SLOVENSKI STANDARD
SIST EN 16306:2013

01-december-2013

Preskušanje naravnega kamna - Ugotavljanje odpornosti marmorja proti cikličnim toplotnim in vlažnostnim obremenitvam

Natural stone test methods - Determination of resistance of marble to thermal and moisture cycles

Prüfverfahren für Naturstein - Bestimmungen der Beständigkeit von Marmor bei zyklischer Belastung mit Wärme und Feuchtigkeit

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Méthodes d'essai pour pierres naturelles - Détermination de la résistance du marbre aux cycles thermiques et d'humidité

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Ta slovenski standard je istoveten z: **EN 16306:2013**

ICS:

91.100.15	Mineralni materiali in izdelki	Mineral materials and products

SIST EN 16306:2013 **en,fr,de**

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EUROPEAN STANDARD

NORME EUROPÉENNE

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ICS 73.020; 91.100.15

English Version

Natural stone test methods - Determination of resistance of marble to thermal and moisture cycles

Méthodes d'essai pour pierres naturelles - Détermination de la résistance du marbre aux cycles thermiques et d'humidité

Prüfverfahren für Naturstein - Bestimmungen der Beständigkeit von Marmor bei zyklischer Belastung mit Wärme und Feuchtigkeit

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SIST EN 16306:2013

Contents

Page

iTeh STANDARD PREVIEW
(standards.iteh.ai)
SIST EN 16306:2013
https://standards.iteh.ai/catalog/standards/sist/b373144f-7117-4854-b477-771ee030a90c/sist-en-16306-2013

SIST EN 16306:2013

Foreword

This document (EN 16306:2013) has been prepared by Technical Committee CEN/TC 246 “Natural stones”, the secretariat of which is held by UNI.

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of an identical text or by endorsement, at the latest by August 2013, and conflicting national standards shall be withdrawn at the latest by August 2013.

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SIST EN 16306:2013
https://standards.iteh.ai/catalog/standards/sist/b373144f-7117-4854-b477-771ee030a90c/sist-en-16306-2013

SIST EN 16306:2013

1 Scope

This European Standard specifies a laboratory method for determining the resistance to thermal and moisture cycling of marble intended for cladding of building facades.

For scientific definition of marble, reference is made to EN 12670:2001, Terminology: 2.1.243 a.

NOTE Bowing and rapid strength loss is known to occur in some marbles when used as exterior claddings.

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 12372, *Natural stone test methods – Determination of flexural strength under concentrated load*

EN 12670:2001, *Natural stone – Terminology*

EN 13161, *Natural stone test methods – Determination of flexural strength under constant moment*

EN 14146, *Natural stone test methods – Determination of the dynamic modulus of elasticity (by measuring the fundamental resonance frequency)*

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EN 14579, *Natural stone test methods – Determination of sound speed propagation*

EN ISO 4892-1:2000, *Plastics - Methods of exposure to laboratory light sources - Part 1: General guidance (ISO 4892-1:1999)*

SIST EN 16306:2013
https://standards.iteh.ai/catalog/standards/sist/b373144f-7117-4854-b477-771ee030a90c/sist-en-16306-2013

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
bowing
change in shape from flat and planar to a curved or dished shape in a convex or concave direction

Note 1 to entry: Other terms commonly used for the same phenomenon are dishing and warping. Convex bowing is quantified by positive values, concave bowing by negative values.

3.2
convex
centre part of the specimen is bowing upwards, away from the moist substratum

3.3
concave
centre part of the specimen is bowing downwards, against the moist substratum

4 Principle

Bowing is measured on test samples exposed to moisture from beneath and heating from above. The temperature interval is from 20°C to 80°C, one cycle completed each 24 h. The 80 ºC is measured on a black reference, placed on the surface of one specimen to control the climate of the chamber/bath.

SIST EN 16306:2013

The potential strength loss is measured according to EN 12372 or EN 13161 on reference and exposed specimens (Annex A).

5 Symbols

T temperature

H_0 initial height of the specimen at the measuring point [mm]

H difference between the initial height and the height after a given cycle [mm]

H_N the normalised height difference, related to L_N = 1 m [mm]

B H_N / L_N = the normalised bowing value [mm/m]

B_n bow values after n cycles [mm/m]

L distance between the supports under the specimen = 0,35 [m]

L_N normalised length = 1 [m]

6 Apparatus

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6.1 A non-corrosive bath (Figure 1) of sufficient capacity to hold the required number of specimens. The container must be designed in a way that specimens receive continuous moisture from one side and are exposed to cyclic heating on the other side. The container shall be furnished with a device that ensures a constant water level during the cycling. Lying on the bottom of the container is a grating, which is covered by a sheet of heat stable filter cloth.

SIST EN 16306:2013
https://standards.iteh.ai/catalog/standards/sist/b373144f-7117-4854-b477-771ea030a90c/sist-en-16306-2013

6.2 A non-corrosive grating that fits the length and width of the container and has a height of at least 1 cm. The function of the grating is to ensure a water reservoir beneath the filter cloth.

6.3 A soft, heat and dimension stable non-hygroscopic needle filter cloth of thickness approximately 5 mm and without any water soluble substances or chemicals. The cloth (e.g. polyester or PTFE (polytetrafluoroethylene) needle felt) is to be placed on top of the grating. The function of the cloth is to provide moisture and a uniform support to the specimen.

6.4 Heating panels of sufficient sizes/and numbers to cover the container. The panels must be capable of providing a uniform heat flow, heating the black reference from 20 °C to 80 °C at average rate of (0,30 ± 0,05) °C per minute. The maximum allowed temperature difference within the bath, during heating exposure, is 3 °C. Walls of insulating material should preferably be placed around the container (Figure 1) to avoid unwanted cooling or air circulation. Before the system is taken into use, trial measurements of the temperature shall be performed at nine surface points widely distributed within the heating frame (Figure 2). The temperature is measured on a uniform surface preferably with an infrared thermometer or a surface measuring thermometer. The temperature readings shall be taken on the surface of the black reference.

NOTE 1 The heating rate may be adjusted by changing the distance between the heating device and the samples, or by controlling the effect of the heater. The heating curve is displayed in Figure 5.

6.5 A black reference plate, according to EN ISO 4892-1:2000 (Figure 3), to establish the maximum surface temperature at 80°C. The black reference is connected by a thermocouple (cable type K), preferably to a high stability temperature and process controllers. A simple logger is also possible.

NOTE 2 The black reference is placed on the surface of the measured sample, preferably in the middle of the container. The temperature for the experimental exposure is programmed in advance. The heating elements are connected to the whole system and are controlled by the process controller. The temperature of the black reference is

SIST EN 16306:2013

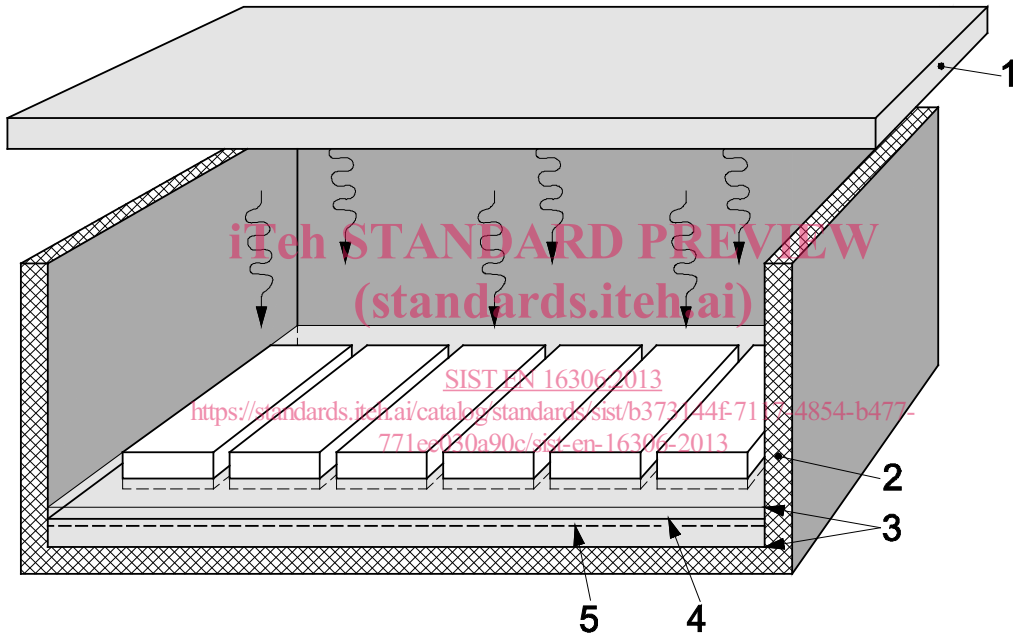
read and the signal is sent to the process controller that adjusts the heating. The whole system can thus be computer-controlled and the surface temperature can be monitored on-line.

6.6 An infrared thermometer or other thermometer capable of measuring the surface temperature of the specimens.

6.7 A bow-test rig for bow measurements (Figure 4). The rig is composed of a steel plate with three supporting points upon which the specimen is lying, and three cylinders guiding the edges of the specimen. The supporting points are situated (350 ± 5) mm apart from each other, and they must be well rounded and smooth in order to accommodate for eventual irregularities in the sawn surface of the specimens. Above the centre of the specimen a gauge is mounted, which shall be readable to 0,001 mm. The whole system shall have an accuracy better than ± 0,01 mm.

6.8 A reference cylinder (coplanar bases with an accuracy better than ± 0,005 mm) consisting of a material with a low linear expansion coefficient (e.g. quartz glass or invar steel).

6.9 A ventilated oven capable of maintaining a temperature of (40 ± 5)°C.



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SIST EN 16306:2013
https://standards.iteh.ai/catalog/standards/sist/b373144f-7164-4854-b477-771ec030a90c/sist-en-16306-2013

Key

1 heating device
2 insulation
3 water level
4 filter cloth
5 grating

NOTE The front wall is omitted here for a better view of the interior.

Figure 1 — Principle sketch and an example of exposure equipment for testing the potential bowing properties of marble

SIST EN 16306:2013

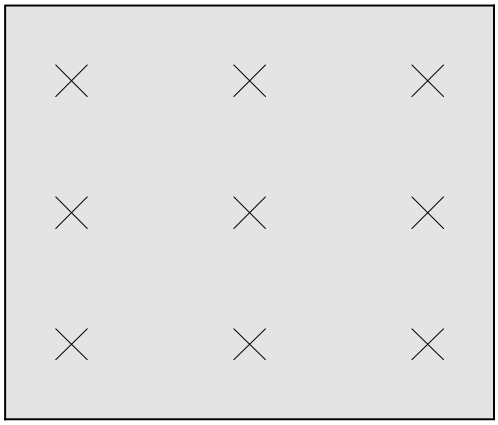
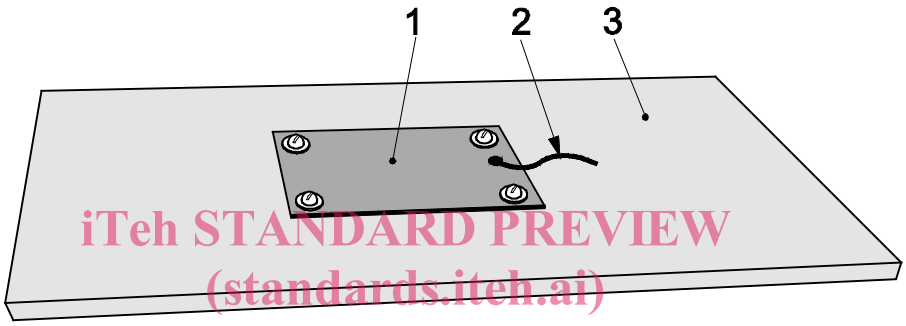


Figure 2 — Location of temperature control points



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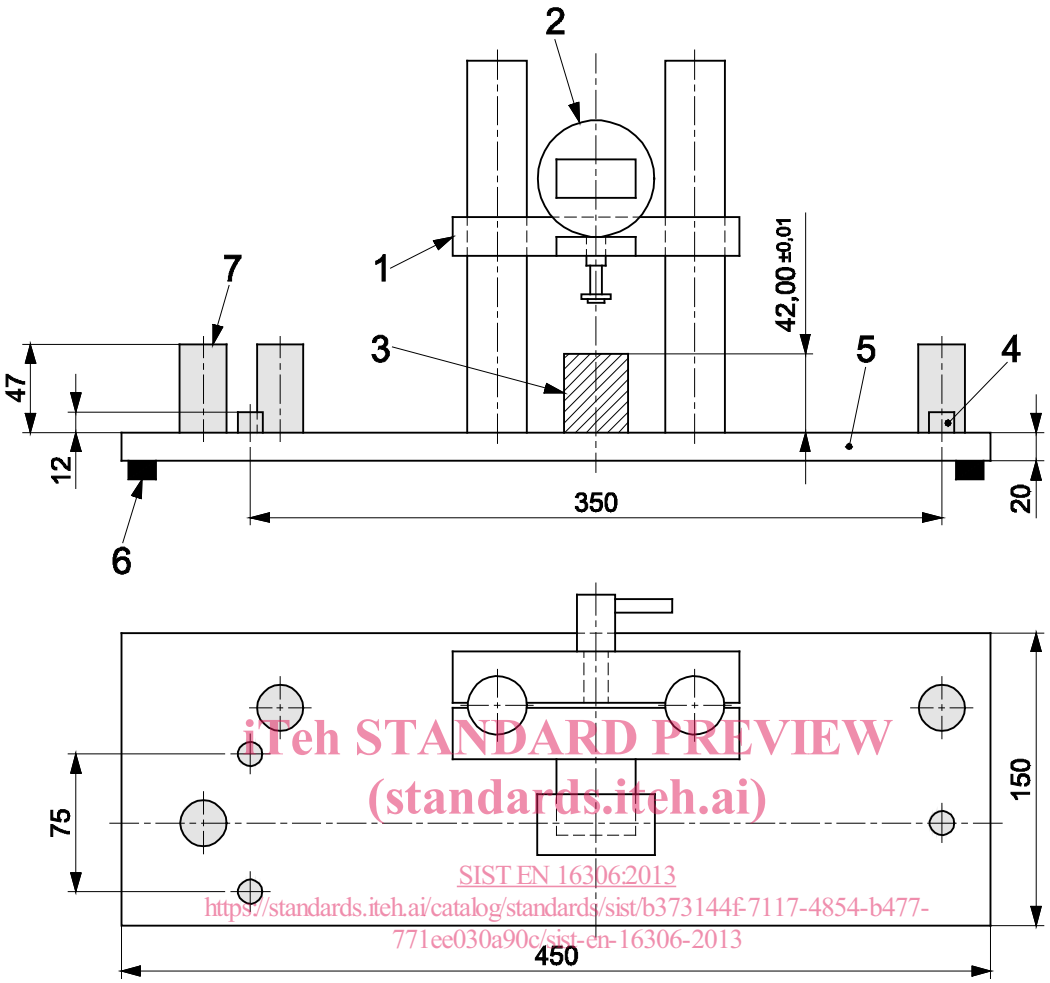
SIST EN 16306:2013
https://standards.iteh.ai/catalog/standards/sist/b373144f-7117-4854-b477-771ee030a90c/sist-en-16306-2013

1 black reference
2 thermocouple
3 test specimen

Figure 3 — Black reference plate (EN ISO 4892-1:2000) for T-measurements

SIST EN 16306:2013

Dimensions in millimetres



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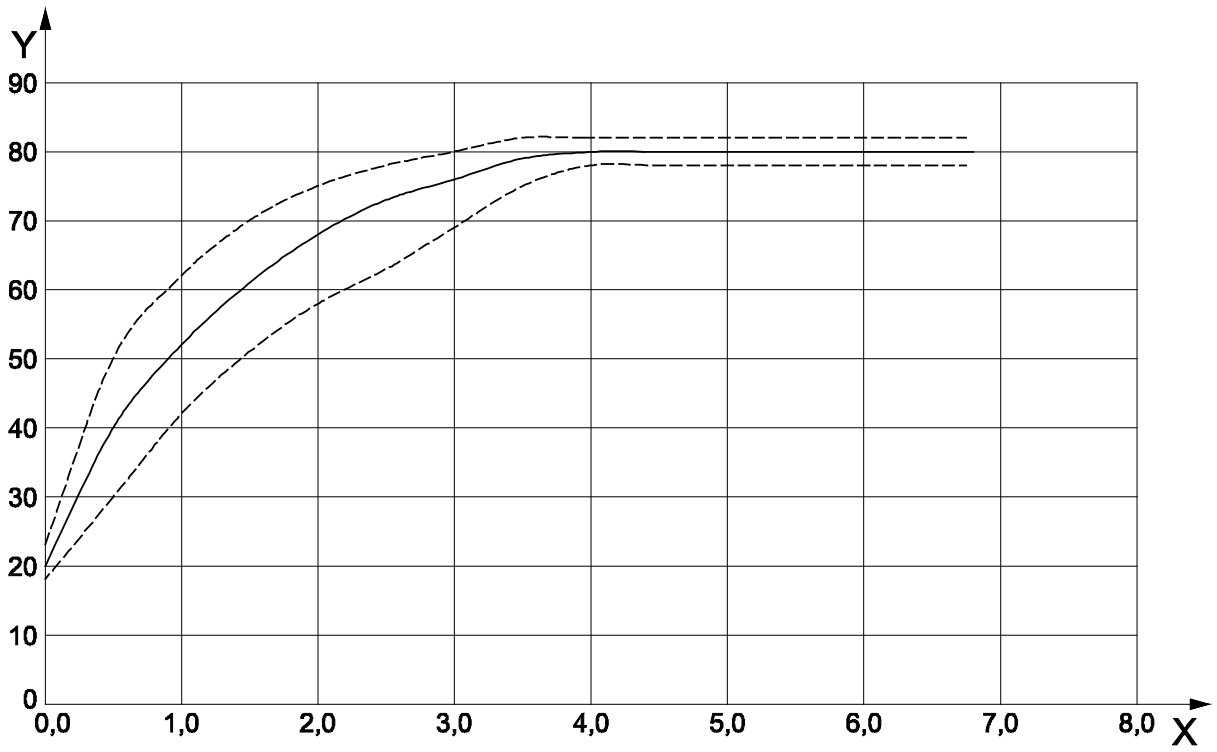
SIST EN 16306:2013
https://standards.iteh.ai/catalog/standards/sist/b373144f-7117-4854-b477-771ee030a90c/sist-en-16306-2013

Key

1 stand
2 gauge
3 reference piece
4 support
5 steel plate (rust resistance)
6 rubber studs
7 guide

Figure 4 — Schematic drawing of the bow test rig

SIST EN 16306:2013



Key

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X time (h)
Y temperature, black ref. (°C)

SIST EN 16306:2013
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_____ ideal temperature curve
– – – – – – upper and lower tolerances

Figure 5 — Requested temperature cycle and allowed tolerance

7 Preparation of specimens

7.1 Sampling

The sampling is not the responsibility of the test laboratory except where specifically requested.

At least six specimens are to be exposed and another set of six specimens are to be used as references for flexural strength measurement of unexposed material. Samples shall be chosen in order to be representative of the batch to be tested. For identification testing, any foliation must be taken into consideration. Six specimens with faces perpendicular to and six specimens parallel to the foliation must be selected. For technological tests, it is sufficient to select samples with one set of orientations according to the use of the slabs.

NOTE For very heterogeneous marble types, it has proven valuable to double the number of test specimens.

7.2 Test specimens

Test specimens shall be slabs with a length of (400 ± 5) mm, a width of (100 ± 5) mm and a thickness of (30 ± 2) mm. The upper surfaces of the specimen shall be honed (not polished) and the back surface shall be smooth. The specimens must not be chemically treated in any way.