



SLOVENSKI STANDARD

SIST EN 16012:2012

01-junij-2012

Toplotnoizolacijski proizvodi za stavbe - Odsevni izolacijski proizvodi - Ugotavljanje nazivnih toplotnih lastnosti

Thermal insulation for buildings - Reflective insulation products - Determination of the declared thermal performance

Wärmedämmstoffe für Gebäude - Reflektierende Wärmedämm-Produkte - Bestimmung der Nennwerte der wärmetechnischen Eigenschaften

Isolation thermique des bâtiments - Produits d'isolation réfléchissants - Détermination de la performance thermique déclarée

[SIST EN 16012:2012](#)

[https://standards.iteh.ai/catalog/standards/sist/2c02e496-d25c-43b4-a7cb-](https://standards.iteh.ai/catalog/standards/sist/2c02e496-d25c-43b4-a7cb-26d25e0339f4/sist-en-16012-2012)

[26d25e0339f4/sist-en-16012-2012](https://standards.iteh.ai/catalog/standards/sist/2c02e496-d25c-43b4-a7cb-26d25e0339f4/sist-en-16012-2012)

Ta slovenski standard je istoveten z: EN 16012:2012

ICS:

91.100.60	Materiali za toplotno in zvočno izolacijo	Thermal and sound insulating materials
-----------	---	--

SIST EN 16012:2012

en,fr,de

iTeh STANDARD PREVIEW
(standards.iteh.ai)

SIST EN 16012:2012

<https://standards.iteh.ai/catalog/standards/sist/2c02e496-d25c-43b4-a7cb-26d25e0339f4/sist-en-16012-2012>

EUROPEAN STANDARD

EN 16012

NORME EUROPÉENNE

EUROPÄISCHE NORM

February 2012

ICS 91.100.60

English Version

Thermal insulation for buildings - Reflective insulation products - Determination of the declared thermal performance

Isolation thermique des bâtiments - Produits d'isolation
réfléchissants - Détermination de la performance thermique
déclarée

Wärmedämmstoffe für Gebäude - Reflektierende
Wärmedämm-Produkte - Bestimmung der Nennwerte der
wärmetechnischen Eigenschaften

This European Standard was approved by CEN on 23 December 2011.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.

<https://standards.iteh.ai/catalog/standards/sist/2c02e496-d25c-43b4-a7cb-26d25e0339f4/sist-en-16012-2012>



EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: Avenue Marnix 17, B-1000 Brussels

Contents

Page

Foreword.....	4
Introduction	5
1 Scope	6
2 Normative references	6
3 Terms, definitions, symbols and units	7
3.1 Terms and definitions	7
3.2 Symbols and units	7
4 Description of product types	8
4.1 Product classification	8
4.2 Product Type 1	8
4.3 Product Type 2	9
4.4 Product Type 3	9
4.5 Product Type 4	10
5 Methods of assessment	10
5.1 General.....	10
5.2 Thickness measurement	10
5.3 Conditioning and specimen preparation.....	11
5.4 Determination of thermal resistance – outline	11
5.5 Determination of core thermal resistance of Product Type 1	11
5.6 Determination of core thermal resistance of Product Type 2	12
5.7 Determination of core thermal resistance of Product Type 3 (METHOD C)	13
5.8 Determination of the thermal performance of Product Type 4	17
5.9 Emissivity	17
6 Uncertainty	18
6.1 General.....	18
6.2 Thickness measurements	18
6.3 Use of surface thermocouples on thin samples in a guarded hot plate or in heat flow meter measurement.....	19
6.4 Use of dummy insulation specimens	19
6.5 Derivation of the core resistance of a Type 3 Product from hot box measurements.....	19
7 Expression of results	19
7.1 Results derived from hot plate and emissivity measurements (Products Type 1 & 2)	19
7.2 Results derived from hot box and emissivity measurements (Product Types 1, 2 & 3)	20
7.3 Results derived from emissivity measurements only (product Type 4)	20
8 Report	20
Annex A (normative) Decision making flow chart for identification of product types	21
Annex B (normative) Selection of test methodology for product type 1 when using a hot plate method	22
Annex C (normative) Selection of the measurement technique for product type 2.....	23
Annex D (normative) Measurement of emissivity using a Thermal Infra-Red apparatus	24
D.1 Principle of the hemispherical blackbody radiator	24
D.2 Description of suitable hemispherical blackbody radiator and specimen holder	25
D.3 Calibration standards	25
D.4 Calculation of the emissivity	26
D.5 Sampling and preparation of the test specimens	26

D.6	Procedure for measurement of specimens	26
D.7	Expression of results	27
Annex E	(normative) “Dummy specimen” technique for the heat flow meter apparatus	28
E.1	Principle	28
E.2	Procedure	28
E.3	Specimens of low thermal resistance	29
E.4	Calibration	29
Bibliography	30

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[SIST EN 16012:2012](https://standards.iteh.ai/catalog/standards/sist/2c02e496-d25c-43b4-a7cb-26d25e0339f4/sist-en-16012-2012)

<https://standards.iteh.ai/catalog/standards/sist/2c02e496-d25c-43b4-a7cb-26d25e0339f4/sist-en-16012-2012>

EN 16012:2012 (E)**Foreword**

This document (EN 16012:2012) has been prepared by Technical Committee CEN/TC 89 “Thermal performance of buildings and building components”, the secretariat of which is held by SIS.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by August 2012, and conflicting national standards shall be withdrawn at the latest by August 2012.

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

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[SIST EN 16012:2012](https://standards.iteh.ai/catalog/standards/sist/2c02e496-d25c-43b4-a7cb-26d25e0339f4/sist-en-16012-2012)

<https://standards.iteh.ai/catalog/standards/sist/2c02e496-d25c-43b4-a7cb-26d25e0339f4/sist-en-16012-2012>

Introduction

Reflective (low emissivity at the appropriate wavelength) surfaces are utilized in a number of ways to enhance the thermal performance of insulating products. Their role is to reduce the heat transfer by thermal radiation in some parts of the system. This is achieved because low emissivity surfaces reduce the radiant heat transferred through a product that is wholly or partially transparent to infra-red radiation (e.g. very low density fibrous insulation). They will also reduce the radiant heat transfer across any air gap or gaps that are present in the system. In some cases, air gaps can be an intrinsic part of the structure and in other cases the insulation can be installed in such a way as to deliberately create an air gap between the reflective surfaces and the structure.

Unless otherwise stipulated by the manufacturer, the declared thermal performance should include an adjacent vertical air space on either side of the product, and the declared thermal performance should also include a statement of the thickness of these airspaces included as part of the declared value. The declared value can, alternatively, be given as the combination of the thermal resistance of the “core” of the product together with the measured value of the emissivity of the surfaces.

Since all conventional thermal insulation products declare their thermal performance on the basis of the value to be expected over a reasonable working life, this is also addressed in a limited manner in this standard in the assessment of emissivity of the surface(s) of reflective insulation. In the absence of any quantified and certified data on the aged performance of a facing over a normal lifetime for a building material, the ageing of the low emissivity surface is assessed by use of an accelerated ageing procedure.

How the thermal properties of insulation materials that utilize reflective surfaces are determined will depend on the form in which they are sold and how they are intended to be used. This standard describes a number of different approaches which can be utilized and specifies which approach to use for the different types of product. Where a product is already subject to a product specification that describes procedures for the measurement of the aged 90/90 fracture thermal conductivity or thermal resistance of the core insulation material, the following guidance should only be used to determine the component of its thermal performance that depends on the emissivity of its external faces. However, it should be remembered that the declared value is only the first step, giving comparative performance values under specified conditions, and the design value can give more information for use by the designer in specific applications, especially under different climatic conditions.

EN 16012:2012 (E)**1 Scope**

This European Standard describes a set of procedures for using existing standardized CEN or ISO test and calculation methods to determine the declared thermal performance of reflective insulation products. This European Standard supports and does not replace existing CEN or ISO test methods.

This European Standard applies to any thermal insulation product that derives a proportion of its claimed thermal properties from the presence of one or more reflective or low emissivity surfaces together with any associated airspace(s). It does not replace the existing procedures for the determination of the thermal performance of products already covered by an existing harmonized product standard where the declared value of these products does not specifically include any claims attributable to the emissivity of the facing.

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.

EN 823:1994, *Thermal insulating products for building applications — Determination of thickness*

EN 1946-1, *Thermal performance of building products and components — Specific criteria for the assessment of laboratories measuring heat transfer properties — Part 1: Common criteria*

EN 1946-2, *Thermal performance of building products and components — Specific criteria for the assessment of laboratories measuring heat transfer properties — Part 2: Measurements by guarded hot plate method*

EN 1946-3, *Thermal performance of building products and components — Specific criteria for the assessment of laboratories measuring heat transfer properties — Part 3: Measurements by heat flow meter method*

EN 1946-4, *Thermal performance of building products and components — Specific criteria for the assessment of laboratories measuring heat transfer properties — Part 4: Measurements by hot box methods*

EN 12664, *Thermal performance of building materials and products — Determination of thermal resistance by means of guarded hot plate and heat flow meter methods — Dry and moist products of medium and low thermal resistance*

EN 12667, *Thermal performance of building materials and products — Determination of thermal resistance by means of guarded hot plate and heat flow meter methods — Products of high and medium thermal resistance*

EN ISO 6946, *Building components and building elements — Thermal resistance and thermal transmittance — Calculation method (ISO 6946)*

EN ISO 7345, *Thermal insulation — Physical quantities and definitions (ISO 7345)*

EN ISO 8990, *Thermal insulation — Determination of steady-state thermal transmission properties — Calibrated and guarded hot box (ISO 8990)*

EN ISO 9229, *Thermal Insulation — Vocabulary (ISO 9229)*

EN ISO 9288, *Thermal insulation — Heat transfer by radiation — Physical quantities and definitions (ISO 9288)*

EN ISO 10456, *Building materials and products — Hygrothermal properties — Tabulated design values and procedures for determining declared and design thermal values (ISO 10456)*

ISO 8301:1991, *Thermal insulation — Determination of steady-state thermal resistance and related properties — Heat flow meter apparatus*

ISO 8302:1991, *Thermal insulation — Determination of steady-state thermal resistance and related properties — Guarded hot plate apparatus*

ISO/IEC Guide 98-3, *Uncertainty of measurement — Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)*

3 Terms, definitions, symbols and units

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in EN ISO 7345, EN ISO 9288, EN ISO 9229 and the following apply.

3.1.1

declared thermal performance

value of thermal performance, declared by a manufacturer, which is derived from measured values under the specified conditions and rules given in this standard

3.1.2

indentation

concave depression in the surface of the facing (foil) such that shallow air pockets are created when the surface is in contact with a smooth flat plate

3.1.3

core thermal resistance

thermal resistance of the product from face to face at the tested thickness, excluding the contribution of any low emissivity outer surface or any air space(s) adjacent to the product

3.1.4

emissivity

ratio of the energy radiated by a surface relative to the energy radiated by a blackbody at the same temperature

3.1.5

reflective surface

low emissivity surface

surface which has a low emissivity at the appropriate wavelength within the temperature range found in building elements

3.1.6

reflective insulation

insulation product which has one or both external face(s) comprising a reflective surface

Note 1 to entry It is a measure of a material's ability to radiate heat.

3.2 Symbols and units

For the purposes of this standard, the following symbols and units apply.

Symbol	Quantity	Unit
P	perimeter	m
U	sensor signal	V
ε	emissivity	-
λ	thermal conductivity	W/(m·K)
Φ	heat flow rate	W
Ψ	linear thermal transmittance	W/(m·K)
$\Delta\theta$	temperature difference	K

Subscripts	
L	low
H	high
e	edge
sur	surround
D	declared

iTeh STANDARD PREVIEW
(standards.iteh.ai)

4 Description of product types

[SIST EN 16012:2012](#)

4.1 Product classification

<https://standards.iteh.ai/catalog/standards/sist/2c02e496-d25c-43b4-a7cb-26d25e0339f4/sist-en-16012-2012>

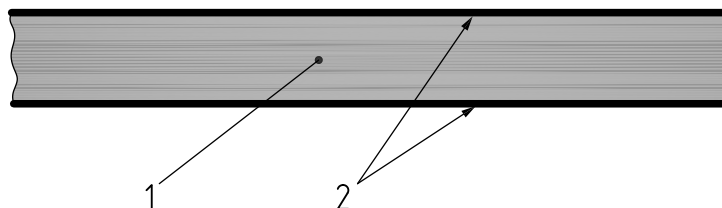
This clause describes the various generic product types to which this standard refers. Product type is defined solely for the purpose of selecting the most appropriate test method (product type number does not refer to a generic species of product). Together with 4.2, 4.3 and 4.4, the flow charts in Annexes A, B and C shall be followed in assigning a given product to a product type.

In 4.2, 4.3 and 4.4, the product type is determined by reference to its compressibility or otherwise to achieve flat parallel surfaces. This implies the removal of measurable air-gaps between the specimen and the hot and cold plates of the test apparatus whilst not unduly reducing the overall thickness of the specimen to be tested. When using the weighted plate method from EN 823:1994 there shall be no residual air spaces between the weighted plate and the specimen surface. The weight of plate used for the thickness measurement shall be the lowest of either plate sufficient to eliminate air gaps. The thickness measured under the chosen plate shall be the thickness subsequently used for the measurement of the core thermal resistance and given in the test report.

4.2 Product Type 1

A product shall be classified as Type 1 when it has a regular geometry with parallel faces or is compressible so that the product can be contained between the hot and cold plates of the apparatus without significantly changing its core thermal properties. This is achieved when its surfaces are smooth and flat with no discernible depth of pattern or indentation.

EXAMPLES Including (but not limited to) foam insulation with aluminium foil facing on each side (see Figure 1), mineral wool faced with aluminium foil, multi-foil insulation product which is stitched or seamed only at the edges and substantially flat with parallel faces (see also the limitation in Clause 1).

**Key**

- 1 insulation core
- 2 low emissivity surface or surfaces

NOTE The emissivity of each of the outer surfaces can be different or the product can be faced on only one side.

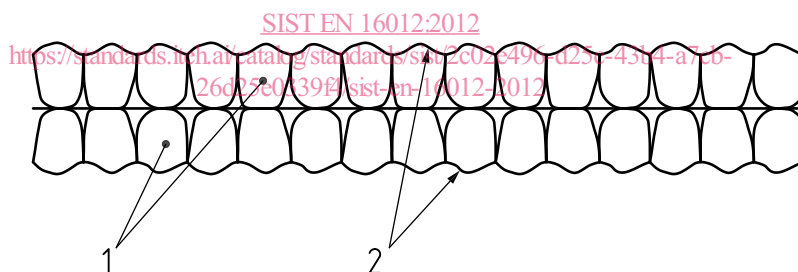
Figure 1 — Example of insulation material with reflective facing on each side

4.3 Product Type 2

A product shall be classified as Type 2 when it has a regular geometry with parallel faces or is compressible so that the product can be contained between the test apparatus hot and cold plates without changing its core thermal properties. The surface or surfaces shall not be flat and smooth and can have indentations of less than 5 mm depth when measured using the pin and plate described in EN 823:1994, subclause B.1, or an alternative method with at least the same level of accuracy. The pin shall be placed in the lowest point of any indentation but shall not pierce the surface.

NOTE If the indentations are 5 mm or greater, it is product Type 3.

EXAMPLES Including, but not limited to, some types of bubble foil insulation with reflective surfaces (see Figure 2).

**Key**

- 1 air filled plastic bubbles
- 2 reflective surface(s)

Figure 2 — Example of bubble foil insulation with reflective surfaces

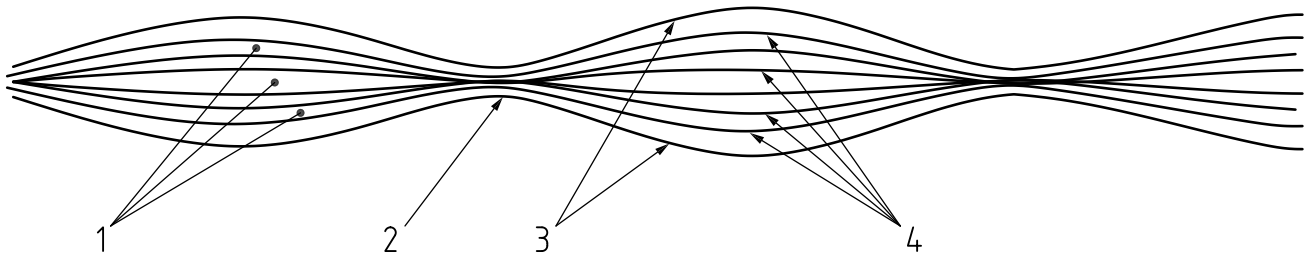
4.4 Product Type 3

A product shall be classified as Type 3 when it has irregular thickness geometry, does not have flat parallel faces, or cannot be compressed to produce flat and parallel faces without changing its core thermal properties. Product Type 3 shall not be measured in a guarded hot plate or heat flow meter apparatus.

NOTE 1 Its surfaces might or might not have indentations, the depth of which is not limited to any specific value.

NOTE 2 It could include stitching or seams. A typical example would be the stitched multi-foil reflective insulation products, or sealed "pockets" or "pillows" made from reflective foil sheets, as shown in Figure 3.

EN 16012:2012 (E)

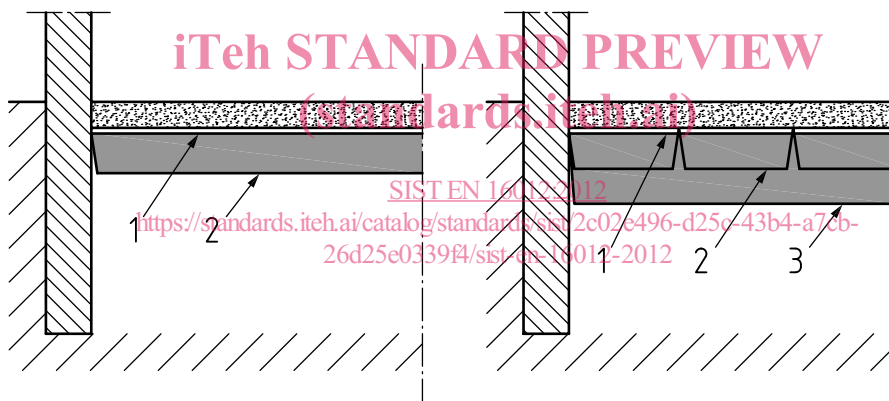
**Key**

- 1 insulation layer(s) between foil – such as foam or wadding
- 2 welded or stitched fabrication feature
- 3 low emissivity external surface or surfaces
- 4 intermediate layers of foil

Figure 3 – Example of stitched multi-foil insulation

4.5 Product Type 4

Product Type 4 is a thin film or sheet, less than 2 mm thickness, used singly or in multiple layers, which makes use of a low emissivity surface to increase the thermal resistance of adjacent or enclosed air space(s), but which has no significant thermal resistance of its own. See Figure 4.

**Key**

- Left picture: 2-layer foil system (1 and 2) with one air layer in-between
- Right picture: 3-layer foil system (foil layers 1, 2 and 3) with two air layers in between

Figure 4 – Example of multiple layers of product Type 4 under flooring

5 Methods of assessment

5.1 General

In addition to the general requirements for testing thermal performance in accordance with EN 12664, EN 12667 and EN ISO 8990, the specific requirements for mounting of specimens given in 5.4–5.8 shall also be followed. The measurement of thermal performance of reflective insulation products Type 1, Type 2 and Type 3 shall require the measurement of the thickness of the specimens.

5.2 Thickness measurement

With the exception of thin single layer films or sheets, the thickness of all types of product which are in excess of 2 mm nominal declared thickness shall be determined using the procedures in EN 823:1994, using the