SLOVENSKI STANDARD
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01-februar-2019

Nadomešča:

SIST-TS CEN/TS 772-22:2006

Metode preskušanja zidakov - 22. del: Ugotavljanje odpornosti proti zmrzovanju/tajanju opečnih zidakov

Methods of test for masonry units - Part 22: Determination of freeze/thaw resistance of clay masonry units

Prüfverfahren für Mauersteine - Teil 22: Bestimmung des Frost-Tau-Widerstandes von Mauerziegeln

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Méthodes d'essai des éléments de maçonnerie - Partie 22: Détermination de la résistance au gel/dégel des éléments de maçonnerie en terre cuite

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ICS:

91.100.25	Gradbeni izdelki iz terakote	Terracotta building products

SIST EN 772-22:2019 **en,fr,de**

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 772-22

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Supersedes CEN/TS 772-22:2006

English Version

Methods of test for masonry units - Part 22: Determination of freeze/thaw resistance of clay masonry units

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This European Standard was approved by CEN on 26 October 2018.

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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.

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European Foreword

This document (EN 772-22:2018) has been prepared by Technical Committee CEN/TC 125 “Masonry”, the secretariat of which is held by BSI.

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of an identical text or by endorsement, at the latest by June 2019, and conflicting national standards shall be withdrawn at the latest by June 2019.

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

This document supersedes CEN/TS 772-22:2006.

The most significant changes compared to the previous edition include:

— definition for sand grading for mortar has been tightened;

— rubber joints between units are only permitted for product development and factory production control testing;

— a clause for partial saturation at 80 °C is added;

— only flush finish joints are permitted;

— monitoring of temperature is taken from 30 mm from the face not 40 mm;

— classification as F2 is given if not more than 10% of units exhibit damage of Type 4 or above, rather than no units of type 4 or above;

— classifications of F1(n) and F2(80°C) are added;

— a detailed description of a heat flow meter is provided.

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

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1 Scope

This document specifies a method for determining the freeze/thaw resistance of clay masonry units in one of two categories F1 or F2.

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.

EN 771-1, *Specification for masonry units — Part 1: Clay masonry units*

EN 772-21, *Methods of test for masonry units — Part 21: Determination of water absorption of clay and calcium silicate masonry units by cold water absorption*

EN 197-1, *Cement — Part 1: Composition, specifications and conformity criteria for common cements*

EN 13139, *Aggregates for mortar*

3 Terms and definitions

No terms and definitions are listed in this document.

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ISO and IEC maintain terminological databases for use in standardization at the following addresses:

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- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

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4 Principle

A panel of clay masonry units is assembled from units and rapid hardening mortar which when sufficiently hardened is immersed in water for a prescribed period of time. The panel is subsequently cooled for a specified period and the water in the units near to one face is repeatedly thawed and refrozen while the rear of the panel remains permanently frozen (achieving a so called pinch effect). Damage caused by the freezing and thawing action is assessed and used to determine the freeze/thaw resistance of the bricks.

5 Apparatus

An appropriate **testing machine** capable of generating the freeze–thaw cycles specified in 9.2 and ensuring unidirectional freezing and thawing through one face of the units.

Several different designs of testing machines are suitable all of which use a fan to circulate air in the machine. It is important that the machine circulates the air such that the flow is essentially parallel to the face of the panel under test.

A **water tank for soaking**, made of plastic or steel.

A **heat flow meter**. The heat flow meter is an insulated device for extracting heat over the central area of the surface of what during a test would be the exposed face of the panel. The area is matt black and shall be capable of extracting heat such that when the air temperature is recorded as −15°C as in 9.2.2 and the centre of the plate is maintained at 0°C the average rate of heat extraction can be measured. A typical example is described in Annex A and a suitable calibration procedure in Annex C.

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6 Materials

High alumina cement shall conform to EN 197-1.

Sand shall conform to EN 13139 with a grain size distribution between the limits shown in Figure 1.

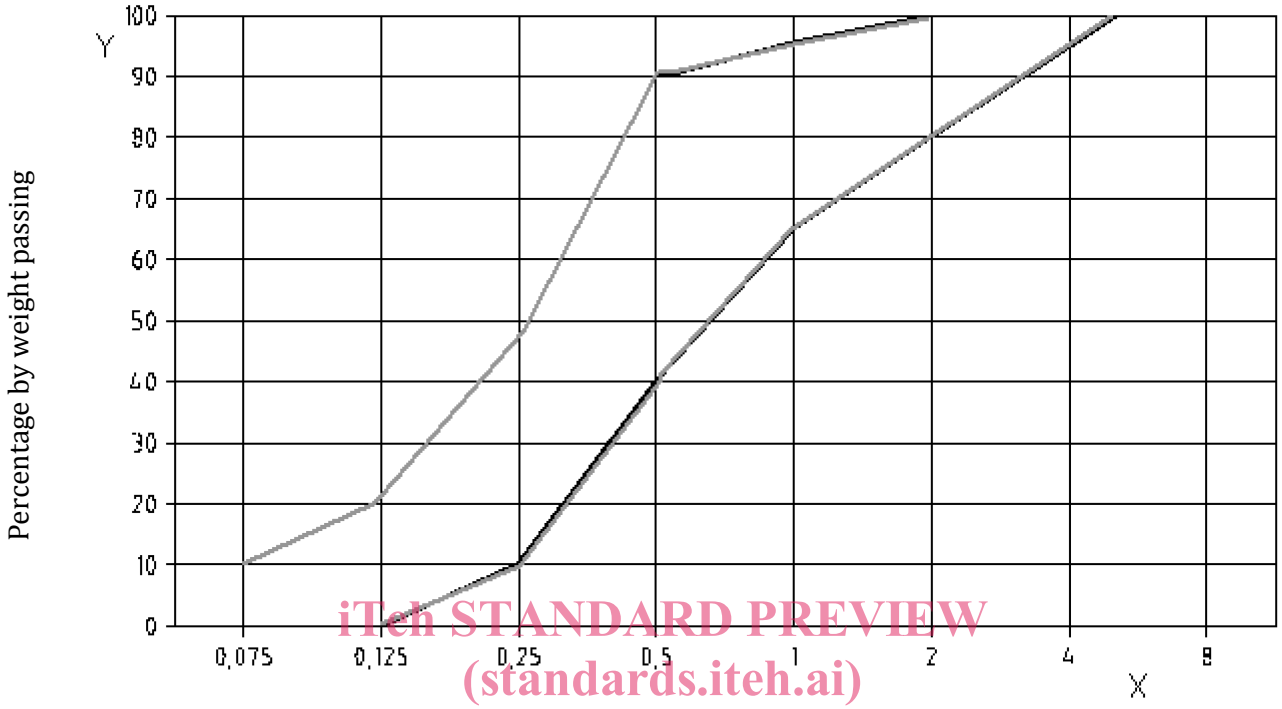

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Figure 1 — Grain size distribution

7 Preparation of specimens

7.1 Sampling

The method of sampling shall be in accordance with EN 771-1. Sufficient units shall be sampled in order to construct a panel with a face which has a surface area in between 0,25 m² and 0,5 m². Each unit shall be numbered.

7.2 Water absorption

All units selected to construct the panel may be characterized for their water absorption following the procedure described in EN 772-21.

7.3 Conditioning and preparation of specimens

If the water absorption has been determined, all of the units shall be left to dry individually for at least one day under laboratory conditions. Units, the headers of which are exposed in the panel, shall be cut and, if necessary, shortened in order to prevent part of the cut unit from protruding at the rear of the panel. Both half units shall be renumbered with the original unit number and e.g. the addition a and b.

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8 Construction of a test panel

8.1 General

Test panels shall be constructed from units with the identifying marks visible on the face of the panel to be exposed and a rapid setting high alumina cement mortar.

NOTE The mortar needs to be strong enough and provide adequate adhesion such that panels can be handled safely but which is not so strong as to make dismantling the panel after testing difficult. This has been achieved in different laboratories by using a cement:sand mix of 1:4 or 1:6 by volume depending on the characteristics of the sand used. For product development or factory production control some laboratories find it more convenient to form the joints of neoprene rubber or similar. Wherever testing is carried out to test the validity of a manufacturer's declaration, mortar joints should be used in accordance with this clause.

If the initial rate of water absorption needs to be adjusted before laying, the bricks should be wetted.

A typical panel is shown in Figure 2. Cut units at the end of courses shall be turned so that the header of the unit forms part of the face of the panel to be exposed to the freeze/thaw cycles. The depth of these header faced units should be equal to the width of the full units in order to create such a plane that in the freeze/thaw test the panel can be fitted closely to the insulation at the rear. A layer of foam rubber should be used at the rear face such that the flow of air in any gap is eliminated.

The panel height should be limited to 0,75 m.

The mortar joints shall be finished with a steel tool to give a flush finish on the front and back faces of the panels as shown in Figure 3. Sufficient units shall be used to construct a panel measuring between 0,25 m^2 and 0,5 m^2.

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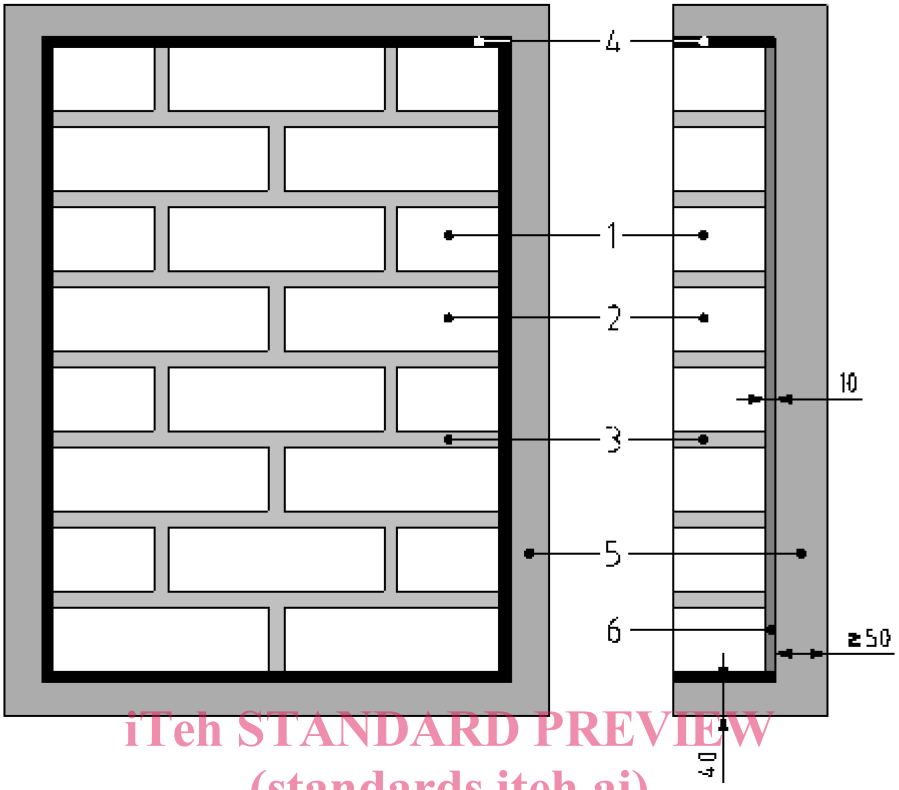
Dimensions in millimetres



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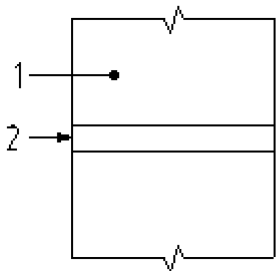
Key

1 Header
2 Stretcher
3 Mortar joint
4 Foam rubber
5 Insulation
6 Foam rubber

Figure 2 — Typical test panel



Key

1 Masonry unit
2 Flush finish to mortar joint

Figure 3 — Joint finish

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8.2 Conditioning of a test panel

8.2.1 General

The test panel shall be allowed to cure in ambient laboratory conditions for at least 3 days. Each unit in the panel shall than be examined. Any existing defects shall be noted with a water proof marker. The situation (with or without markings) shall be captured by means of a high resolution photograph.

The panel will then be partially saturated by one of the two methods given below.

8.2.2 Partial saturation by cold water immersion

The panel will be completely immersed in a tank of water at room temperature for 7 days ± 8 h.

8.2.3 Partial saturation by immersion in water at 80°C

The panel is immersed in an insulated tank filled with tap water at room temperature. The tank is closed and the water temperature is raised to (80 ± 3)°C within a period of 2 to 5 hours. The temperature is maintained for a total of (24 ± 1) hours including a 2 to 5 hours temperature rise. The temperature is then decreased to room temperature within a period of 2 to 5 hours. This is done by gradually putting tap water at room temperature into the tank. In this condition the panel remains until the total immersion time from the start of the process is at least 44 hours and not more than 56 hours.

9 Procedure of freezing and thawing

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9.1 General

All faces of the panel except that exposed to freeze/thaw cycling conditions shall be enclosed in a close fitting jacket of extruded polystyrene foam with a density of less than or equal to 50 kg/m^3 . The minimum thickness of the jacket shall be 50 mm at the back and 40 mm around the perimeter of the test panel. Minimum thicknesses for other insulation materials can be derived, assuming a typical λ- value of 0,035 W/mK for extruded polystyrene.

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The joint between the polystyrene outer wall and the test panel shall be finished so that in the thawing phase applied water is prevented from running behind the test panel. This may be achieved by placing a layer of foam rubber around the perimeter of the test panel and a further closure using water tight tape.

The test regime should commence within 4 h of removing the panels from the soaking tank. When the panel is installed in the apparatus it shall be preconditioned before the freeze/thaw cycling commences by spraying the face of the panel for (15 ± 1) min with a flood coat of water at ambient temperature at a rate of 6 ± 0,5 l/min. metre width of test panel as measured in accordance with Annex B. Ensure an unbroken flood coat of water using a perforated pipe system with a maximum distance between the perforations of 20 mm. The water spray should be applied to the face of the top course of the units. Ensure that water does not enter the panel through the top or the sides of the panel, that there will be no back splashing and that all water supplied should contact the panel at the top course.

9.2 Freeze/thaw cycling

9.2.1 General

During the freezing and thawing period the rates of heat transfer and the temperature distributions over the exposed face of the panel shall be as defined in 9.2.2 and 9.2.3. The panel is subjected to a maximum of 100 freeze/thaw cycles and any damage is assessed as described in 10.

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9.2.2 Freezing period

The first freezing period shall last for 24 h ± 5 min. Each following freezing period shall be for (120 ± 5) min. The air temperature measured at a distance of (40 ± 10) mm away from the centre of the exposed face shall fall from (20 ± 3) °C to (−15 ± 3) °C in not less than 20 min but not more than 30 min. The average temperature of (−15 ± 1) °C shall be maintained for a further 90 min to 100 min so that the total freezing period is (120 ± 5) minutes. The air temperature for control purposes of the equipment should be monitored within the air flow (not remote from it).

The corrected rate of heat loss, as measured in accordance with Annex C, when the air temperature is −15 °C and the temperature of the exposed surface of the panel is 0°C shall be 350 ± 50 W/m^2.

9.2.3 Thawing period

The air temperature measured at a distance of (40 ± 10) mm from the centre of the exposed face of the panel shall rise from (−15 ± 1) °C to (20 ± 3) °C in not less than 15 min and not more than 20 min. The total warm air period including the period of temperature rise shall be (20 ± 1) min.

The following water spray period shall last (120 ± 10) s with the water spraying evenly across the face of the units in the top course of the panel to provide an evenly distributed flood coat over the entire face of the panel. The water shall be supplied at a rate of (6 ± 0,5) l/min. metre width of test panel at a temperature of (23 ± 2) °C.

At the end of the spray period, (120 ± 10) s shall be allowed for water to drain from the system.

9.2.4 Reconditioning after an interruption

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In the event of an interruption to the cycling procedure which results in the face of the panel being exposed to thawing conditions for more than two hours the panel shall be reconditioned by starting with a (15 ± 1) min spray period as described in 9.1 followed by a freezing period of 24 h as in 9.2.2. This 24 h freezing period shall be considered the first freezing period after the interruption. Each following freezing period shall consist of (120 ± 5) min as in 9.2.2.

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9.3 Examination of test panel and units

The panel may be examined after any number of freeze thaw cycles up to a maximum of 100.

At the end of the 100th freeze/thaw cycle or fewer cycles if specified the panel is allowed to thaw completely and dry out under laboratory circumstances during at least two days and any damage to the exposed face of the panel is then recorded according to Figures 4 and 5. The situation shall be captured by means of one or more high resolution photographs.

During examination, any incipient lamination of the surface layer of the units may be determined by tapping the exposed surface with a small steel rod. A flat sound indicates hollowness. In this case the panel is then carefully dismantled and the bedding faces examined for laminar cracking (see 10.1).

If, after examination, the freeze/thaw cycling is to be continued, the panel shall first be partially saturated as in 8.2.2.

10 Evaluation of results

10.1 Assessment of damage

The unit number in the panel displaying any damage shown in Figures 4 and 5 after 100 cycles shall be recorded with the highest damage number. All damages should be recorded. Only damage numbers 4 and higher shall be recorded as unacceptable. Damage to the sides of the panel shall be ignored.

Laminar cracks in the bed face which have formed during the test, but which are only apparent after dismantling the panel, shall be reported as delamination.