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Thermal insulation products — Determination of ageing by settlement —

Part 1: Blown loose-fill insulation for ventilated attics

Produits isolants thermiques — Détermination du tassement après vieillissement —

Partie 1: Isolant en vrac soufflé pour combles ventilés

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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 18393-1 was prepared by Technical Committee ISO/TC 163, *Thermal performance and energy use in the built environment*, Subcommittee SC 1, *Test and measurement methods*.

This second edition cancels and replaces the first edition (ISO 18393-1:2012), clauses 3, 7, 8, 9, 10 and subclause 6.1 of which have been technically revised.

ISO 18393 consists of the following parts, under the general title *Thermal insulation products — Determination of ageing by settlement*:

— *Part 1: Blown loose fill for ventilated attics*

— *Part 2: Blown loose fill insulation for closed cavity frame constructions*[1)]

1) In preparation.

Introduction

Blown loose-fill insulation is subject to settlement, which is a reduction of insulation thickness and can result in a change of the thermal performance of the insulation. It is necessary to know the thickness of the insulation when the settlement is completed in order to predict the long term thermal performance of the structure where the insulation is applied.

Thermal insulation products — Determination of ageing by settlement — Part 1: Blown loose fill for ventilated attics

1 Scope

This part of ISO 18393 specifies a test method for the determination of settlement of blown loose-fill insulation applied horizontally in ventilated attics. This test method measures the effects of humidity and temperature cycling; however, there may be other factors, such as vibration or impact, which may influence a change in thickness

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 12570, *Hygrothermal performance of building materials and products — Determination of moisture content by drying at elevated temperature*

ISO 29466, *Thermal insulating products for building applications — Determination of thickness*

3 Terms and definitions

For the purposes of this document, the following term and definition applies.

3.1
attic
ventilated loft space of a building enclosed between the roof and the ceiling

3.2
settlement
decrease of installed insulation thickness in lofts or height in cavities and frame constructions with time, expressed as a percentage of the initial installed thickness or installed height

3.3
installed density
density before settlement, determined by the ratio of the mass and the volume of the specimen

4 Principle

A test specimen is made by blowing the product into a box, using a machine as approved by the manufacturer. The box with the blown specimen is subjected to moisture and temperature cycling. At the beginning and during the climate cycling, the thickness is monitored and the change is calculated.

5 Test equipment

5.1 Specimen container

Perforated metal box with the dimensions of the holes of 4 mm^2 and a grid thickness of 1 mm.

The inside dimensions of the box are:

— length: 600 mm ± 10 mm;

— width: 600 mm ± 10 mm;

— height: 300 mm + $^{+20}_{0}$ mm.

The thickness measurement shall be made according to ISO 29466 to the nearest 1 mm at nine positions evenly distributed over the area of the box.

EXAMPLE Nine rulers, graduated in mm, of 320 mm long with a maximum diameter of 8 mm, are fixed at the base and are parallel with the vertical sides of the box and evenly distributed across the base.

5.2 Climate chamber

The climate chamber shall be large enough to accommodate the specimen boxes and it shall provide a controlled climate for the whole specimen area in a range from (5 ± 1) °C to (60 ± 1) °C, and (50 ± 5) % RH (relative humidity) to (85 ± 5) % RH.

6 Test specimens

6.1 Preparations of test specimens

In the specimen box, the insulation is blown to a thickness of 300 mm in accordance with the manufacturer's recommendations for installation and the product standards. Do not over-fill container more than 6 mm above top edge. Carefully remove (screed) excess material above 300 mm so that surface is a uniform thickness. Calculate weight (mass per mm^2) and installed density. The blown density should be the lowest density in practice for the intended use, given by an application Standard or the manufacturer`s recommendations

6.2 Number of test specimens

The number of test specimens shall be as specified in the product standard. If a number is not specified in the standard, at least one specimen shall be used.

6.3 Conditioning of test specimens

The test specimens shall be stored for at least 6 h at (23 ± 2) °C. In case of dispute, it shall be carried out at (23 ± 2) °C and (50 ± 5) % RH until stabilization at constant weight is achieved according to ISO 12570. After finishing the condition time, the actual density is documented

In tropical climates, different conditioning and testing conditions may be relevant. In this case, the conditions shall be (27 ± 2) °C and (65 ± 5) % RH and be stated clearly in the test report.

7 Test procedure

To avoid disturbances to the test specimen, e.g. by shock, the test box with the installed insulation shall be carefully placed into the climate chamber. Care shall also be taken to avoid any disturbances during the measurement, e.g. the container being shifted back and forth.

The chamber shall be controlled to the following conditions:

a) Period 1: 14 d at (23 ± 1) ºC with (85 ± 5) % RH + 14 d at (50 ± 2) ºC with (15 ± 5) % RH;

b) Period 2: 14 d at (23 ± 1) ºC with (85 ± 5) % RH +14 d at (50 ± 2) ºC with (15 ± 5) % RH;

c) Period 3: 14 d at (23 ± 1) ºC with (85 ± 5) % RH + 14 d at (50 ± 2) ºC with (15 ± 5) % RH;

d) Period 4: 14 d at (23 ± 1) ºC with (85 ± 5) % RH + 14 d at (50 ± 2) ºC with (15 ± 5) % RH.

e) Period 5: Allow test specimen to reach constant weight at (23 +/- 2) C and (50 +/- 5) % RH according to ISO 12570.

Do not allow condensation on the ceiling of the chamber to drip into the test specimen.

Do not remove test specimen from climate chamber for more than 10 min.

The settlement of the insulation is recorded from each of the nine positions at fixed intervals and at least three times a week.

The readings shall be taken to the nearest millimetre.

When experience has been gained with a product, the periods can be shortened, but not less than 20 d for each period.

8 Calculations and expression of results

For each specimen the mean value of the readings from the nine positions is one test result, rounded to the nearest mm. This shall be used to create a graph of settlement over the time, based upon a best fit equation.

The percentage of settlement, result of the AVCP, is given by formula (1):

$$s = \frac{1}{n}\sum_{k=1}^{n}\left(\frac{e_{i,k} - e_{f,k}}{e_{i,k}}\right) \quad (1)$$

where

$e_{i,k}$ is the initial thickness of sample k (out of n samples), before cycle 1 (beginning of the test)

$e_{f,k}$ is the final thickness of sample k, after cycle no. 4 (end of the test).

The result shall be expressed in a percentage rounded to the nearest unit.

9 Accuracy of measurement

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

10 Test report

The test report shall include the following information:

a) reference to this part of ISO 18393, i.e. ISO 18393-1;

b) product identification:

c) product name, factory, manufacturer, or supplier,

1) production code number,

2) type of product,