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Thermal insulation products — Flexible microporous ~~thermal~~ insulation for industrial applications — Specification

FDIS stage

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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.*

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Field Code Changed

Thermal insulation products — Flexible microporous ~~thermal~~ insulation for industrial applications — Specification

1 Scope

This document specifies the requirements for factory-made flexible microporous insulation (FMI), which ~~are~~is used for the thermal insulation of industrial applications. ~~This document~~It specifies requirements for insulation that exhibits thermal insulating performance through nano-sized pore composite material comprising a blend of inorganic powder, fibres and opacifiers. The products are delivered as a flexible microporous type.

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

~~This document~~It 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 can be found in regulations or non-conflicting standards.

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 846:2019, *Plastics — Evaluation of the action of microorganisms*

ISO 1663, *Rigid cellular plastics — Determination of water vapour transmission properties*

ISO 8301, *Thermal insulation — Determination of steady-state thermal resistance and related properties — Heat flow meter apparatus*

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

ISO 23993, *Thermal insulation products for building equipment and industrial installations — Determination of design thermal conductivity*

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

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

ISO 16535, *Thermal insulating products for building applications — Determination of long-term water absorption by immersion*

ISO 18097, *Thermal insulating products for building equipment and industrial installations — Determination of maximum service temperature*

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

3 Terms, definitions, symbols and abbreviated terms

For the purposes of this document, the following terms and definitions 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 http://www.electropedia.org/

3.1 Terms and definitions

3.1.1
inorganic powder
base ingredient of microporous thermal insulation (e.g. fumed silica) composed of SiO_2 and fumed alumina oxide

3.1.2
microporous
composite material that comes in the form of fibre reinforced inorganic powder (e.g. small particles of dispersed silica), creating micro-pores

3.1.3
flexible microporous thermal insulation
type of microporous thermal insulation that is encased in incombustible fabric (e.g. glass fibre fabric, silica fibre fabric) and stitched with sewing thread for flexibility

3.2 Symbols and units

Symbol	Quantity	Unit
l	length	mm
b	width	mm
t	thickness	mm
$\Delta\varepsilon_l$,	relative change in length	%
$\Delta\varepsilon_b$	relative change in width	%
$\Delta\varepsilon_t$	relative change in thickness	%
λ	thermal conductivity	W/(m·K)

Symbol	Quantity	Unit
λ_D	declared thermal conductivity as determined by ISO 13787, and expressed with three significant digits	W/(m·K)

3.3 Abbreviated terms

3.3.1 Abbreviated terms

Abbreviated term	Meaning
FMI	Flexible microporous insulation
ITT	Initial type test
FPC	Factory production control

3.3.2 Abbreviated terms for declared properties

Abbreviated term	Declared property
ST (+)	declared level for maximum service temperature
CS(Y)	declared level for compressive strength
CS(10)	declared level for compressive strength at 10 % deformation
Cl	declared level for chloride content
T	declared level for thickness

4 Requirements

4.1 General

Product properties shall be assessed in accordance with ~~Clause 5.~~Clause 5. To conform to this document, products shall meet the requirements of ~~4.2,~~4.2, and the requirements of ~~4.3,~~4.3, as appropriate.

The test methods for the determination of each property are given in ~~Table 6.~~Table 6, 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 6.~~Table 6.

4.2 For all applications

4.2.1 Linear dimensions

Length and width shall be measured in accordance with ISO 29465 for each of the four specimens.

A minimum of four measurements shall be made for each dimension. Each value shall be within the tolerances specified in ~~Table 1.~~Table 1.

The thickness of microporous insulation shall be measured in accordance with ISO 29466 by using a square plate under pressure of 250 Pa and shall be subject to the tolerances detailed in ~~Table 1.~~Table 1. The pressure employed during measurement shall be disclosed.

Tighter tolerances can be necessary for certain applications; this shall be agreed by the supplier and purchaser.

Table 1 — Dimensional tolerances

Length		Width		Thickness	
Nominal	Tolerance(mm)	Nominal	Tolerance(mm)	Nominal	Tolerance (%)
≤ 1 m	-0 / +10	≤ 1 m	-0 / +10	T1	-0 / +2
				T2	-0 / +5
1 m ~ 3 m	-0 / +15	1 m ~ 3 m	-0 / +15	T3	-0 / +10
				T4	-0 / +15
> 3 m	-0 / +20	> 3 m	-0 / +20	T5	-0 / > +15

4.2.44.2.2 Density

Density shall be determined in accordance with ISO 29470 in each of the four specimens and reported as the average of the four specimens.

4.2.54.2.3 Thermal conductivity

For thermal conductivity testing, the specimen shall be conditioned according to 5.2.5.2.

Thermal conductivity shall be based upon measurements carried out in accordance with ISO 8301 or ISO 8302.

The measured values shall be expressed with three significant figures and the test mean temperatures shall be according to Table 2Table 2 depending on the usage environment and requirement.

The declared thermal conductivity shall be determined in accordance with ISO 23993.

Table 2 — Thermal conductivity category

	Test mean temperature
Thermal conductivity (λ)	10 °C or 23 °C
	100 °C
	200 °C
	300 °C
	400 °C
	500 °C

4.3 For specific applications

4.3.1 Reaction to fire

The fire properties with respect to reaction to fire should be assessed.

NOTE Legislation can apply regarding reaction to fire in the individual territories where the product is used, can apply.

4.3.2 Water absorption

The test shall be conducted in accordance with the test method in ISO 29767 or in ISO 16535.

ISO 29767 specifies the equipment and procedures for determining the short-term water absorption of specimens by partial immersion.

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ISO 16535 specifies the equipment and procedures for determining the long-term water absorption of test specimens.

4.3.3 Water vapour transmission

Water vapour transmission shall be determined in accordance with ISO 1663 and the mass of the aqueous solution dish shall be measured at appropriate time intervals for at least five points in succession.

Calculate the water vapour transmission by using the water vapour flow rate.

4.3.4 Permanent linear change

Permanent linear change shall be determined in accordance with ISO 18097. At the maximum service temperature of soaking heat for 24 h, the relative changes in length, $\Delta\varepsilon_l$, and width, $\Delta\varepsilon_b$, shall not exceed 2 % and the relative changes in thickness, $\Delta\varepsilon_t$, shall not exceed 10 %. The maximum service temperature, ST (+), shall be declared in °C in levels with steps of100of 100 °C as given in the examples shown in Table 3.Table 3. The test specimen shall not be faced or coated.

Table 3 — Levels for maximum service temperature

Level	Requirement °C
ST (+) 800	800
ST (+) 900	900
ST (+) 1 000	1 000

4.3.5 Compressive strength

Compressive strength at 10 % deformation shall be determined in accordance with ISO 29469. The test result shall not be less than the declared level, CS(10\Y), given in Table 4.Table 4.

One test result for a product is the average of the measured values out ofaof a number of four specimens.

The compressive strength shall be measured in the direction normal to the surface of the board.

Table 4 — Levels for compressive strength at 10 % deformation

Level	Requirement kPa
CS(10\Y)25	≥25
CS(10\Y)50	≥50
CS(10\Y)75	≥75
CS(10\Y)100	≥100

4.3.6 Corrosiveness to steel

This test is for determining trace quantities of the water-soluble chloride ions in an aqueous extract of the product and shall be carried out in accordance with ISO 12624. Trace quantities of water-soluble chloride ions shall be declared as levels in milligrams per kilogram of product and no test result shall exceed the declared value.

NOTE The determination of this parameter can be relevant for thermal insulating products intended for applications to austenitic stainless-steel surfaces. The presence of chloride ions under certain conditions can influence the risk of stress corrosion cracking.

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4.3.7 Resistance to fungi

Test strains listed in ~~Table 5~~Table 5 shall be used when tested according to ISO 846, which provides a test method for fungi resistance~~.~~. Test specimens that have growth greater than that on the comparative item shall be considered to have failed. Test specimens on which the growth is not greater than that on the comparative item shall be considered to have passed.

Table 5 — Types of fungi to be tested

Name	Strain
Aspergillus niger van Tieghem	ATCC 6275
Penicillium funiculosum Thom	CMI 114933
Paecilomyces variotii Bainier	ATCC 18502
Gliocladium virens Miller et al.	ATCC 9645
Chaetomium globosum Kunze: Fries	ATCC 6205

4.3.8 Flexibility

Flexibility test methods and procedures are as follows.

Test specimen size is (300 x 300) mm and shall be coated with fabric. Place the insulation on the NPS (21,3 mm outer diameter, at least 305 mm of length) iron pipe, gently bend the specimen at a 90° angle and observe if the outer surface shows rupture. If none, then the 'flexible' classification is given. There shall be no visible ruptures on the four specimens tested

5 Test methods

5.1 Sampling

Sufficient test specimens shall be taken in accordance with the test methods.

5.2 Conditioning

Prior to dimensional measurements and physical-property testing, unless otherwise specified in the test method, the test specimens shall be conditioned, with all surfaces exposed, for a minimum of 24 h at (23 ± 2) °C and (50 ± 10) % relative humidity.

When measuring the dimensions of FMI with full size width or length >1,5 m, the conditioning step set above is not required, and may be eliminated at the manufacturer's discretion.

5.3 Testing

5.3.1 General

~~Table 6~~Table 6 gives the dimensions of the test specimens. It provides the minimum number of measurements required to get one test result and any specific conditions which are necessary.

Table 6 — Test methods, test specimens and conditions

Clause		Test method	Test specimens		Specific conditions
No.	Title		Dimensions (mm)	Minimum number to get one test result	
~~4.2.1~~4.2.1	Linear dimensions	ISO 29465 ISO 29466	Full-size	4	—