SLOVENSKI STANDARD
SIST EN 539-2:2006

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Opečni strešniki – Ugotavljanje fizikalnih lastnosti – 2. del: Preskušanje odpornosti proti zamrzovanju

Clay roofing tiles for discontinuous laying - Determination of physical characteristics - Part 2: Test for frost resistance

Dachziegel für überdeckende Verlegung - Bestimmung der physikalischen Eigenschaften - Teil 2: Prüfung der Frostwiderstandsfähigkeit

Tuiles de terre cuite pour pose en discontinu - Détermination des caractéristiques physiques - Partie 2: Essais de résistance au gel

Ta slovenski standard je istoveten z: **EN 539-2:2006**

ICS:

91.060.20	Strehe	Roofs
91.100.25	Keramični gradbeni izdelki	Ceramic building products

SIST EN 539-2:2006 **en**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 539-2

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English Version

Clay roofing tiles for discontinuous laying - Determination of physical characteristics - Part 2: Test for frost resistance

Tuiles de terre cuite pour pose en discontinu - Détermination des caractéristiques physiques - Partie 2 : Essais de résistance au gel

Tondachziegel für überlappende Verlegung - Bestimmung der physikalischen Eigenschaften - Teil 2: Prüfung der Frostwiderstandsfähigkeit

This European Standard was approved by CEN on 18 May 2006.

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 Central Secretariat 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 Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, 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 and United Kingdom.

EUROPEAN COMMITTEE FOR STANDARDIZATION
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EUROPÄISCHES KOMITEE FÜR NORMUNG

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Foreword

This document (EN 539-2:2006) has been prepared by Technical Committee CEN/TC 128 “Roof covering products for discontinuous laying and products for wall cladding”, the secretariat of which is held by IBN/BIN.

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 December 2006, and conflicting national standards shall be withdrawn at the latest by December 2006.

This document supersedes EN 539-2:1998.

This part of the standard is one of a series of standards concerning clay roofing tiles, the list of which is indicated below:

EN 1304, *Clay roofing tiles and fittings — Products definitions and specifications*

EN 538, *Clay roofing tiles for discontinuous laying — Flexural strength test*

EN 1024, *Clay roofing tiles for discontinuous laying — Determination of geometric characteristics*

This part of EN 539 is preceded by Part 1:

EN 539-1, *Clay roofing tiles for discontinuous laying — Determination of physical characteristics — Part 1: Impermeability test*

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, 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 and United Kingdom.

1 Scope

This part of this European Standard specifies five test methods for the determination of frost resistance of clay roofing tiles and fittings.

The first four test methods (methods A, B, C and D) are applicable according to the requirements described in EN 1304.

The fifth test method (E) is applicable in all the CEN members in accordance with the requirement of each member state. Each country indicates the level or levels in their national foreword of EN 539-2.

2 Normative references

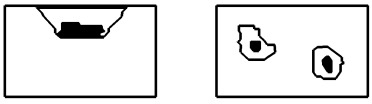
The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 1304, *Clay roofing tiles for discontinuous laying — Products definitions and specifications*

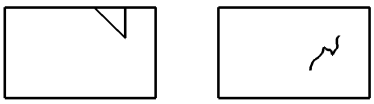
3 Terms and definitions

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

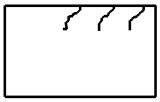
3.1
pit
see definition in EN 1304



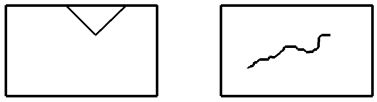
3.2
hair crack
superficial crack having a width of not more than 0,20 mm



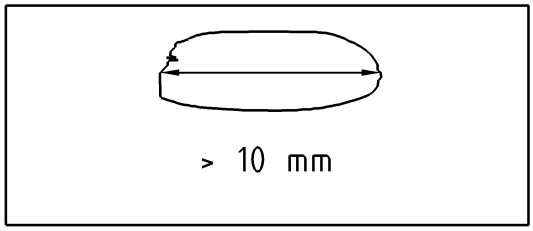
3.3
nascent crack
crack formation at the edge, only crack penetrating slightly into the interior of the ceramic body



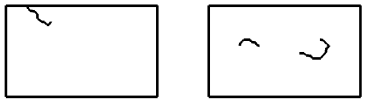
3.4
surface crack
crack more than 0,20 mm wide and with a length of more than 30 mm, which does not pass through the thickness of the product



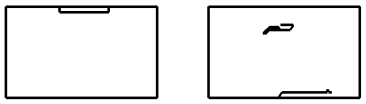
3.5
surface damage
loss of a part of the ceramic body from the surface of the product, one of the dimensions of that part being greater than 10 mm. The surface area of the product remains unchanged



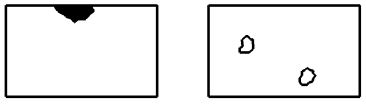
3.5.1
scaling
surface raising, nascent chipping, or crack, which initiates damage



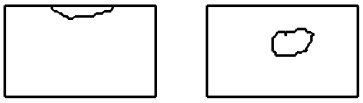
3.5.2
chip
loss of a fraction of the body material of the product



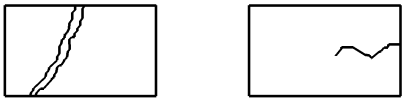
3.5.3
peeling
loss of a part of the superficial layer of the product



3.5.4
flaking
progressive loss of body material affecting parts or the whole thickness of the product

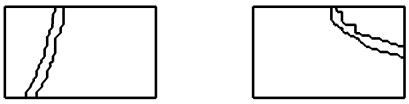


3.6
structural crack
see definition in EN 1304

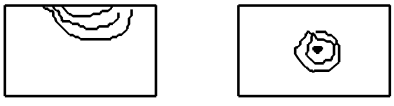


3.7
loss of ribs
loss of body material from the interlocking ribs sufficient to influence their function

3.8
break
see definition in EN 1304



3.9
delamination
lamellar flaking which can lead to the delamination of the body in a succession of parallel layers



3.10
calibration device (applies to method E only)
roof tile or ceramic slab which may be specially made to possess the characteristics defined within 9.4.1.1 and which will not be damaged during the calibration

4 Test pieces

If the tiles or fittings are placed on the market with a ceramic coating and/or treatment, the tests shall be carried out on test pieces having this coating and/or treatment.

When the tiles or fittings are taken from a site or building, they shall be tested in the state in which they are found, but the interpretation of the test results shall take into account the stresses to which these installed products have been subjected.

5 Test method A

5.1 Principle

The sample of test pieces is immersed in water under vacuum at an absolute air pressure of 4×10^4 Pa. It is next subjected to a fixed number of freeze/thaw cycles, after which the individual test pieces are examined for any possible damage caused by frost. The heat extraction at the exposed surface of the product creates a unidirectional freezing flow from the exposed surface of the product towards its interior. After each freezing stage the test pieces are completely thawed out in water. The preliminary soaking and the freeze/thaw cycles are carried out following exact procedures.

5.2 Apparatus

5.2.1 Drying oven

It shall be adjustable to (110 ± 5) °C.

5.2.2 Balance

It shall be accurate to within 1 g.

5.2.3 Programme controlled freezing unit

Consisting of:

— exposure chamber, thermally insulated and fitted with a grid. The exposure chamber shall be able to accommodate at least one sample;

— air circulation system allowing an even air flow to be directed towards the lower part of the exposure chamber at a velocity of about 1,5 m/s in the section above the test pieces, so that the extraction of heat at the surface of the test pieces corresponds to:

  (300 ± 60) W/m² at (- 15 ± 3) °C and (100 ± 20) W/m² at (- 5 ± 1) °C;

— refrigeration unit, capable of reducing the air temperature in the test chamber from (18 ± 2) °C to (- 15 ± 3) °C in 1 h 45 min ± 15 min;

— thawing system, with provision for the supply of water to and the removal of water from the exposure chamber, as well as an overflow system and a mechanism for reheating the thawed water to (18 ± 2) °C. This unit shall be capable of being filled with and emptied of water in a period of less than 15 min;

— control and measuring unit, capable of controlling and checking the successive freeze/thaw cycles according to the appropriate programme. Temperature measurements shall be accurate to within 0,5 °C. The measurement is carried out at a distance of 25 mm from the middle of the test piece in the middle of the exposure chamber. The temperature of the test piece is measured at the centre of the gravel filler directly beneath the test piece.

5.2.4 Miscellaneous

The following are also necessary for carrying out this test:

— material allowing the construction of a test assembly (see Figure 1) made up of two test pieces arranged back to back at a distance of about 50 mm, as well as a gravel filler which will allow the unidirectional freezing of the test pieces and a damp atmosphere around their back sides (e.g. gravel with a particle size of 2 mm to 4 mm);

— absorbent cloths, waterproof ink, potable water.

5.3 Sampling

5.3.1 Laboratory sample

The laboratory sample shall be selected at random from the production or consignment concerned and shall consist of eight whole and undamaged clay roofing test pieces (tiles or fittings).

The sampled test pieces shall conform to the requirements concerning structural characteristics laid down in EN 1304.

5.3.2 Test sample

The test sample consists of six out of the eight test pieces referred to above.

After the soaking operation as described in 5.4.3, the three test pieces displaying the highest water absorption are selected, as well as three other test pieces chosen at random.

These test pieces shall be marked with waterproof ink. The remaining two test pieces are kept as a reference to use when compiling the test results.

5.4 Preliminary treatment

5.4.1 Drying of the sample

Dry the test pieces at (110 ± 5) °C for 48 h.

Weigh each test piece in its dry state to an accuracy of one gram to determine its dry mass (M_d) after cooling in the ambient air of the laboratory.

5.4.2 Visual inspection of the sample

Examine the dry test pieces with the naked eye and in normal daylight for possible imperfections. Mark each imperfection with waterproof ink.

5.4.3 Soaking of the test pieces

5.4.3.1 General

The procedure for soaking in water described below is carried out before the freeze/thaw test to realize the saturation prior to doing this test.

5.4.3.2 Principle

The water absorption takes place at absolute pressure of 4×10^4 Pa.

5.4.3.3 Apparatus

Water supply tank, filled with potable water.

Vacuum tank, easily accessible and fitted with a grid and water gauge, suitable for the soaking of at least one test sample.

Connecting pipe with control valve, between the bottom of the water supply tank and the space below the grid in the vacuum tank.

Vacuum pump with pressure control unit, connected with the vacuum tank above the maximum water level and capable of reaching and maintaining an absolute air pressure of 3×10^3 Pa.

5.4.3.4 Procedure

Place the dry test pieces in a vertical and free position in the vacuum tank, with their longest edges resting on the grid.

Evacuate the vacuum tank now filled and closed, for (60 ± 5) min at absolute pressure of $(4 \times 10^4 \pm 10^3)$ Pa.

Introduce water from the water supply tank into the vacuum tank for (30 ± 3) min whilst maintaining the absolute pressure, so as to immerse the test pieces gradually until the water level is 20 mm to 25 mm above their highest point. Maintain the pressure above the immersed test pieces for another (30 ± 3) min. Then restore atmospheric pressure in the tank.

The soaking procedure is now completed.

Remove each test piece from the water tank, wipe off the surface water with an absorbent cloth and weigh it to the nearest gram to determine its wet mass (M_s). Calculate the water content (W_s) in % of the dry mass using the following equation:

$$W_s = [(M_s - M_d) / M_d] \text{ in } \%.$$

Do not allow the test pieces to dry out whilst waiting to start the freeze/thaw test.

5.5 Procedure

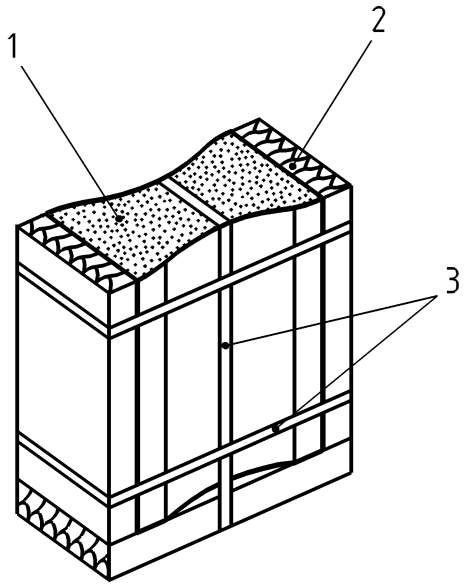
5.5.1 Positioning of the test pieces

Arrange the test pieces in pairs using elastic bands or equivalent material to constitute an assembly as shown in Figure 1, so that the test pieces are positioned back to back with a gap of approximately 50 mm between the closest points filled with gravel (2 mm to 4 mm particle size).

Place a temperature sensor behind the test piece with the highest water content; this is simply to check the temperature.

Place the test assemblies vertically on the grid in the exposure chamber of the freeze/thaw simulator with a gap between them of at least 50 mm.

If necessary, fix the test assemblies to the grid to improve their stability in the submerged situation.



Key

1 gravel
2 slab of extruded foam with closed pores
3 elastic band

Figure 1 — Example of assembly with two tiles

5.5.2 Freeze/thaw programme

Submit the test sample to 24 freeze/thaw cycles, consisting of 12 cycles with an air temperature of (- 15 ± 1) °C in the freezing stage, followed by 12 cycles with an air temperature of (- 5 ± 0,5) °C in the freezing stage.

Immerse the test pieces in water at (18 ± 2) °C during the thawing stage.

Each freezing stage shall last for 8 h ± 6 min and each thawing phase for 4 h ± 6 min.

The freezing stage of 8 h ± 6 min includes the time necessary for lowering the temperature to and maintaining it at (- 15 ± 3) °C.

The thawing stage of 4 h ± 6 min includes the time necessary for filling with water and draining it away.

5.5.3 Carrying out of the test

Carry out the freeze/thaw test as specified in 5.5.2 after a period of soaking in water at (18 ± 2) °C for a minimum of 2 h and a maximum of 4 h. Commence the 24 freeze/thaw cycles with a freezing stage at an air temperature of (- 15 ± 3) °C.

5.5.4 Assessment of possible damage caused by frost

5.5.4.1 Drying of the test pieces

After completion of the freeze/thaw test remove the test pieces from the test assemblies, rinse thoroughly in clear water and then dry at (110 ± 5) °C for 48 h.

5.5.4.2 Final visual inspection

Examine each test piece of the sample on all its surfaces with the naked eye in normal daylight from a distance of 250 mm to 400 mm for any visible frost damage caused during the test.

Record the nature, position and extent of any possible frost damage separately on each test piece (see Clause 3).

5.6 Interpretation of the results

The sample shall be considered frost resistant if none of the test pieces show any of the following types of damage constituting failure of this test:

— loss of rib(s);

— surface crack(s) or structural crack(s);

— breaks;

— scaling or surface damage;

— flaking;

— delamination;

— peeling;

— each of the test pieces has kept one nib intact[1)].

A test piece revealing a hair crack on one of its edges shall be sawn through to check on internal delamination. For comparison, the test pieces kept in reserve (see 5.3.2) should also be sawn through. Hair cracks on the tile edges due to internal delamination caused during the test and consequently not found in the reference test pieces, shall be considered as frost damage constituting failure of this test.

Whatever their dimension, pits caused by the presence of concentrations of pyrites or lime, hair cracks and nascent cracks shall not be considered as frost damage constituting failure of this test.

Equally, minor damages such as:

— scaling;

— flaking;

— peeling

are not considered as frost damage constituting failure of this test;

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1) This last specification concerns only test pieces with one or several nibs before testing.