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Thermal insulating products for building equipment and industrial installations — Determination of the apparent density of preformed pipe insulation

Produits isolants thermiques pour l'équipement du bâtiment et les installations industrielles — Détermination de la masse volumique apparente des coquilles isolantes préformées

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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 18098 was prepared by Technical Committee ISO/TC 163, *Thermal performance and energy use in the built environment*, Subcommittee SC 1, *Test and measurement methods*.

ISO 18098 includes the original EN 13470 prepared by Technical Committee CEN/TC 88, *Thermal insulating materials and products*. However, the following have been modified to reflect conditions for tropical countries:

— 6.4 “Conditioning of test specimens”;

— 7.1 “Test conditions”; and

— Clause 10 “Test report”.

Introduction

This International Standard is one of a series of existing European Standards on test methods for products used to insulate building equipment and industrial installations which comprises the following group of International Standards:

ISO standard	Title	Respective EN standard
ISO 12623	*Thermal insulating products for building equipment and industrial installations — Determination of short-term water absorption by partial immersion of preformed pipe insulation*	EN 13472
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*	EN 13468
ISO 12628	*Thermal insulating products for building equipment and industrial installations — Determination of dimensions, squareness and linearity of preformed pipe insulation*	EN 13467
ISO 12629	*Thermal insulating products for building equipment and industrial installations — Determination of water vapour transmission properties of preformed pipe insulation*	EN 13469
ISO 18096	*Thermal insulating products for building equipment and industrial installations — Determination of maximum service temperature for preformed pipe insulation*	EN 14707
ISO 18097	*Thermal insulating products for building equipment and industrial installations — Determination of maximum service temperature*	EN 14706
ISO 18098	*Thermal insulating products for building equipment and industrial installations — Determination of the apparent density of preformed pipe insulation*	EN 13470
ISO 18099	*Thermal insulating products for building equipment and industrial installations — Determination of the coefficient of thermal expansion*	EN 13471

A further series of existing European Standards on test methods was adopted by ISO. This "package" of standards comprises the following group of interrelated standards:

ISO standard	Title	Respective EN standard
ISO 12344	*Thermal insulating products for building applications — Determination of bending behaviour*	EN 12089
ISO 12968	*Thermal insulation products for building applications — Determination of the pull-off resistance of external thermal insulation composite systems (ETICS) (foam block test)*	EN 13495
ISO 29465	*Thermal insulating products for building applications — Determination of length and width*	EN 822
ISO 29466	*Thermal insulating products for building applications — Determination of thickness*	EN 823
ISO 29467	*Thermal insulating products for building applications — Determination of squareness*	EN 824
ISO 29468	*Thermal insulating products for building applications — Determination of flatness*	EN 825
ISO 29469	*Thermal insulating products for building applications — Determination of compression behaviour*	EN 826
ISO 29470	*Thermal insulating products for building applications — Determination of the apparent density*	EN 1602
ISO 29471	*Thermal insulating products for building applications — Determination of dimensional stability under constant normal laboratory conditions (23 degrees C/50 % relative humidity)*	EN 1603
ISO 29472	*Thermal insulating products for building applications — Determination of dimensional stability under specified temperature and humidity conditions*	EN 1604
ISO 29764	*Thermal insulating products for building applications — Determination of deformation under specified compressive load and temperature conditions*	EN 1605
ISO 29765	*Thermal insulating products for building applications — Determination of tensile strength perpendicular to faces*	EN 1607
ISO 29766	*Thermal insulating products for building applications — Determination of tensile strength parallel to faces*	EN 1608
ISO 29767	*Thermal insulating products for building applications — Determination of short-term water absorption by partial immersion*	EN 1609
ISO 29768	*Thermal insulating products for building applications — Determination of linear dimensions of test specimens*	EN 12085
ISO 29769	*Thermal insulating products for building applications — Determination of behaviour under point load*	EN 12430
ISO 29770	*Thermal insulating products for building applications — Determination of thickness for floating-floor insulating products*	EN 12431
ISO 29771	*Thermal insulating materials for building applications — Determination of organic content*	EN 13820
ISO 29803	*Thermal insulation products for building applications — Determination of the resistance to impact of external thermal insulation composite systems (ETICS)*	EN 13497

The Application of Agreement on technical cooperation between ISO and CEN (Vienna Agreement), Modes 1, 2, 4, and 5, was not approved by CEN/TC 88 and the necessity not seen by its stakeholders.

This International Standard is one of a series of standards which specify test methods for determining dimensions and properties of thermal insulating materials and products. The original EN 13470 supports a series of product standards for thermal insulating materials and products which derive from the Council Directive of 21 December 1988 on the approximation of laws, regulations, and administrative provisions of the Member States relating to construction products (Directive 89/106/EEC) through the consideration of the essential requirements.

This International Standard has been prepared for products used to insulate building equipment and industrial installations, but it may also be applied to products used in other areas.

Thermal insulating products for building equipment and industrial installations — Determination of the apparent density of preformed pipe insulation

1 Scope

This International Standard specifies the equipment and procedures for determining the apparent overall density and the apparent core density under reference conditions. It is applicable to full-size thermal insulating products and test specimens of preformed pipe insulation.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

3 Terms and definitions

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

3.1
apparent overall density
ρ_a
mass per unit volume of a product, including all surface skins formed during production, but excluding any facings and/or coatings

3.2
apparent core density
ρ_c
mass per unit volume of the core of a product after all surface skins formed during production and all facings and/or coatings have been removed

4 Principle

The density is determined as the quotient of the mass and the volume of the test specimen.

5 Apparatus

5.1 **Balance**, capable of determining the mass of a test specimen to an accuracy of 0,5 %.

5.2 **Equipment**, for the determination of the dimensions of preformed pipe insulation (see 7.2).

6 Test specimens

6.1 Dimensions of test specimens

The test specimens shall be full-size products or parts of them, or test specimens used for other tests.

When the apparent overall density is being determined using test specimens cut from a product with surface skins formed during production, the ratio of the area of the surface skin to the total volume shall be the same for the test specimen as for the product.

The size of a test specimen should preferably be as large as possible, commensurate with the apparatus available and with the shape of the original product. The size of the test specimens may also be specified in other test methods.

6.2 Number of test specimens

The number of test specimens for full-size products shall be as specified in the relevant product standard. If test specimens from other tests are used, the number shall be as specified in the test method. If the number is not specified, then at least three test specimens shall be used.

NOTE In the absence of a product standard or any other international technical specification, the number of test specimens may be agreed between parties.

6.3 Preparation of test specimens

The test specimens shall be cut by methods that do not change the original structure of the product.

The location from which the test specimens are taken shall be such that the density obtained is representative of the density of the product.

For determining the apparent overall density, any facings and/or coatings shall be removed from the product. For determining the apparent core density, any surface skins formed during production and any facings and/or coatings shall be removed from the product.

When it is not possible to remove the facings and/or coatings without influencing the apparent density of the product, the mass of the facings and/or coatings shall be deducted by calculation.

NOTE Special methods of preparation, when needed, are given in the relevant product standard.

6.4 Conditioning of test specimens

The test specimens shall be conditioned at (23 ± 2) °C and (50 ± 5) % relative humidity (RH) until constant mass is achieved.

The time for conditioning and the required accuracy of the constant mass measurements shall be given in the relevant product standard.

NOTE 1 If it can be shown that temperature and humidity has negligible influence on the determination of the density, then the conditioning can be carried out at (23 ± 5) °C.

NOTE 2 The conditioning time can be shortened by pre-drying the test specimen in a ventilated drying chamber at a prescribed temperature. Appropriate procedures may be given in the relevant product standard.

In tropical countries, different conditioning and testing conditions can be relevant. In this case, the conditions shall be (27 ± 5) °C and (65 ± 5) % RH.

7 Procedure

7.1 Test conditions

The test shall be carried out at (23 ± 2) °C and (50 ± 5) % RH.

NOTE If it can be shown that temperature and humidity has negligible influence on the determination of the density, the testing can be carried out at (23 ± 5) °C.

In tropical countries, different conditioning and testing conditions can be relevant. In this case, the conditions shall be (27 ± 5) °C and (65 ± 5) % RH.

7.2 Test procedure

Measure the linear dimensions of full-size products and test specimens in accordance with ISO 12628. Calculate the volumes of the test specimens from these measurements.

Weigh each test specimen to an accuracy of 0,5 % and record its mass in kilogrammes. If the facings and/or coatings are retained, the mass of the product shall be calculated by deducting the mass of the facings and/or coatings and adhesives, if any, from the overall mass.

If a higher accuracy for dimensions of full-size products is needed, it shall be specified in the relevant product standard.

8 Calculation and expression of results

Calculate the apparent overall density, ρ_a, or apparent core density, ρ_c, in kilogrammes per cubic metre using the formula:

$$p=\frac{m}{V} \tag{1}$$

where

m is the mass of the test specimen, in kilogrammes;

V is the volume of the test specimen, in cubic metres.

The calculation of V for a full-size pipe insulation is made as follows:

$$V=l\times\frac{\pi}{4}\times\left(D_o^2-D_i^2\right) \tag{2}$$

where

l is the length of the test specimen, in metres;

D_o is the outside diameter, in metres;

D_i is the inside diameter, in metres.

ρ (ρ_a or ρ_c) for the test specimen is given to three significant figures.

Calculate the arithmetic mean value of the density from the results for all test specimens and express the value to three significant figures.

For some products, the determination of the volume used for the calculation of the density of test specimens, with an irregular or complicated shape, can be made measuring the quantity of displaced