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

*Produits isolants thermiques pour les équipements des bâtiments et les
installations industrielles — Détermination de l'absorption d'eau à court
terme par immersion partielle 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 12623 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 12623 includes the original EN 13472 prepared by Technical Committee CEN/TC 88 *Thermal insulating materials and products*. However,

- Subclause 5.4, “conditioning of test specimen”,
- Subclause 6.1, “test conditions”, and
- Clause 9, “test report”

have been modified to reflect conditions for tropical countries.

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 13472 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 constructive products (Directive 89/106/EEC) through the consideration of the essential requirements.

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 is comprised of the following group of International Standards:

ISO standard	Title	Respective EN standard
ISO 12623	<i>Thermal insulating products for building equipment and industrial installations — Determination of short-term water absorption by partial immersion of preformed pipe insulation</i>	EN 13472
ISO 12624	<i>Thermal insulation products — Determination of trace quantities of water soluble chloride, fluoride, silicate, sodium ions and pH</i>	EN 13468
ISO 12628	<i>Thermal insulating products for building equipment and industrial installations — Determination of dimensions, squareness and linearity of preformed pipe insulation</i>	EN 13467
ISO 12629	<i>Thermal insulating products for building equipment and industrial installations — Determination of water vapour transmission properties of preformed pipe insulation</i>	EN 13469

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 29465	<i>Thermal insulating products for building applications — Determination of length and width</i>	EN 822
ISO 29466	<i>Thermal insulating products for building applications — Determination of thickness</i>	EN 823
ISO 29467	<i>Thermal insulating products for building applications — Determination of squareness</i>	EN 824
ISO 29468	<i>Thermal insulating products for building applications — Determination of flatness</i>	EN 825
ISO 29469	<i>Thermal insulating products for building applications — Determination of compression behaviour</i>	EN 826
ISO 29470	<i>Thermal insulating products for building applications — Determination of the apparent density</i>	EN 1602
ISO 29471	<i>Thermal insulating products for building applications — Determination of dimensional stability under constant normal laboratory conditions (23 degrees C/50 % relative humidity)</i>	EN 1603
ISO 29472	<i>Thermal insulating products for building applications — Determination of dimensional stability under specified temperature and humidity conditions</i>	EN 1604
ISO 29764	<i>Thermal insulating products for building applications — Determination of deformation under specified compressive load and temperature conditions</i>	EN 1605
ISO 29765	<i>Thermal insulating products for building applications — Determination of tensile strength perpendicular to faces</i>	EN 1607
ISO 29766	<i>Thermal insulating products for building applications — Determination of tensile strength parallel to faces</i>	EN 1608
ISO 29767	<i>Thermal insulating products for building applications — Determination of short-term water absorption by partial immersion</i>	EN 1609

ISO standard	Title	Respective EN standard
ISO 29768	<i>Thermal insulating products for building applications — Determination of linear dimensions of test specimens</i>	EN 12085
ISO 29769	<i>Thermal insulating products for building applications — Determination of behaviour under point load</i>	EN 12430
ISO 29770	<i>Thermal insulating products for building applications — Determination of thickness for floating-floor insulating products</i>	EN 12431
ISO 29771	<i>Thermal insulating materials for building applications — Determination of organic content</i>	EN 13820
ISO 29803	<i>Thermal insulation products for building applications — Determination of the resistance to impact of external thermal insulation composite systems (ETICS)</i>	EN 13497
ISO 29804	<i>Thermal insulation products for building applications — Determination of the tensile bond strength of the adhesive and of the base coat to the thermal insulation material</i>	EN 13494
ISO 29805	<i>Thermal insulation products for building applications — Determination of the mechanical properties of glass fibre meshes</i>	EN 13496

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.

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

1 Scope

This International Standard specifies the equipment and procedures for determining the short-term water absorption of preformed pipe insulation by partial immersion in water. It is applicable to thermal insulating products.

NOTE It is intended to simulate the water absorption caused by exposure to rain for 24 h during product installation.

If the pipe insulation is cut from a flat product, then the short-term water absorption by partial immersion can be obtained from tests carried out on the flat product with similar properties in accordance with EN 1609, provided that the test is carried out in the direction giving the highest water uptake.

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.

No existing International Standards supersede this one.

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

3 Principle

The short-term water absorption by partial immersion is determined by measuring the change in mass of a test specimen, the lower part of which is in contact with water for a period of 24 h.

The excess water adhering to the surface and not absorbed by the test specimen is drained according to Method A (6.2.2) or calculated, according to Method B (6.2.3), from the initial water uptake.

4 Apparatus

4.1 Balance, capable of determining the mass of a test specimen to an accuracy of 0,1 g or 0,5 %, whichever is less.

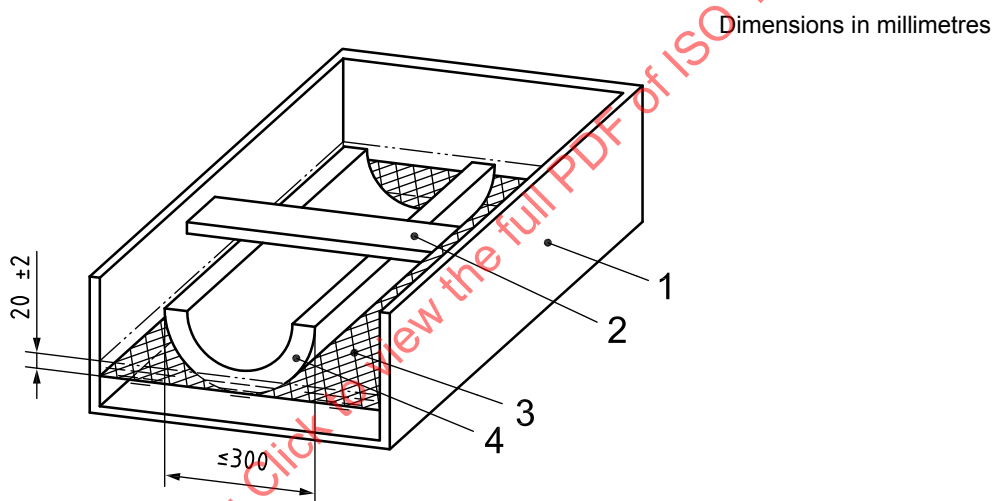
4.2 Water tank, with a device for keeping the water level constant to within ± 2 mm, and a device to keep the test specimen in the required position during the test [see examples in Figures 1a) and 1b)].

The supporting device shall be such that the test specimen contact area with water shall be at least 85 % and such that the original form of the test specimen is maintained.

4.3 Tap water, adjusted to a temperature of (23 ± 5) °C.

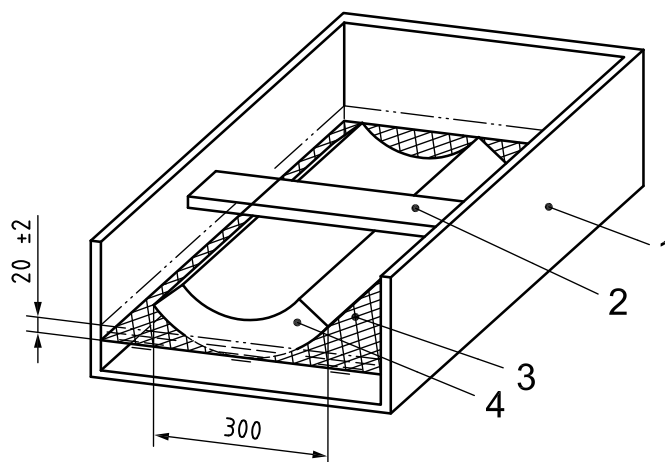
In tropical countries, different conditioning and testing conditions can be relevant. In this case, the temperature of the water shall be adjusted to (27 ± 5) °C and be stated clearly in the test report.

4.4 Equipment, for drainage [see examples in Figures 2a) and 2b)].

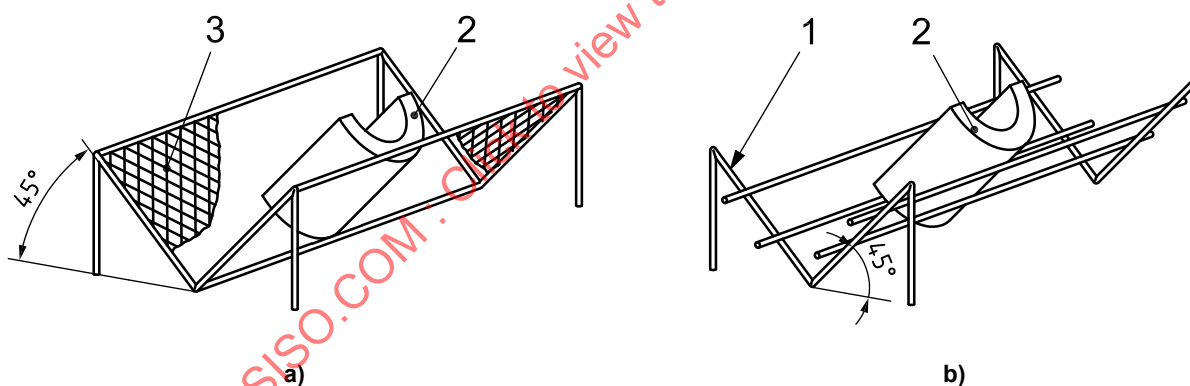


a) Example of $D_o \leq 300$ mm

Figure 1 (continued)

b) Example of $D_o > 300$ mm**Key**

- 1 water tank
- 2 load to keep the test specimen in position
- 3 stainless steel mesh
- 4 test specimen

Figure 1 — Examples of partial immersion test devices**Key**

- 1 perforated stainless steel
- 2 test specimen
- 3 stainless steel mesh

Figure 2 — Examples of equipment for drainage**5 Test specimens****5.1 Dimensions of test specimens**

Test specimens shall be prepared from the product without reducing the original thickness. In the event that the outside diameter of the product is ≤ 300 mm, the test specimen shall have one face with an area equal to the full cross-sectional area of the product or half the original cross-sectional area. For products with outside diameters > 300 mm, the face shall be a segment of the cross-section with an outside chord length of (300 ± 10) mm.

The length of the test specimen shall be adjusted so that the area of the immersed cylindrical surface will be $(40\,000 \pm 400) \text{ mm}^2$.

5.2 Preparation of test specimens

The test specimens shall be cut so that they do not include product ends.

The test specimens shall be prepared by methods that do not change the original structure of the product. Any skins, facings and/or coatings shall be retained.

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

For products with a thickness $< 25 \text{ mm}$, the ends shall be closed to avoid water pickup on the inner main surface of the test specimen (e.g. by use of glued aluminium foil on the ends).

5.3 Number of test specimens

The number of test specimens shall be as specified in the relevant product standard. 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 European technical specification, the number of test specimens can be agreed between parties.

5.4 Conditioning of test specimens

The test specimens shall be stored for at least 6 h at $(23 \pm 5) ^\circ\text{C}$. In case of dispute they shall be stored at $(23 \pm 2) ^\circ\text{C}$ and $(50 \pm 5) \% \text{ RH}$ (relative humidity) for the time specified in the relevant product standard.

In tropical countries, different conditioning and testing conditions can be relevant. In this case, the conditions shall be $(27 \pm 5) ^\circ\text{C}$ and $(65 \pm 5) \% \text{ RH}$, and shall be stated clearly in the test report.

6 Procedure

6.1 Test conditions

The test shall be carried out at $(23 \pm 5) ^\circ\text{C}$. In case of dispute it shall be carried out at $(23 \pm 2) ^\circ\text{C}$ and $(50 \pm 5) \% \text{ RH}$.

In tropical countries, different conditioning and testing conditions can be relevant. In this case, the conditions shall be $(27 \pm 2) ^\circ\text{C}$ and $(65 \pm 5) \% \text{ RH}$.

6.2 Test procedure

6.2.1 General

The choice of Method A or B shall be as specified in the relevant product standard.

NOTE In the absence of a product standard or any other European technical specification, the choice of Method A or B can be agreed between parties.

The dimensions of the test specimens shall be measured in accordance with ISO 12628.

6.2.2 Method A (drainage)

Weigh the test specimen to the nearest 0,1 g or 0,5 %, whichever is less, to determine its initial mass m_0 .

Place the test specimen with the outside surface downwards in the empty water tank and apply a sufficient load to keep the test specimen partially immersed when water is added. Carefully adjust the water added to the tank until the lowest point of the outside face of the test specimen is (20 ± 2) mm below the surface of the water [see examples in Figures 1a) and 1b)]. Ensure that the water level remains constant during the test.

Remove the test specimen after 24 h and drain it for $(10 \pm 0,5)$ min by placing it supported on the exterior surface on a mesh, inclined at 45° , as shown in Figure 2a) or 2b). Weigh the test specimen again to determine the mass m_{24} .

6.2.3 Method B (deduction of initial water uptake)

Weigh the test specimen to the nearest 0,1 g or 0,5 %, whichever is less, to determine its initial mass m_0 .

Place the test specimen with the outside surface downwards in the water tank in such position that it is partially immersed in water with the lowest point of the outside face of the test specimen (20 ± 2) mm below the water level. Remove the test specimen after 10 s, holding it horizontally, and place it within 5 s in a plastic tray of known mass. Reweigh this tray with the test specimen to determine the mass of the test specimen including the initial water uptake m_1 .

Replace the test specimen in the water tank in the same position and apply a sufficient load to keep the test specimen partially immersed in water, with the lowest point of the outside face of the test specimen (20 ± 2) mm below the water level [see examples in Figures 1a) and 1b)]. Ensure that the water level remains constant during the test.

Remove the test specimen after 24 h, holding it horizontally and place it within 5 s in the plastic tray of known mass to determine the mass m_{24} .

Method B is only applicable if the initial water uptake is:

$$\frac{m_1 - m_0}{A_p} \leq 0,5 \text{ kg/m}^2 \quad (1)$$

where

m_1 is the mass of the test specimen including the initial water uptake in Method B, in kilogrammes;

m_0 is the initial mass of the test specimen as determined in Method B, in kilogrammes;

A_p is the immersed cylindrical surface area of the test specimen, in square metres.

7 Calculation and expression of results

The test result shall be the mean value of the individual values.

NOTE Results obtained with test specimens of different outside diameters and thicknesses might not be comparable.

Calculate the short-term water absorption by partial immersion, W_p , in kilogrammes per square metre using the equations:

Method A (drainage):

$$W_p = \frac{m_{24} - m_0}{A_p} \quad (2)$$

Method B (deduction of initial water uptake):

$$W_p = \frac{m_{24} - m_1}{A_p} \quad (3)$$

where

m_1 is the mass of the test specimen including the initial water uptake in Method B, in kilograms;

m_{24} is the mass of the test specimen after partial immersion for 24 h (Methods A and B), in kilograms;

A_p is the immersed cylindrical surface area of the test specimen, in square metres;

W_p shall be rounded to the nearest 0,01 kg/m².

The calculation of A_p , necessary for both Methods A and B, is as follows:

$$A_p = \arccos \left[\frac{\frac{D_o}{2} - 0,02}{\frac{D_o}{2}} \right] \times D_o \times l \quad (4)$$

where

D_o is the outside diameter, in metres;

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

m_0 is the initial mass of the test specimen as determined in Method A, in kilograms.

The calculated arc cos angle shall be in radians and not in degrees.

8 Accuracy of measurement

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

9 Test report

The test report shall include the following information:

- a) reference to this International Standard;
- b) product identification;
 - 1) product name, factory, manufacturer or supplier;
 - 2) production code number;
 - 3) type of product;
 - 4) packaging;
 - 5) the form in which the product arrived at the laboratory;
 - 6) other information as appropriate, e.g. nominal dimensions, nominal density;

- c) test procedure;
 - 1) pre-test history and sampling, e.g. who sampled and where;
 - 2) conditioning;
 - 3) dimensions of the test specimens;
 - 4) deviation from Clauses 5 and 6, if applicable;
 - 5) conditioning and testing conditions in tropical countries, if applicable;
 - 6) date of testing;
 - 7) general information relating to the test including reference to Method A or B and, if relevant, initial water uptake;
 - 8) events which may 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;
- e) all individual values and the mean value.

Annex A

(informative)

Table with examples of calculation of the length of test specimens

Table A.1 gives the length and other dimensions of test specimens necessary to achieve an immersed cylindrical surface area, A_p , of 0,040 m².

The values have been calculated from Equation (4) for A_p given in Clause 7 and Equation (A.1):

$$l = \frac{A_p}{D_o \times \arccos \left[\frac{\frac{D_o}{2} - 0,02}{\frac{D_o}{2}} \right]} \quad (\text{A.1})$$

where

D_o is the outside diameter, in metres;

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

The calculated arc cos angle shall be in radians and not in degrees.

Table A.1 — Examples of calculation of the length of test specimens

Dimensions in millimetres

Inner diameter	Nominal thickness	Outer diameter D_o	Outer radius	Outer arc length	Length l	Inner diameter	Nominal thickness	Outer diameter D_o	Outer radius	Outer arc length	Length l
17	20	57	28,5	72,3	553,5	21	20	61	30,5	74,4	537,8
17	30	77	38,5	82,4	485,7	21	30	81	40,5	84,2	474,8
17	40	97	48,5	91,4	437,4	21	40	101	50,5	93,2	429,4
17	50	117	58,5	99,7	401,0	21	50	121	60,5	101,3	394,8
17	60	137	68,5	107,4	372,4	21	60	141	70,5	108,9	367,3
17	70	157	78,5	114,6	349,0	21	70	161	80,5	116,0	344,9
17	80	177	88,5	121,4	329,6	21	80	181	90,5	122,7	326,1
27	20	67	33,5	77,5	516,4	34	20	74	37	80,9	494,4
27	30	87	43,5	87,0	459,7	34	30	94	47	90,1	443,8
27	40	107	53,5	95,7	418,1	34	40	114	57	98,5	405,9
27	50	127	63,5	103,6	385,9	34	50	134	67	106,3	376,3
27	60	147	73,5	111,1	360,1	34	60	154	77	113,6	352,3
27	70	167	83,5	118,0	338,9	34	70	174	87	120,4	332,3
27	80	187	93,5	124,6	321,0	34	80	194	97	126,8	315,4
42	30	102	51	93,6	427,4	48	30	108	54	96,1	416,3
42	40	122	61	101,7	393,3	48	40	128	64	104,0	384,5
42	50	142	71	109,3	366,1	48	50	148	74	111,4	359,0
42	60	162	81	116,3	343,9	48	60	168	84	118,4	337,9
42	70	182	91	123,0	325,2	48	70	188	94	124,9	320,2
42	80	202	101	129,3	309,3	48	80	208	104	131,2	305,0
60	20	100	50	92,7	431,4	76	20	116	58	99,3	402,7
60	30	120	60	100,9	396,3	76	30	136	68	107,0	373,7
60	40	140	70	108,5	368,6	76	40	156	78	114,3	350,1
60	50	160	80	115,6	345,9	76	50	176	88	121,0	330,5
60	60	180	90	122,3	327,0	76	60	196	98	127,5	313,8
60	70	200	100	128,7	310,8	76	70	216	108	133,6	299,5
60	80	220	110	134,8	296,8	76	80	236	118	139,4	286,9

Table A.1 (continued)

Dimensions in millimetres

Inner diameter	Nominal thickness	Outer diameter D_o	Outer radius	Outer arc length	Length l	Inner diameter	Nominal thickness	Outer diameter D_o	Outer radius	Outer arc length	Length l
89	40	169	84,5	118,7	337,0	102	40	182	91	123,0	325,2
89	50	189	94,5	125,2	319,4	102	50	202	101	129,3	309,3
89	60	209	104,5	131,5	304,3	102	60	222	111	135,4	295,5
89	70	229	114,5	137,4	291,1	102	70	242	121	141,1	283,4
89	80	249	124,5	143,1	279,5	102	80	262	131	146,7	272,7
108	20	148	74	111,4	359,0	114	20	154	77	113,6	352,3
108	30	168	84	118,4	337,9	114	30	174	87	120,4	332,3
108	40	188	94	124,9	320,2	114	40	194	97	126,8	315,4
108	50	208	104	131,2	305,0	114	50	214	107	133,0	300,8
108	60	228	114	137,1	291,7	114	60	234	117	138,8	288,1
108	70	248	124	142,8	280,1	114	70	254	127	144,5	276,8
108	80	268	134	148,3	269,7	114	80	274	137	149,9	266,8
133	20	173	86,5	120,0	333,2	140	20	180	90	122,3	327,0
133	30	193	96,5	126,5	316,2	140	30	200	100	128,7	310,8
133	40	213	106,5	132,7	301,5	140	40	220	110	134,8	296,8
133	50	233	116,5	138,6	288,7	140	50	240	120	140,6	284,6
133	60	253	126,5	144,2	277,4	140	60	260	130	146,1	273,7
133	70	273	136,5	149,7	267,3	140	70	280	140	151,5	264,0
133	80	293	146,5	154,9	258,2	140	80	300	150	156,7	255,3
159	20	199	99,5	128,4	311,6	168	20	208	104	131,2	305,0
159	30	219	109,5	134,5	297,5	168	30	228	114	137,1	291,7
159	40	239	119,5	140,3	285,1	168	40	248	124	142,8	280,1
159	50	259	129,5	145,9	274,2	168	50	268	134	148,3	269,7
159	60	279	139,5	151,2	264,5	168	60	288	144	153,6	260,4
159	70	299	149,5	156,4	255,7	168	70	308	154	158,7	252,0
159	80	319	159,5	161,5	247,7	168	80	328	164	163,7	244,4