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Thermal insulation products — Determination of settlement~~—~~ —

Part 1: ~~loose~~ Loose-fill insulation for ventilated attics simulating humidity and temperature cycling

Produits isolants thermiques — Détermination du tassement~~— Partie 1: Isolant en vrac pour combles ventilés, cyclage en température et humidité~~ —

Document type: **Error! Reference source not found.**

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~~This~~Partie 1: Isolant en vrac pour combles ventilés, cyclage en température et humidité

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Foreword

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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~~document 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~~www.iso.org/directives).

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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~~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 18393-1:2012), which has been technically revised.

The main changes are as follows:

— ~~Clause 5.1~~Clause 5.1: change of the size of specimen container;

— ~~Clause 7~~Clause 7: change of the condition of the test temperature, moisture and duration;

— ~~Clause 8~~Clause 8: change of calculation of test ~~result~~results.

A list of all parts in the ISO 18393 series can be found on the ISO website.

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~~www.iso.org/members.html.

EN ISO 18393 consists of the following 4 parts, under the general title Thermal insulation products — Determination of *ageing by* settlement: —

Part 1:
Blown Loose-fill insulation for ventilated attics simulating humidity and temperature cycling

Part 2: Blown loose fill and injected insulation for cavity walls and timber and steel framed walls, simulating vibration

Part 3: Blown or injected insulation for closed cavities, simulating humidity and temperature cycling

Part 4: Blown loose-fill insulation for ventilated attics and ceilings simulating vibration

~~Thermal insulation products — Determination of settlement — Part 1: loose fill for ventilated attics simulating humidity and temperature cycling~~

1 Scope

This document specifies a test method for the determination of settlement of loose-fill insulation applied horizontally in ventilated attics. This test method measures the effects of humidity and temperature cycling.

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 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 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~~https://www.iso.org/obp

— ~~—~~IEC Electropedia: available at ~~https://www.electropedia.org/~~https://www.electropedia.org/

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

Note 1 to entry: A ventilated attic may also include an unventilated space sealed by a low vapour resistance roof tile underlay.

3.2
settlement
~~Blown loose-fill insulation can be subject to settlement, which is a~~ decrease, with time, of installed insulation thickness in lofts

Note 1 to entry: Blown loose-fill insulation can be subject to settlement.

Note 2 to entry: Settlement is expressed as a percentage of the initial installed thickness or installed height.

3.3
installed density
density of the specimen just after blowing before conditioning

3.4
initial density
density of the specimen when the product is put in the climatic chamber at beginning of the first cycle

3.5
installed thickness
thickness of the specimen just after blowing before conditioning

3.6
initial thickness
thickness of the specimen when the product is put in the climatic chamber at beginning of the first cycle

3.7
blown loose-fill insulation
loose-fill insulation material applied or installed by pneumatic application

3.8
loose-fill insulation
granules, nodules, beads, powder, fibre or similar forms of thermal insulation material designed to be installed manually or with pneumatic equipment

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

A box is used to perform the settlement test.

The inside dimensions of the box are:

— ~~—~~length: 600 mm ± 10 mm;

— ~~—~~width: 600 mm ± 10 mm;

— ~~—~~height: 300 mm ~~+~~ $^{+20}_{0}$ ~~±~~ $^{+20}_{0}$ mm.

Higher thickness can be tested in higher and larger boxes.

The thickness measurement shall be made visually without any load to the nearest 1 mm at nine positions evenly distributed over the area of the box.

Nine rulers, graduated in ~~mm~~millimetres, 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 at least 100 mm from the vertical walls.

~~Note:~~ Alternative optical methods of thickness measurement are possible, but should be made at ~~9~~ nine positions at nearest 1 mm without any load.

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 (15 ± 5) % relative humidity (RH) to (85 ± 5) % RH.

6 Test specimens

6.1 Preparations of test specimens

When a pre-conditioning of material is carried out, it shall be done at (23~~ ± ~~ ± 2) °C and (50~~ ± ~~ ± 5) % RH until stabilization at constant weight is achieved according to ISO 12570 (preparation of the sample) before blowing.

NOTE~~:~~ 1 Additional information can be given in the product standard.

The insulation material is blown into the specimen box to a thickness of 300 mm in accordance with the manufacturer's recommendations for installation and the product standards. Do not over-fill the container more than 6 mm above the top edge. Carefully remove (screed) excess material above 300 mm until an even surface is achieved. Measure the weight and installed thickness and calculate the installed density~~.~~

The installed density shall be the lowest density in practice for the intended use as defined by an application standard, product standard or manufacturer's installation guideline.

NOTE~~:~~ 2 It is possible to use a higher thickness in higher and larger boxes. The installed thickness will then be the height of the box.

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 two specimens 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 conditioning time, the current thickness and density shall be documented (see ~~Clause 7)~~Clause 7) and called thickness and density after conditioning. If there is a preconditioning of the material, the conditioning time is not needed.

In tropical climates, different conditioning and testing conditions can 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 initial thickness is determined once the specimen is positioned in the climatic chamber. The initial density of the product under test is established from this initial thickness.

The test is composed of four cycles of two periods.

The chamber shall be controlled to the following conditions:

Cycle 1 Period 1: 14 days at (23~~ ± ~~ ± 1) °C with (85~~ ± ~~ ± 5) % RH
Period 2: 14 days at (50~~ ± ~~ ± 2) °C with (15~~ ± ~~ ± 5) % RH

Cycle 2 Period 1: 14 days at (23~~ ± ~~ ± 1) °C with (85~~ ± ~~ ± 5) % RH
Period 2: 14 days at (50~~ ± ~~ ± 2) °C with (15~~ ± ~~ ± 5) % RH

Cycle 3 Period 1: 14 days at (23~~ ± ~~ ± 1) °C with (85~~ ± ~~ ± 5) % RH
Period 2: 14 days at (50~~ ± ~~ ± 2) °C with (15~~ ± ~~ ± 5) % RH

Cycle 4 Period 1: 14 days at (23~~ ± ~~ ± 1) °C with (85~~ ± ~~ ± 5) % RH

Period 2: 14 days at (50 ~~±~~ ± 2) °C with (15 ~~±~~ ± 5) % RH

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

Every precaution shall be taken to avoid any movement of the test specimen during the entire duration of the test. If it must be moved this should be mentioned in the test report.

The thickness of the insulation shall be recorded from each of the nine positions at fixed intervals and at least at the end of each period.

The readings shall be taken to the nearest millimetre.

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~~millimetre. This can be used to create a graph of settlement over time.

$$s_k = \frac{1}{n}\sum_{k=1}^{n}\frac{e_{j,k} - e_{f,k}}{e_{i,k}}$$

$$S_k = \frac{1}{n}\sum_{k=1}^{n}\frac{e_{j,k} - e_{f,k}}{e_{i,k}}$$

where

s_k is the settlement test result value for each box;

$e_{i,k}$ is the initial thickness (mean value of the nine position) of sample k (out of 2 samples), measured just before the cycle 1 at the installation of the boxes in the climatic chamber (beginning of the test);

$e_{f,k}$ is the final thickness (mean value of the nine position) of sample k (out of 2 samples), after cycle 4 (end of the test).

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

Final result, s, is the mean of the two box measures (mean of s_k).

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~~ document, but such a statement ~~is~~ is intended to be included when the document is next revised.

10 Test report

The test report shall include the following information:

a) ~~a)~~ reference to this document, i.e. ISO 18393-1:20—;

b) ~~b)~~ product identification~~,~~;

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

1) ~~1)~~ production code number,

2) ~~2)~~ type of product,

3) ~~3)~~ packaging,

