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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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TECHNICAL SPECIFICATION

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English Version

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

This Technical Specification (CEN/TS) was approved by CEN on 21 March 2006 for provisional application.

The period of validity of this CEN/TS is limited initially to three years. After two years the members of CEN will be requested to submit their comments, particularly on the question whether the CEN/TS can be converted into a European Standard.

CEN members are required to announce the existence of this CEN/TS in the same way as for an EN and to make the CEN/TS available promptly at national level in an appropriate form. It is permissible to keep conflicting national standards in force (in parallel to the CEN/TS) until the final decision about the possible conversion of the CEN/TS into an EN is reached.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
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Foreword

This Technical Specification (CEN/TS 772-22:2006) has been prepared by Technical Committee CEN/TC 125 “Masonry”, the secretariat of which is held by BSI.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to announce this Technical Specification: 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 Technical Specification specifies a method for determining the freeze/thaw resistance of clay masonry units that are declared by the manufacturer as meeting the requirements for HD units and as suitable to be subjected to severe (F2) exposure.

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 771-1, *Specification for Masonry Units — Clay Masonry Units*

3 Principle

A panel of clay masonry units is assembled either from units which have been immersed in water for a prescribed period of time and which are separated from one another by a specified rubber jointing material or 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 near to one face is repeatedly thawed and refrozen. Damage caused by the freezing and thawing action is assessed and used to determine the freeze/thaw resistance of the bricks.

4 Symbols

m_d is the mass of the specimen after drying, in grams (g)

m_w is the wet mass of the specimen, in grams (g)

w_m is the water absorption of an individual specimen, in mass percent (%)

5 Apparatus

An appropriate **testing machine** capable of generating the freeze-thaw cycles specified in clause 8.3 and ensuring unidirectional freezing and thawing through one face of the units.

Several different designs of testing machine 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**, made of plastic or steel.

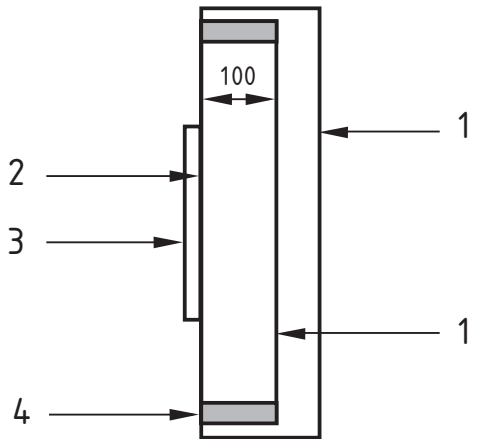
A **drying oven** capable of maintaining a temperature of 105 °C ± 5 °C and of providing forced air circulation.

A **weighing instrument** capable of weighing specimens to an accuracy of 1 g.

A **heat flow meter** suitable for carrying out the calibration procedure. A suitable heat flow meter can be constructed by bonding an electrically heated resistance mat of appropriate rating to an aluminium plate of the same shape and size, typically 2 mm thick × 200 mm × 400 mm and a sheet of extruded polystyrene foam 100 mm thick (see Figure 1). The polystyrene sheet should be of sufficient size to fill the opening in the cabinet which is normally occupied by the test panel of masonry units. The aluminium plate, which shall be painted matt black, is sealed to the centre of this opening with a thermocouple attached to its external surface

at the approximate centre of the plate. The heated mat is connected to a continuously variable transformer with a means of measuring current and voltage.

Dimensions in mm



Key

1 Insulation
2 Electric resistance mat
3 Matt black aluminium sheet
4 Foam rubber

Figure 1 — Heat flow meter

6 Materials

Foam rubber with closed pores 10 mm ± 2 mm thick and which does not absorb water during the test.

High alumina cement

Sand with a maximum grain size of 1 mm

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 of between 0,25 m^2 and 0,5 m^2.

7.2 Preliminary examination of specimens

Each unit shall be numbered and examined. Any existing defects shall be noted. The descriptions given in Table 1 and shown diagrammatically in Annex A may be used for guidance. Only defects with a damage type 4 and above need be recorded.

7.3 Conditioning of Specimens

Water absorption may be determined using the method described in Annex B.

If the construction method described in 8.2 i.e. with rubber joints is to be used, then each unit is placed in the tank of water at room temperature. That water is to be in contact with all faces of the unit and this may be achieved by the resting of the units on small pads which act as spacers. The units are left submerged for 7 days.

If the construction method described in 8.3 i.e. with mortar joints is to be used, the conditioning of the test panels shall be in accordance with 8.3.2.

8 Construction of test panel

8.1 General

Test panels may be constructed using either foam rubber or mortar as jointing materials. However in cases of dispute the jointing medium should be the same as that upon which the declaration of the freeze/thaw category was based.

NOTE Current scientific knowledge indicates that the results from tests carried out using rubber or mortar for panel construction are, within the natural variation of results, the same.

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 25 mm around the perimeter of the test panel. The joint between the polystyrene outer wall and the test panel shall be finished so that melt water is prevented from running behind the test panel. This may be achieved by placing a layer of the foam rubber around the perimeter of the test panel.

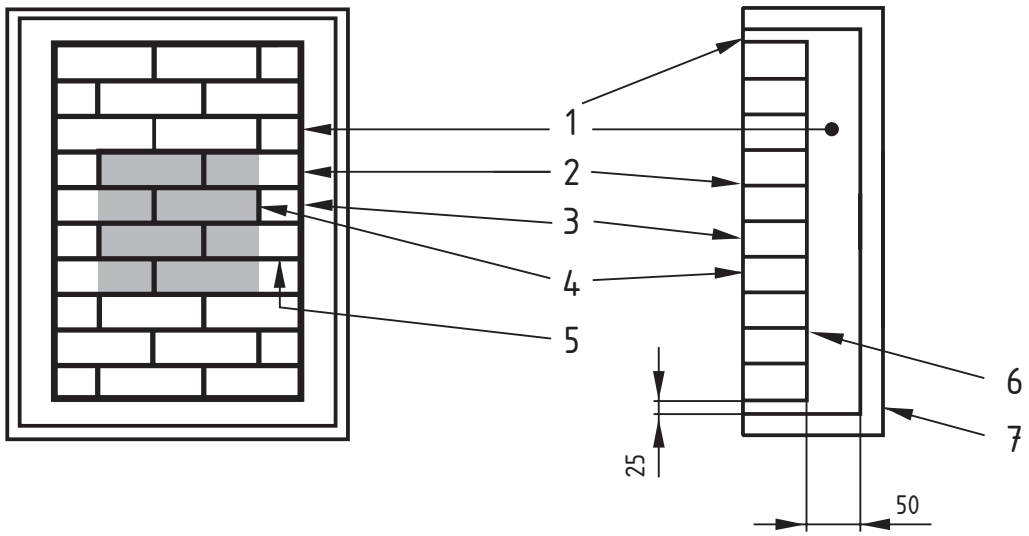
8.2 Rubber Joints

Remove the units from the water and assemble them into a panel using the closed pore foam rubber (10 mm ± 2 mm thick) as a jointing material. The units shall be arranged so that the vertical joints in one course are approximately above the centre of a whole unit in the course beneath it (stretcher bond). Half units at the ends of courses shall be turned so that the uncut end of the unit (header) forms part of the face of the panel to be exposed to the freeze-thaw cycles. Sufficient units shall be used to construct a panel measuring between 0,25 m^2 and 0,5 m^2.

It is important that water does not enter the panel at the interfaces between the masonry units and the foam rubber. This may be prevented by lightly precompressing the panel horizontally and vertically using “T” bolts or eye bolts or similar which may be tightened by hand.

A typical panel is shown in Figure 2.

Dimensions in mm



Key:

1 Insulation
2 Stretcher
3 Header
4 Area for location of thermocouple (shaded)
5 Mortar or rubber joint
6 Intimate contact between insulation and brickwork
7 Wooden jacket

Figure 2 — Typical test panel

8.3 Mortar Joints

8.3.1 General

Test panels shall be constructed from units and a rapid setting high alumina cement mortar with a cement: sand ratio of 1: 4 by volume. A typical panel is shown in Figure 2. The units shall be arranged so that the vertical joints in one course are approximately above the centre of a whole unit in the course beneath it. Half units at the ends of courses shall be turned so that the end of the unit forms part of the face of the panel to be exposed to the freeze-thaw cycles. The mortar joints shall be finished with a steel tool to give a flush or bucket handled finish 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.

NOTE There are advantages and disadvantages associated with both jointing mediums. Mortar is more realistic but requires the laboratory to have available a skilled mason and a means of lifting whole panels when they are saturated. Rubber joints may need sealing to prevent failures on the bed faces but are more easily assembled and can if necessary be dismantled after fewer than 100 cycles. It is also easier to freeze and thaw bricks the individual water absorption of which is known.