
1 000 to 2 000	±10	5	14,0
> 2 000 to 4 000	±10	5	28,0
> 4 000	±10	5	35,0

4.2.3 Thickness

Thickness, d , shall be determined in accordance with EN 823. No test result shall deviate from the nominal thickness, d_N , by more than the tolerances given in Table 2 for the labelled class.

Table 2 — Classes for thickness tolerances

Class	Tolerances mm		Thickness mm
T1	-2	+2	< 50
	-2	+3	$50 \leq d_N \leq 120$
	-2	+8	> 120
T2	-1,5	+1,5	< 50
	-1,5	+1,5	$50 \leq d_N \leq 120$
	-1,5	+1,5	> 120
T3	-1	+1	< 50
	-1	+1	$50 \leq d_N \leq 120$
	-1	+1	> 120

4.2.4 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 test shall be carried out after storage for 48 h at $(23 \pm 2) ^\circ\text{C}$ and $(90 \pm 5) \%$ relative humidity. The relative changes in length, $\Delta\epsilon_l$, in width, $\Delta\epsilon_b$, and in thickness, $\Delta\epsilon_d$, shall not exceed 2 %. This test shall not be performed when the more severe test, described in 4.3.2.2, is used.

4.2.5 Compressive stress or compressive strength

The 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 greatest, shall be lower than the values given in Table 3 for the declared level.