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## Thermal insulation products for building equipment and industrial installations — Expanded perlite products — Specification

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## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see [www.iso.org/directives](http://www.iso.org/directives)).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html).

This document was prepared by Technical Committee ISO/TC 163, *Thermal performance and energy use in the built environment*, Subcommittee SC 3, *Thermal insulation products, components and systems*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at [www.iso.org/members.html](http://www.iso.org/members.html).

# Thermal insulation products for building equipment and industrial installations — Expanded perlite products — Specification

## 1 Scope

This document specifies the requirements for factory-made expanded perlite products which are used for thermal insulation of industrial installations and building equipment with an operating temperature from 23 °C to ~ 1 000 °C.

The products are manufactured in the form of boards, pipe sections, segments, prefabricated ware and special ware.

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

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

This document does not specify the required level or class of a given property required to be achieved by a product in order to demonstrate fitness for purpose in a particular application. The levels required for a given application can be found in regulations and invitations to tender.

This document is not applicable to:

- a) products with a declared thermal conductivity greater than 0 072 W/(m·K) at 70 °C;
- b) products intended to be used for the insulation of the building structure;
- c) the acoustical aspects
  - 1) direct airborne sound insulation, and
  - 2) impact noise transmission index.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

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

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

ISO 2477, *Shaped insulating refractory products — Determination of permanent change in dimensions on heating*

ISO 8302, *Thermal insulation — Determination of steady-state thermal resistance and related properties — Guarded hot plate apparatus*

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

ISO 8894-1, *Refractory materials — Determination of thermal conductivity — Part 1: Hot-wire methods (cross-array and resistance thermometer)*

## ISO/FDIS 6334:2023(E)

ISO 9053, *Acoustics — Determination of airflow resistance*

ISO 9229, *Thermal insulation — Vocabulary*

ISO 11654, *Acoustics — Sound absorbers for use in buildings — Rating of sound absorption*

ISO 12570, *Hygrothermal performance of building materials and products — Determination of moisture content by drying at elevated temperature*

ISO 12576-1, *Thermal insulation — Insulating materials and products for buildings — Conformity control systems — Part 1: Factory-made products*

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

ISO 21129, *Hygrothermal performance of building materials and products — Determination of water-vapour transmission properties — Box method*

ISO 29465, *Thermal insulating products for building applications — Determination of length and width*

ISO 29466, *Thermal insulating products for building applications — Determination of thickness*

ISO 29467, *Thermal insulating products for building applications — Determination of squareness*

ISO 29468, *Thermal insulating products for building applications — Determination of flatness*

ISO 29469:2022, *Thermal insulating products for building applications — Determination of compression behaviour*

ISO 29470, *Thermal insulating products for building applications — Determination of the apparent density*

ISO 29472, *Thermal insulating products for building applications — Determination of dimensional stability under specified temperature and humidity conditions*

ISO 29767, *Thermal insulating products for building applications — Determination of short-term water absorption by partial immersion*

ISO 5017, *Dense shaped refractory products — Determination of bulk density, apparent porosity and true porosity*

ISO 8841, *Dense, shaped refractory products — Determination of permeability to gases*

ISO 20392, *Thermal-insulating materials — Determination of compressive creep*

ISO 16537, *Thermal insulating products for building applications — Determination of shear behaviour*

ISO 12628, *Thermal insulating products for building equipment and industrial installations — Determination of dimensions, squareness and linearity of preformed pipe insulation*

ISO 12624, *Thermal insulating products for building equipment and industrial installations — Determination of trace quantities of water-soluble chloride, fluoride, silicate, sodium ions and pH*

ISO 12629, *Thermal insulating products for building equipment and industrial installations — Determination of water vapour transmission properties of preformed pipe insulation*

ISO 18099, *Thermal insulating products for building equipment and industrial installations — Determination of the coefficient of thermal expansion*

ISO 12623, *Thermal insulating products for building equipment and industrial installations — Determination of short-term water absorption by partial immersion of preformed pipe insulation*

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

#### 3.1 Terms and definitions

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

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

##### 3.1.1

##### **production line**

equipment that produces products in a continuous process

Note 1 to entry: For initial type test (ITT) and factory production control (FPC), each line is considered separately.

##### 3.1.2

##### **production unit**

equipment that produces products in a discontinuous process

Note 1 to entry: For initial type test (ITT) and factory production control (FPC), units using the same process in one factory are considered together (as one production line).

#### 3.2 Symbols, units and abbreviated terms

##### 3.2.1 Symbols and units

Symbol	Quantity	Unit
$d$	inside diameter of pipe section	mm
$b$	width	mm
$t$	thickness	mm
$t_D$	declared thickness of the product	mm
$S_{lin}$	deviation from linearity	mm
$l$	length	mm
$S_b$	deviation from squareness of boards on length and width	mm/m
$S_t$	deviation from squareness of boards on thickness	mm
$S_p$	deviation from squareness for pipe insulation	mm
$S_{max}$	deviation from flatness	mm
$\Delta\varepsilon_l$	relative change in length	%
$\Delta\varepsilon_b$	relative change in width	%
$\Delta\varepsilon_t$	relative change in thickness	%
$\lambda$	thermal conductivity	W/(m·K)
$\lambda_D$	declared thermal conductivity	W/(m·K)
$\mu$	water vapour diffusion resistance factor	—
$\sigma_m$	bending strength	kPa
$\rho_a$	apparent density	kg/m <sup>3</sup>

### 3.2.2 Abbreviated terms for declared properties

Abbreviated term	Declared property
CS(5/Y)	declared level for compressive stress at 5 % deformation
Cl	declared level for chloride content
F	declared level for fluoride content
Na	declared level for sodium
K	declared level for potassium content
pH	declared level for pH
L	declared class for length tolerances
MU	declared value for water vapour diffusion resistance factor
P	declared value for flatness tolerances
S	declared class for squareness tolerances
ST	declared level for maximum service temperature
T	declared class for thickness tolerances
W	declared class for width tolerances

### 3.2.3 Abbreviated terms

Abbreviated term	Meaning
EP	Expanded perlite
ITT	Initial type test
ML	Manufacturer's literature
FPC	Factory production control

## 4 Requirements

### 4.1 General

Product properties shall be assessed in accordance with [Clause 5](#). To be in conformance with this document, products shall meet the requirements of [4.2](#), and the requirements of [4.3](#), as appropriate.

The test methods to be used for determination of each property are given in [Table 4](#), which also shows the required test specimen dimensions and the minimum number of test specimens required to give one test result.

One test result for a product property is the average of the measured values on the number of test specimens given in [Table 4](#).

For FPC, see [Annex A](#).

### 4.2 For all applications

#### 4.2.1 Thermal conductivity

The thermal conductivity values shall be declared by the manufacturer at reference mean temperatures covering the product service temperature (ST) range. The following conditions apply:

- the measured values shall be expressed with three significant figures;
- the declared conductivity curve shall be given as a limit curve, as defined in ISO 13787.



## 4.2.2 Dimensions and tolerances

### 4.2.2.1 Linear dimensions

The length,  $l$ , width,  $b$ , and thickness,  $t$ , of boards and the dimensions of pipe sections and prefabricated ware shall be declared. When determined, no test result shall deviate from the declared values by more than the tolerance given in [Table 1](#).

**Table 1 — Dimensional tolerances**

Form of delivery	Length	Width	Thickness	Inside diameter
Board	$\pm 3$ mm or $\pm 0,6$ % <sup>a</sup>	$\pm 3$ mm or $\pm 0,4$ % <sup>a</sup>	$\begin{matrix} +3 \\ -2 \end{matrix}$ mm	
Pipe section or segment	$\pm 3$ mm or $\pm 0,6$ % <sup>a</sup>		$\begin{matrix} +3 \\ -2 \end{matrix}$ mm	0 mm to $\pm 5$ mm

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

### 4.2.2.2 Squareness

The deviation from squareness of boards on length and width,  $S_p$ , shall not exceed 6 mm/m and the deviation from squareness of boards on thickness,  $S_v$ , shall not exceed 2 mm. For pipe sections and segments, the deviation from squareness,  $S_p$ , shall not exceed 3 mm.

### 4.2.2.3 Flatness

The deviation from flatness,  $S_{max}$ , shall not exceed 6 mm.

### 4.2.2.4 Pipe section linearity

The deviation from linearity,  $S_{lin}$ , shall not exceed 3 mm or 0,6 % on length, whichever gives the greatest numerical tolerance.

## 4.2.3 Dimensional stability

Standard atmospheres used for initial and final conditioning shall be chosen in accordance with [5.2](#).

The test shall be carried out after storage for 48 h at  $(23 \pm 2)$  °C and  $(90 \pm 5)$  % relative humidity. The relative changes in length,  $\Delta \varepsilon_l$ , width,  $\Delta \varepsilon_b$ , and thickness,  $\Delta \varepsilon_v$ , shall not exceed 1,0 %.

## 4.2.4 Fire properties

Fire properties with respect to reaction to fire should be assessed, taking into consideration the applicable legislation and building codes in the individual territories in which the product is to be used.

## 4.2.5 Durability characteristics

### 4.2.5.1 General

The appropriate durability characteristics have been considered and are covered in [4.2.5.2](#), [4.2.5.3](#) and [4.2.5.4](#).

### 4.2.5.2 Durability of fire properties against ageing/degradation and high temperature

The fire properties in respect to reaction to fire performance of EP products does not change with time or when subjected to high temperature.

**4.2.5.3 Durability of thermal resistance against ageing/degradation**

The thermal conductivity of EP products does not change with time.

**4.2.5.4 Durability of thermal resistance against high temperature**

The thermal conductivity of EP products does not change with time at a high temperature.

**4.3 For specific applications**

**4.3.1 General**

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

If a property described in 4.3 is declared, it shall be determined in accordance with the test method shown in Table 4.

NOTE For information on additional properties, see Annex B.

**4.3.2 Maximum service temperature (ST)**

The maximum ST for flat products shall be determined in accordance with ISO 2477.

At the maximum ST, the relative changes in length,  $\Delta\epsilon_l$ , and width,  $\Delta\epsilon_p$ , shall not exceed 2 %. The maximum ST, shall be declared in °C in levels with steps of 50 °C as given in the examples shown in Table 2. The test specimen shall not exhibit evidence of self-heating.

**Table 2 — Levels for maximum service temperature (ST)**

Level	Requirement °C
ST 650	≥650
ST 700	≥700
ST 750	≥750
ST 800	≥800
ST 850	≥850
ST 900	≥900
ST 950	≥950
ST 1 000	≥1 000

**4.3.3 Compressive stress or strength**

No test result shall be lower than the value, given in Table 3, for the declared level.

**Table 3 — Levels for compressive stress at 5 % deformation or compressive strength**

Level	Requirement kPa
CS (5/Y) 300	> 300
CS (5/Y) 350	> 350
CS (5/Y) 400	> 400
CS (5/Y) 450	> 450
CS (5/Y) 500	> 500

Table 3 (continued)

Level	Requirement kPa
CS (5/Y) 550	> 550

NOTE ISO 29469 is not applicable to pipe sections.

#### 4.3.4 Trace quantities of water-soluble ions and the pH-value

Trace quantities of water-soluble ions and the pH-value shall be declared as levels in milligrams per kilogram of product and the pH-value as levels in steps of 0,5. For chloride and fluoride, no test result shall exceed the declared value. For sodium and potassium, no test result shall be below the declared value. For the pH-value, no test result shall deviate from the declared value by more than 1,0.

#### 4.3.5 Water vapour diffusion resistance

Expanded perlite products are used for applications at high temperatures where high humidity and water adsorption are irrelevant. In exceptional cases, the water vapour diffusion resistance factor,  $\mu$ , may be measured and declared.

#### 4.3.6 Short-term water absorption by partial immersion

Expanded perlite products can absorb water under poor storage conditions. If necessary, the product may be tested for short-term water absorption by partial immersion.

## 5 Test methods

### 5.1 Sampling

Flat test specimens shall be taken from the same sample and be sufficient to cover the needed tests. Pipe section specimens shall be taken from a sample consisting of at least three full-sized sections.

If this is not possible, the properties of the product shall be measured on the boards from which the product is fabricated. In all cases, dimensions and, when relevant, squareness and flatness shall be measured on the finished product.

### 5.2 Conditioning

Test specimens shall be conditioned to constant mass as specified in ISO 12570. The surfaces of the test specimens shall be free of dust and water. Constant mass is reached when the change of mass between three consecutive weighing made 24 h apart is less than 0,1 % of the total mass

In cases of dispute or when obtaining comparative data on products, such as for databases, the test specimens shall be conditioned by storage at  $(23 \pm 2)$  °C and  $(50 \pm 10)$  % relative humidity, until constant mass is reached.

### 5.3 Testing

#### 5.3.1 General

Table 4 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.

In the case of pipe sections and prefabricated wares cut from boards, the properties shall be determined on the boards from which they are cut, except dimensions and, where relevant, linearity and squareness.