
**Thermal insulation products for building
equipment and industrial installations —
Calcium silicate products**

*Produits isolants thermiques pour l'équipement du bâtiment et les
installations industrielles — Produits en silicate de calcium*

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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

ISO 8143 was prepared by Technical Committee ISO/TC 163, *Thermal performance and energy use in the built environment*, Subcommittee SC 3, *Thermal insulation products*.

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Thermal insulation products for building equipment and industrial installations — Calcium silicate products

1 Scope

This International Standard specifies the requirements for factory-made calcium silicate products which are used for thermal insulation of industrial installations and building equipment with an operating temperature of up to approximately +1 100 °C.

NOTE Calcium silicate products can be used at temperatures lower than 0 °C. For operating temperatures below 0 °C, special tests, regarding the suitability of the product in the intended application, are advised (e.g. liquefaction of oxygen). It is advisable to seek the advice of the manufacturer(s) in all cases.

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

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

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

This International Standard 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 International Standard is not applicable to

- a) products with a declared thermal conductivity greater than 0,6 W/(m·K) at 23 °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 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.

ISO 1182¹⁾, *Reaction to fire tests for products — Non-combustibility test*

1) To be published. (Revision of ISO 1182:2002)

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ISO 1716²⁾, *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 8894-1, *Refractory materials — Determination of thermal conductivity — Part 1: Hot-wire method (cross-array)*

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 9229, *Thermal insulation — Vocabulary*

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 29469:2008, *Thermal insulating products for building applications — Determination of compression behaviour*

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*

EN 13467, *Thermal insulating products for building equipment and industrial installations — Determination of dimensions, squareness and linearity of preformed pipe insulation*

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 13469:2002, *Thermal insulating products for building equipment and industrial installations — Determination of water vapour transmission properties of preformed pipe insulation*

EN 13472, *Thermal insulating products for building equipment and industrial installations — Determination of short term water absorption by partial immersion of preformed pipe insulation*

2) To be published. (Revision of ISO 1716:2002)

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.

3.1.1

production line

equipment that produces products in a continuous process

NOTE 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 For ITT and FPC, units using the same process in one factory are considered together (as one production line).

3.1.3

minimum service temperature

lowest temperature to which a thermal insulation product may be exposed at a given thickness and at which it will continue to function within specified limits of performance

NOTE The required performance may be in the areas of dimensional stability, thermal properties and mechanical properties.

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3.2 Symbols, units and abbreviated terms

3.2.1 Symbols and units

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Symbol	Quantity	Unit
d	inside diameter of pipe section	mm
b	width	mm
t	thickness	mm
t_{dec}	declared thickness of the product	mm
S_{lin}	deviation from linearity	mm
l	length	mm
S_{h}	deviation from squareness of boards on length and width	mm/m
S_{d}	deviation from squareness of boards on thickness	mm
S_{max}	deviation from flatness	mm
$\Delta\varepsilon_{\text{b}}$	relative change in width	%
$\Delta\varepsilon_{\text{d}}$	relative change in thickness	%
$\Delta\varepsilon_{\text{l}}$	relative change in length	%
λ	thermal conductivity	W/(m·K)
λ_{D}	declared thermal conductivity	W/(m·K)
μ	water vapour diffusion resistance factor	—
σ_5	compressive stress at 5 % deformation	kPa
σ_{m}	compressive strength	kPa
S_{p}	deviation from squareness for pipe insulation	mm
ρ_{a}	apparent density	kg/m ³

3.2.2 Abbreviated terms for declared properties

Abbreviated term	Declared property
CS(Y)	declared level for compressive strength
CS(5)	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
ST (-)	declared level for minimum service temperature
T	declared class for thickness tolerances
W	declared class for width tolerances

3.2.3 Abbreviated terms

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Abbreviated term	Meaning
CS	Calcium silicate
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 comply with this International Standard, 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 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	± 3 mm or $\pm 0,6$ % ^a	± 3 mm or $\pm 0,4$ % ^a	$\begin{matrix} +3 \\ -2 \end{matrix}$ mm	
Pipe section or segment	± 3 mm or $\pm 0,6$ % ^a		$\begin{matrix} +3 \\ -2 \end{matrix}$ mm	0 mm to +5 mm

^a Whichever gives the greatest numerical tolerance. ISO 8143:2010

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4.2.2.2 Squareness

The deviation from squareness of boards on length and width, S_b , shall not exceed 6 mm/m and the deviation from squareness of boards on thickness, S_d , 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 ± 2) °C and (90 ± 5) % relative humidity. The relative changes in length, $\Delta\epsilon_l$, width, $\Delta\epsilon_b$, and thickness, $\Delta\epsilon_d$, shall not exceed 1,0 %.

4.2.4 Fire properties

It is recommended that the fire properties with respect to reaction to fire be assessed according to the legislation 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 CS 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 CS products does not change with time.

4.2.5.4 Durability of thermal resistance against high temperature

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

4.3 For specific applications (standards.iteh.ai)

4.3.1 General

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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

At the maximum service temperature, the relative changes in length, $\Delta\epsilon_l$, and width, $\Delta\epsilon_b$, shall not exceed 2 %. The maximum service temperature, ST (+), shall be declared in °C in levels with steps of 50 °C as given in the examples shown in Table 2.

Table 2 — Levels for maximum service temperature

Level	Requirement °C
ST (+) 650	650
ST (+) 800	800
ST (+) 1 000	1 000
ST (+) 1 100	1 100

4.3.3 Minimum service temperature

The minimum service temperature, ST (–), shall be declared in levels with steps of 50 °C.

At the minimum service temperature, ST (–), the relative changes in length, $\Delta\epsilon_l$, and in width, $\Delta\epsilon_b$, shall not exceed 2 %.

Minimum service temperature within the scope of this International Standard, but above 0 °C, need not be tested.

4.3.4 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) 500	> 500
CS (5\Y) 1 000	> 1 000
CS (5\Y) 1 500	> 1 500
CS (5\Y) 2 000	> 2 000
CS (5\Y) 3 000	> 3 000
CS (5\Y) 4 000	> 4 000
CS (5\Y) 5 000	> 5 000
CS (5\Y) 10 000	> 10 000

NOTE ISO 29469 is not applicable to pipe sections.

4.3.5 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.

4.3.6 Water vapour diffusion resistance

Calcium silicate 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, μ , may be measured and declared.

4.3.7 Short-term water absorption by partial immersion

Calcium silicate products may absorb water under poor storage conditions. The product may be tested for short-term water absorption by partial immersion.