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Light weight fill and insulation products for civil engineering applications - Factory made products of expanded polystyrene (EPS) - Specification

Remblai léger et produits isolants pour les applications de génie civil - Produits manufacturés polystyrène expansé (EPS) - Spécifications

Leichtaufschüttungen und Dämmprodukte für Anwendungen im Tiefbau - Werkmäßig hergestellte Produkte aus expandiertem Polystyrol (EPS) - Spezifikation

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If this draft becomes a European Standard, 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.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
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Management Centre: rue de Stassart, 36 B-1050 Brussels

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Foreword

This document (prEN 14933:2004) has been prepared by Technical Committee CEN/TC 88 “Thermal insulating materials and products”, the secretariat of which is held by DIN.

This document is currently submitted to the CEN Enquiry.

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 Directives.

For relationship with EU Directives, see informative Annex ZA, which is an integral part of this document.

This European Standard contains five annexes:

Annex A (normative) Determination of the declared values of thermal conductivity and thermal resistance

Annex B (normative) Factory production control

Annex C (normative) Product classification

Annex D (informative) Additional properties

Annex ZA (informative) Clauses of this European Standard addressing the provision of the EU Construction Products Directive

This European Standard is one of a series of standards for products used for insulation in buildings, installed equipment and in civil engineering applications.

1 Scope

This European Standard specifies the requirements for factory made products of expanded polystyrene which are used in civil engineering applications, such as light weight fill and frost insulation. Other typical applications are: reduction of lateral earth pressure on retaining walls and bridge abutments, redistribution of loads on buried pipes (“imperfect ditch”), compressible inclusion on swelling soils, as dampers for reduction of vibrations, marine floating devices etcetera. The products are manufactured in the form of boards or blocks.

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

Products covered by this standard are also used for thermal insulation of building for which EN 13163 is applicable and for insulation of building equipment and industrial installations for which prEN 14309 is applicable.

The standard does not specify the required class or level of a given property to be achieved by a product to demonstrate fitness for purpose in a particular application. The classes and 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 $m^2 \cdot K/W$ or a declared thermal conductivity at 10 °C greater than 0,060 W/(m·K) 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.*

EN ISO 1182, *Reaction to fire tests for building products — Non combustibility test (ISO 1182:2002).*

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

EN 1603, *Thermal insulating products for building applications — Determination of dimensional stability under constant normal laboratory conditions (23 °C/50 % relative humidity).*

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 conditions.*

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

EN ISO 1716, *Reaction to fire tests for building products — Determination of the heat of combustion (ISO 1716:2002).*

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

EN ISO 11925-2, *Reaction to fire tests — Ignitability of building products subjected to direct impingement of flame — Part 2: Single-flame source test (ISO 11925-2:2002).*

EN 12085, *Thermal insulating products for building applications — Determination of linear dimensions of test specimens.*

EN 12086, *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 12089, *Thermal insulating products for building applications — Determination of bending behaviour.*

EN 12090, *Thermal insulating products for building applications — Determination of shear strength.*

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

EN 12667, *Thermal performance of building materials and products — Determination of thermal resistance by means of guarded hot plate and heat flow meter methods — Products of high and medium thermal resistance.*

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

EN 13172, *Thermal insulation products — Evaluation of conformity.*

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

prEN 13793, *Thermal insulating products for building applications — Determination of behaviour under cyclic loading.*

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

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

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

SP 2687, *Determination of the resistance to cyclic compressive loading.*

3 Terms, definitions, symbols, units and abbreviated terms

3.1 Terms and definitions

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

3.1.1
expanded polystyrene (EPS)
rigid cellular plastic material, manufactured by moulding prefoamed beads of expandable polystyrene or one of its copolymers, with an air filled closed cellular structure

3.1.2
expanded polystyrene block
rigid insulation product or material generally of rectangular cross section and with a thickness not significantly smaller than the width. Blocks are supplied trimmed or untrimmed

3.1.3
expanded polystyrene board
rigid insulation product (cut, moulded, or continuously foamed) of rectangular shape and cross section in which the thickness is significantly smaller than the other dimensions. Boards may be of uniform thickness or tapered. The board edges may be of various sorts (e.g., square, half lapped, tongue and groove)

3.1.4
preformed ware
insulation shapes formed by cutting or grinding from blocks or boards or by shape moulding

3.1.5
level
the given value, which is the upper or lower limit of a requirement. The level is given by the declared value of the characteristic concerned

3.1.6
class
a combination of two levels of the same property between which the performance shall fall

3.1.7
civil engineering applications (CEA)
applications in roads, railroads, embankments such as light weight fill and frost insulation, compressible inclusion, floating devices etc.

Other relevant definitions are to be found in prEN ISO 9229.

3.2 Symbols, units and abbreviated terms

Symbols used in this standard:

$1 - \alpha$	is the prediction interval	1
b	is the width	mm
d	is the thickness	mm
δ	is the water vapour permeability	mg/(m·h·Pa)
d_D	is the declared thickness of a product	m
d_s	is the thickness of the test specimen	m
$\Delta\varepsilon_b$	is the relative change in width	%
$\Delta\varepsilon_d$	is the relative change in thickness	%
$\Delta\varepsilon_l$	is the relative change in length	%
Δ_1	is the deformation after step A according EN 1605	%
Δ_2	is the deformation after step B according EN 1605	%
ε_{ct}	is the compressive creep	%
ε_t	is the total relative thickness reduction	%
E_{dyn}	is the dynamic elasticity modulus	MN/m^2
k	is a factor related to the number of test results available	1
l	is the length	mm
L	is the thickness effect parameter	1
$\lambda_{90,\,90}$	is the 90 % fractile with a confidence level of 90 % for the thermal conductivity	W/(m·K)
λ_D	is the declared value of thermal conductivity	W/(m·K)
λ_i	is one test result of thermal conductivity	W/(m·K)

λ'_i	is one test result of thermal conductivity for which the thickness effect is not negligible	W/(m·K)
λ_{mean}	is the mean thermal conductivity	W/(m·K)
λ_{pred}	is the thermal conductivity with a prediction interval of 90 %	W/(m·K)
μ	is the water vapour diffusion resistance factor	1
n	is the number of test results	1
ρ_a	is the apparent density	kg/m^3
$R_{90/90}$	is the 90 % fractile with a confidence level of 90 % for the thermal resistance	m^2·K/W
R_D	is the declared thermal resistance	m^2·K/W
R_i	is one test result of thermal resistance	m^2·K/W
R'_i	is one test result of thermal resistance for which the thickness effect is not negligible	m^2·K/W
R_{mean}	is the mean thermal resistance	m^2·K/W
σ_{10}	is the compressive stress at 10 % deformation	kPa
$\sigma_{10,\ mean}$	is the mean compressive stress at 10 % deformation	kPa
$\sigma_{10,\ pred}$	is the predicted compressive stress at 10 % deformation with a prediction interval of 90 %	kPa
σ_5	is the compressive stress at 5 % deformation	kPa
σ_2	is the compressive stress at 2 % deformation	kPa
σ_b	is the bending strength	kPa
S_b	is the deviation from squareness	mm/m
s_λ	is the estimate of the standard deviation of the thermal conductivity	W/(m·K)
σ_c	is the compressive stress to determine ε_t	kPa
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
τ	is the shear strength	kPa
W_{dV}	is the water absorption by diffusion	vol. %
W_{lt}	is the long-term water absorption by total immersion	vol.-%
W_{lp}	is the long-term water absorption by partial immersion	kg/m^2
X_{ct}	is the compressive creep	mm
X_t	is the total compressive deflection	mm
Z	is the water vapour resistance	m^2·h·Pa/mg

BS	is the symbol of the declared level for bending strength
CC(i_1,i_2/y) σ	is the symbol of the declared level for compressive creep
CLR(L)	is the symbol of the declared level for resistance to cyclic loading under a specified load
CS (10)	is the symbol of the declared level for compressive stress at 10 % deformation
CS (5)	is the symbol of the declared level for compressive stress at 5 % deformation
CS (2)	is the symbol of the declared level for compressive stress at 2 % deformation
DS(N)	is the symbol of the declared class for dimensional stability under normal laboratory conditions
DLT	is the symbol of the declared level for dimensional stability under load and temperature
FT	is the symbol of the declared level for freeze thaw resistance
L	is the symbol of the declared class for length tolerances
P	is the symbol of the declared class for flatness tolerance
S	is the symbol of the declared class for squareness tolerance
T	is the symbol of the declared class for thickness tolerance
W	is the symbol of the declared class for width tolerance
WD(V)	is the symbol of the declared level for water absorption by diffusion
WL(T)	is the symbol of the declared level for water absorption by total immersion
WS	is the symbol of the declared level for short term water absorption
Z	is the symbol of the declared water vapour resistance value

Abbreviations used in this standard:

EPS	is **E**xpanded **P**oly**S**tyrene
ITT	is **I**nitial **T**ype **T**esting

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 13. Wherever limit values are used, they shall represent the value achieved by at least 90% of the production with a confidence level of 90 %.

For mechanical properties no single measured value within the consecutive group used for obtaining the test result, shall be more than 10% lower than of the limit value defining the level. For non mechanical properties a deviation from the limit value may be required and where appropriate these are expressed in the text.

4.2 For all applications

4.2.1 Length and width

Length, l, and width, b, shall be determined in accordance with EN 822. No test result shall deviate from the declared values by more than the tolerances given in Table 1 for the declared class.

4.2.2 Thickness

Thickness, d, shall be determined in accordance with EN 823. No test result shall deviate from the declared thickness, d_D, by more than the tolerances given in Table 1, for the declared class.

4.2.3 Squareness

Squareness shall be determined in accordance with EN 824. The deviation from squareness on length and width, S_b, shall not exceed the tolerances given in Table 1, for the declared class.

4.2.4 Flatness

Flatness shall be determined in accordance with EN 825. The maximum deviation from flatness, S_{max}, shall not exceed the tolerances given in Table 1 for the declared class.

Table 1 — Classes of dimensional tolerances

Property	Class	Tolerances
Length	L0	No requirement
	L1	± 1,0 % or ± 10 mm [a]
	L2	± 0,5 % or ± 5 mm [a]
	L3	± 0,3 % or ± 3 mm [a]
Width	W0	No requirement
	W1	± 0,5 % or ± 5 mm [a]
	W2	± 0,3 % or ± 3 mm [a]
Thickness	T0	No requirement
	T1	± 0,5 % or ± 5 mm [a]
	T2	± 0,3 % or ± 3 mm [a]
	T3	± 0,2 % or ± 2 mm [a]
Squareness	S0	No requirement
	S1	± 5/1 000 mm
	S2	± 2/1 000 mm
Flatness	P0	No requirement
	P1	± 30 mm/m
	P2	± 15 mm/m
	P3	± 10 mm/m
	P4	± 5 mm/m

[a] Whichever gives the least numerical tolerance.

4.2.5 Dimensional stability

4.2.5.1 Dimensional stability under constant normal laboratory conditions

Dimensional stability under constant normal laboratory conditions (23 °C, 50 % relative humidity) shall be determined in accordance with EN 1603. The relative changes in length, $\Delta\varepsilon_l$, and width, $\Delta\varepsilon_b$, shall not exceed the values given in Table 2 for the declared class.

Table 2 — Classes of dimensional stability under normal laboratory conditions

Classes	Requirement %
DS(N) 5	±0,5
DS(N) 2	±0,2

4.2.5.2 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 for 48 h at (23 ± 2) °C temperature and (90 ± 5) % relative humidity. The relative changes in length, $\Delta\varepsilon_l$, width, $\Delta\varepsilon_b$, and thickness, $\Delta\varepsilon_d$, shall not exceed 1 %.

The test shall not be performed when the more severe test, described in 4.3.3, is used for a product in a specific application.

4.2.6 Compressive stress at 2% or 5% and 10% deformation

Compressive stress at 2 % or 5 % and 10 % deformation, σ_2 or σ_5 and σ_{10}, shall be determined in accordance with EN 826. No test result shall be less than the values given in Table 3 or Table 4 and Table 5 for the declared level.

NOTE 1 The compressive stress at 10 % deformation is not a design value.

NOTE 2 Although EN 826 does not specify the calculation of the compressive stress at 2 % or 5 %, the calculation should be done in the same way.

NOTE 3 Alternatively the compressive modulus can be determined according to EN 826 and the result declared in steps of 500 kPa.

Table 3 — Levels for compressive stress at 2 % deformation

Level	Requirement kPa
CS(2)20	≥20
CS(2)30	≥30
CS(2)40	≥40
CS(2)50	≥50
CS(2)60	≥60
CS(2)70	≥70
CS(2)80	≥80