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**Toplotnoizolacijski in lahki polnilni proizvodi za inženirske objekte - Proizvodi iz ekstrudiranega polistirena (XPS) - Specifikacija**

Thermal insulation and light weight fill products for civil engineering applications — Factory made products of expanded polystyrene (EPS) — Specification

Wärmedämmung und leichte Füllprodukte für Anwendungen im Tiefbau — Werkmäßig hergestellte Produkte aus expandiertem Polystyrol (EPS) — Spezifikation

Produits isolants thermiques et de remblayage pour les applications de génie civil — Produits manufacturés en polystyrene expansé (EPS) — Spécifications

[SIST EN 14933:2007](https://standards.iteh.ai/catalog/standards/sist/4ba2adec-d9be-4a17-8b2e-c65d4451330/sist-en-14933-2007)

**Ta slovenski standard je istoveten z: EN 14933:2007**

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**ICS:**

83.100	Penjeni polimeri	Cellular materials
91.100.60	Termična izolacijska materiala	Thermal and sound insulating materials

**SIST EN 14933:2007**

**en,de**

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ICS 83.100; 93.010

English Version

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

Produits isolants thermiques et de remblayage pour les applications de génie civil - Produits manufacturés en Polystyrène expansé (EPS) - Spécifications

Wärmedämmung und leichte Füllprodukte für Anwendungen im Tiefbau - Werkmäßig hergestellte Produkte aus expandiertem Polystyrol (EPS) - Spezifikation

This European Standard was approved by CEN on 13 July 2007.

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## Foreword

This document (EN 14933:2007) 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of an identical text or by endorsement, at the latest by March 2008, and conflicting national standards shall be withdrawn at the latest by March 2008.

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 is one of a series of standards for products used for insulation in buildings, insulation of building equipment and industrial installations and in civil engineering applications.

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

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## 1 Scope

This European Standard specifies the requirements for factory made products of expanded polystyrene which are used for frost insulation of roads, railways, trafficked areas, light weight fill for reduction of horizontal and vertical earth pressure and other civil engineering applications.

The products are manufactured in the form of boards or blocks. The standard also covers specially cut shaped boards or blocks.

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

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.

For applications where thermal resistance is required, products with a declared thermal resistance lower than 0,25 m<sup>2</sup>·K/W or a declared thermal conductivity 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 buildings, of building equipment and industrial installations or products intended for acoustic insulation.

## 2 Normative references

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The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies. [SIST EN 14933:2007](https://standards.iteh.ai/catalog/standards/sist/4ba2adec-d9be-4a17-8b2e-b244a317391a/en-14933-2007)

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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 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 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 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 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*

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 13172:2001, *Thermal insulating 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 tests*

EN 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*

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

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

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

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)*

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

### 3 Terms, definitions, symbols, units and abbreviated terms

#### 3.1 Terms and definitions

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

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

###### 3.1.1.1

###### **expanded polystyrene (EPS)**

rigid cellular plastic material, manufactured by moulding beads of expandable polystyrene or one of its copolymers, with an air filled closed cellular structure

3.1.1.2

**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

3.1.1.3

**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)

3.1.1.4

**preformed ware**

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

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

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3.2 Symbols, units and abbreviated terms

Symbols used in this standard:

	<u>SIST EN 14933:2007</u>	
1 – $\alpha$	is the prediction interval	–
$b$	is the width	mm
$d$	is the thickness	mm
$\delta$	is the water vapour permeability	mg/(m·h·Pa)
$D_i$	is the relative compression after $i$ number of cycles	%
$D_N$	is the nominal 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	%
$\varepsilon_1$	is the deformation after step A according to EN 1605	%
$\varepsilon_2$	is the deformation after step B according to EN 1605	%
$\varepsilon_{ct}$	is the compressive creep	%
$\varepsilon_t$	is the total relative thickness reduction	%
$\varepsilon_{I,max}$	is the relative maximum deformation	%
$k$	is a factor related to the number of test results available	–

$l$	is the length	mm
$L$	is the thickness effect parameter	–
$\lambda_{90, 90}$	is the 90 % fractile with a confidence level of 90 % for the thermal conductivity	W/(m·K)
$\lambda_D$	is the declared value of thermal conductivity	W/(m·K)
$\lambda_i$	is one test result of thermal conductivity	W/(m·K)
$\lambda'_i$	is one test result of thermal conductivity for which the thickness effect is not negligible	W/(m·K)
$\lambda_{\text{mean}}$	is the mean thermal conductivity	W/(m·K)
$\lambda_{\text{pred}}$	is the thermal conductivity with a prediction interval of 90 %	W/(m·K)
$\mu$	is the water vapour diffusion resistance factor	–
$n$	is the number of test results	–
$\rho_a$	is the apparent density	kg/m <sup>3</sup>
$R_{90/90}$	is the 90 % fractile with a confidence level of 90 % for the thermal resistance	m <sup>2</sup> ·K/W
$R_D$	is the declared thermal resistance	m <sup>2</sup> ·K/W
$R_i$	is one test result of thermal resistance	m <sup>2</sup> ·K/W
$R'_i$	is one test result of thermal resistance for which the thickness effect is not negligible	m <sup>2</sup> ·K/W
$R_{\text{mean}}$	is the mean thermal resistance	m <sup>2</sup> ·K/W
$s_R$	is the estimate of the standard deviation of the thermal resistance	m <sup>2</sup> ·K/W
$s_\lambda$	is the estimate of the standard deviation of the thermal conductivity	W/(m·K)
$S_b$	is the deviation from squareness	mm/m
$S_{\text{max}}$	is the deviation from flatness	mm
$\sigma_{10}$	is the compressive stress at 10 % deformation	kPa
$\sigma_{10, \text{mean}}$	is the mean compressive stress at 10 % deformation	kPa
$\sigma_{10, \text{pred}}$	is the predicted compressive stress at 10 % deformation with a prediction interval of 90 %	kPa
$\sigma_5$	is the compressive stress at 5 % deformation	kPa
$\sigma_2$	is the compressive stress at 2 % deformation	kPa
$\sigma_b$	is the bending strength	kPa
$\sigma_c$	is the compressive stress to determine $\varepsilon_t$	kPa
$\sigma_c$	is the declared compressive stress	kPa
$\tau$	is the shear strength	kPa
$W_{\text{dV}}$	is the water absorption by diffusion	% by volume

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$W_{lt}$	is the long-term water absorption by total immersion	% by volume
$W_v$	is water absorption by freeze-thaw after water absorption by diffusion	% by volume
$Z$	is the water vapour resistance	$m^2 \cdot h \cdot Pa/mg$
BS	is the symbol of the declared level for bending strength	
CC( $i_1, i_2/y$ ) $\sigma$	is the symbol of the declared level for compressive creep	
CLR( $i, z$ ) $\sigma_i$	is the symbol of the declared level for resistance to cyclic compressive loading with sinus load application	
CLRT( $i, z$ ) $\sigma_i$	is the symbol of the declared level for resistance to cyclic compressive loading with square wave load application	
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	
DLT(i)5	is the symbol of the declared level for dimensional stability under load and temperature at a specific set of conditions with a maximum of 5 % deformation	
DS(TH)	is the symbol of the declared value for dimensional stability under specified temperature and humidity	
FTC	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	
Z	is the symbol of the declared water vapour resistance value	

Abbreviated terms used in this standard:

**EPS** is expanded polystyrene

## 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 E.

One test result for a product property is the average of the measured values on the number of test specimens given in Table 11.

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 permitted 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 nominal thickness,  $d_N$ , 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.

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Table 1 — Classes of dimensional tolerances

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

<sup>a</sup> Whichever gives the greatest tolerance.

#### 4.2.5 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  $(23 \pm 2)^\circ\text{C}$  temperature and  $(90 \pm 5)\%$  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 4.3.2.1, is used.

#### 4.2.6 Compressive stress at 10 % deformation

Compressive stress at 10 % deformation,  $\sigma_{10}$ , shall be determined in accordance with EN 826. No test result shall be lower than the values given in Table 2 for the declared level.

Table 2 — Levels for compressive stress at 10 % deformation

Level	Requirement kPa
CS(10)40	≥40
CS(10)50	≥50
CS(10)60	≥60
CS(10)70	≥70
CS(10)80	≥80
CS(10)90	≥90
CS(10)100	≥100
CS(10)120	≥120
CS(10)150	≥150
CS(10)200	≥200
CS(10)250	≥250
CS(10)300	≥300
CS(10)350	≥350
CS(10)400	≥400
CS(10)450	≥450
CS(10)500	≥500

#### 4.2.7 Bending strength

Bending strength,  $\sigma_b$ , shall be determined in accordance with EN 12089. For handling purposes, products shall have a minimum level of bending strength of 50 kPa.

#### 4.2.8 Reaction to fire

##### 4.2.8.1 Reaction to fire classification

Reaction to fire classification (Euroclasses) shall be determined in accordance with EN 13501-1.

##### 4.2.8.2 Continuous glowing combustion

Where subject to regulation, the continuous glowing combustion shall be declared. In the absence of a European test method which is under development, the existing relevant national test method applies.

#### 4.3 For specific applications

##### 4.3.1 General

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