
**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.

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 documents 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).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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.

This document was prepared by Technical Committee ISO/TC 163, *Thermal performance and energy use in the built environment*, Subcommittee SC 1, *Test and measurement methods*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 88, *Thermal insulating materials and products*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 18098:2013), which has been technically revised.

The main changes are as follows:

- EN 13470:2001 and ISO 18098:2013 have been merged into one document;
- editorial revisions

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.

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

1 Scope

This document 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 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 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.

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

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 can 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 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 have negligible influence on the determination of the density, 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 can be found in the relevant product standard.

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

7 Procedure

7.1 Test conditions

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

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

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

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 [Formula \(1\)](#):

$$\rho = \frac{m}{V} \quad (1)$$

where

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

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

The volume V for a full-size pipe insulation can be calculated as follows:

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

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 shall be rounded 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

water during the complete immersion in water at (23 ± 2) °C. In this case, the mass should be determined before the volume determination.

9 Accuracy of measurement

NOTE It has not been possible to include a statement on the accuracy of the method in this version of this document, but it is intended to include such a statement when this document is next revised.

10 Test report

The test report shall include the following information:

- a) a reference to this document, i.e. ISO 18098:2022;
- b) product identification:
 - 1) product name, factory, manufacturer, or supplier;
 - 2) production code number;
 - 3) type of product;
 - 4) packaging;
 - 5) form in which the product arrived at the laboratory;
 - 6) other information as appropriate, e.g. nominal dimensions;
- c) test procedure:
 - 1) pre-test history and sampling, e.g. who sampled and where;
 - 2) conditioning;
 - 3) conditioning and testing conditions in tropical climates, if applicable;
 - 4) drying conditions;
 - 5) presence of facings, the mass of the facing, and the method of removal, if necessary;
 - 6) presence of surface skins and the method of removal, if necessary;
 - 7) presence of densification, stratification, or defects of the test specimens;
 - 8) any deviation from [Clauses 6](#) and [7](#);
 - 9) date of testing;
 - 10) general information relating to the test;
 - 11) events which can have affected the results;

Information about the apparatus and identity of the technician should be available in the laboratory but it need not be recorded in the report.

- d) results:
 - 1) all individual values and the mean value.