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Methods of test for masonry units - Part 1: Determination of compressive strength

Prüfverfahren für Mauersteine - Teil 1: Bestimmung der Druckfestigkeit

Méthodes d'essai des éléments de maçonnerie - Partie 1: Détermination de la résistance à la compression

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EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

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English Version

**Methods of test for masonry units - Part 1: Determination of
compressive strength**

Méthodes d'essai des éléments de maçonnerie - Partie 1:
Détermination de la résistance à la compression

Prüfverfahren für Mauersteine - Teil 1: Bestimmung der
Druckfestigkeit

This European Standard was approved by CEN on 25 December 2010.

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 CEN-CENELEC Management Centre 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 CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, 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.

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Foreword

This document (EN 772-1:2011) 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of an identical text or by endorsement, at the latest by November 2011, and conflicting national standards shall be withdrawn at the latest by November 2011.

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

This document supersedes EN 772-1:2000.

There have been no technical changes compared to EN 772-1:2000. The opportunity has been taken to introduce a normative Annex B which includes the methods of surface preparation and conditioning for each unit type. This information was previously available in the product specifications only, consequently EN 771-1 now becomes a stand-alone document.

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

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EN 772-1:2011 (E)

1 Scope

This European Standard specifies a method for determining the compressive strength of masonry units.

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 — Part 1: Clay masonry units*

EN 771-2, *Specification for masonry units — Part 2: Calcium silicate masonry units*

EN 771-3, *Specification for masonry units — Part 3: Aggregate concrete masonry units (dense and light-weight aggregates)*

EN 771-4, *Specification for masonry units — Part 4: Autoclaved aerated concrete masonry units*

EN 771-5, *Specification for masonry units — Part 5: Manufactured stone masonry units*

EN 771-6, *Specification for masonry units — Part 6: Natural stone masonry units*

EN 772-2, *Methods of test for masonry units — Part 2: Determination of percentage area of voids in aggregate concrete masonry units (by paper indentation)*

EN 772-10, *Methods of test for masonry units — Part 10: Determination of moisture content of calcium silicate and autoclaved aerated concrete units*

EN 772-13, *Methods of test for masonry units — Part 13: Determination of net and gross dry density of masonry units (except for natural stone)*

EN 772-16, *Methods of test for masonry units — Part 16: Determination of dimensions*

EN 1015-11, *Methods of test for mortar for masonry — Part 11: Determination of flexural and compressive strength of hardened mortar*

EN ISO 6507-1, *Metallic materials — Vickers hardness test — Part 1: Test method (ISO 6507-1:2005)*

3 Principle

The specimens, after preparation, when needed, are laid and centred on the platen of a compression testing machine. A uniformly distributed load is applied and increased continuously up to failure.

4 Symbols

- | | |
|-------|---|
| f_b | normalised compressive strength of masonry unit (N/mm ²); |
| d | shape factor multiplier used to convert the air-dry compressive strength of the masonry specimens to the normalised compressive strength. |

5 Materials

Sand with a maximum grain size of 1 mm.

Cement

6 Apparatus

6.1 Testing machine that conforms to the requirements of Table 1.

Table 1 — Requirements for testing machines

Maximum permissible repeatability of forces as percentage of indicated force	Maximum permissible mean error of forces as percentage of indicated force	Maximum permissible error of zero force as percentage of maximum force of range
%	%	%
2,0	± 2,0	± 0,4

The testing machine shall have adequate capacity to crush all the test specimens, but the scale used shall be such that the failure load on the specimen exceeds one-fifth of the full scale reading. The machine shall be provided with a load-pacer or equivalent means to enable the load to be applied at the rate given in 8.2. The testing machine shall be equipped with two steel-bearing platens. The stiffness of the platens and the manner of load transfer shall be such that the deflection of the platen surfaces at failure load shall be less than 0,1 mm measured over 250 mm. The platens shall either be through hardened or the faces case hardened. The testing faces shall have a Vickers hardness of at least 600 HV when tested in accordance with EN ISO 6507-1.

One platen of the machine shall be able to align freely with the specimens as contact is made, but shall be restrained by friction or other means from tilting during loading. The other platen shall be a plane non-tilting block. The bearing faces of both platens shall be larger than the size of the largest specimen to be tested. Where auxiliary platens are used, they shall be properly located and of the same hardness, stiffness and planeness as the main platens. The bearing surfaces of the platens shall not depart from a plane by more than 0,05 mm.

6.2 Weighing instrument capable of weighing specimens to an accuracy of 0,1 % of their mass.

6.3 Sufficient stiff steel strips for use on shell bedded or strip bedded ground units (See 8.1).

7 Preparation of specimens

7.1 Sampling

The method of sampling shall be in accordance with the relevant part of EN 771. The minimum number of specimens shall be six, but a larger minimum number may be specified in the product specification, in which case that larger number shall be used. In the case of large masonry units representative portions, e.g. cubes, may be cut from the masonry unit in different positions as stated in the relevant part of EN 771 (see also Note to 7.2.4).

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7.2 Surface preparation

7.2.1 General

Specimens shall be tested in the orientation specified, and this shall be stated in the test report. For certain forms of construction, it will be necessary to test the masonry units in more than one orientation. Where grinding in accordance with 7.2.4 significantly alters the contact surface or reduces the height significantly alternative approaches are required, see 7.2.4. Where it is not practicable to prepare clay HD units by grinding e.g. high strength units, the surface preparation may be carried out by capping in accordance with 7.2.5

After the removal of any superfluous material, e.g. flashing from the production process, the faces of the specimen, whether a whole masonry unit or a piece cut from a larger unit (see 7.1), through which the load is to be applied, shall be plane to a tolerance of 0,1 mm in any 100 mm and such that the top surface lies between two parallel planes which are parallel to the bottom surface, and not greater than 1 mm apart for every 100 mm. If the test faces of the masonry unit as manufactured, or the piece cut from a larger unit, fail to achieve this specification, then prepare the surfaces either by grinding (see 7.2.4) or by capping (see 7.2.5).

Masonry units containing frogs, and not required to be capped, shall additionally be treated as given in 7.2.3.

If the specimens contain grooves or tongues first prepare them as given in 7.2.2. Test specimens shall be prepared in accordance with Annex B.

State the method of surface preparation in the test report.

7.2.2 Removal of tongues and grooves

Remove any tongues and/or grooves on the test faces of units prior to testing. If pieces are to be cut from larger units, arrange the cutting so that any tongues and/or grooves are eliminated.

7.2.3 Preparation of masonry units containing frogs and which are not to be capped

For masonry units with frogs that are assessed to have a net loaded area of more than 35 % of the bed face, test them without removing or filling the frogs. Where the net loaded area of masonry units with frogs is less than or equal to 35 % of the gross area then the frogs shall be filled with mortar of the same kind as used for capping (see 7.2.5) and the curing shall be carried out in accordance with the requirements of 7.2.5.4.

7.2.4 Grinding

Grind the surfaces of the specimen until the requirement for planeness and parallelism given in 7.2.1 is achieved. However, if the masonry units have frogs, indented lettering, cavities, perforations, internal or external holes, leave these in place. If the grinding process would significantly alter the contact area of the tested faces then the capping procedure of 7.2.5 shall be followed. If the remaining height of the specimens after they are ground is less than 40 mm or the height/width ratio less than 0,4, then make up a composite specimen by placing one upon the other without using any mortar or binding material or separating layer(s) between them.

NOTE Where a composite specimen is made up from more than one ground unit, this should be considered as a single specimen providing a single test result. Accordingly, a greater number of masonry units than that specifically stated in EN 771 will be necessary in order to provide the required number of test results.

7.2.5 Capping

7.2.5.1 Capping of masonry units without voids or with voids unfilled

Use a cement/sand capping mortar expected to attain a minimum compressive strength, when tested in accordance with EN 1015-11, at the time of testing the specimens, at least that of the expected masonry unit strength or 30 N/mm², whichever is the lesser.

If necessary, e.g. for units with high water absorption characteristics, first moisten the surfaces to be capped. Bed each specimen on a smooth rigid plate of ground glass or stainless steel which does not depart from a true plane surface by more than 0,1 mm in any 100 mm. A suitable method is as follows:

Support the plate firmly with the machined face uppermost and level it in two directions at right angles using a spirit level. Coat the plate with a film of mould release oil or a sheet of thin paper or plastic film to prevent mortar adhering to the plate. Place a uniform layer of mortar about 5 mm thick on the plate about 25 mm longer than the unit and about 10 mm wider. Press one bed face of the specimen firmly into the layer so that the vertical axis of the specimen is perpendicular to the plane of the plate. Check this condition by using a square or spirit level held against each of the four vertical faces of the specimen in turn. Ensure that the thickness of the mortar bed is at least 3 mm over the whole area and that any cavity in the bed face normally filled when the masonry units are laid in the wall is completely filled with mortar. Do not fill cavities except for those that are intended to be filled in the construction. Trim off any surplus mortar flush with the sides of the masonry units. Cover the specimen and mortar with a damp cloth. Keep the cloth damp. When sufficiently hardened, examine the mortar bed. If free from defects such as a lack of compaction, lack of adhesion to the masonry unit and/or cracking, bed the second bed face in the same way as the first, using mortar made with materials drawn from the same batches of cement and sand and using the same mix proportions. After removing the specimen from the plate, check that the mortar bed is free from defects as before. Small holes may be made in the capping to drain water trapped in cavities, if necessary.

7.2.5.2 Capping of masonry units to be face-shell bedded

When masonry units are to be face-shell bedded in use and specimens are not to be prepared by grinding, bed each specimen in mortar as specified in 7.2.5.1 using the following procedure.

Support and coat the plate as described in 7.2.5.1. Lay two parallel strips of mortar about 5 mm thick such that each strip is about 25 mm longer than the length of the unit and about 10 mm wider than the face shell.

Press one bed face of the unit into the mortar such that the thickness of the mortar under the face-shells is at least 3 mm. Check that the vertical axis of the specimen is perpendicular to the plate using a square or vertical level to check each vertical face.

Trim off any surplus mortar. Store the specimen, examine and bed the second face in accordance with 7.2.5.1 and 7.2.5.2 respectively.

7.2.5.3 Capping of masonry units to be strip-bedded

When masonry units are to be strip-bedded the procedure specified in 7.2.5.2 shall be followed except that the capping mortar shall be applied to all of the surfaces to be bedded in use.

7.2.5.4 Storage of capped specimens

Cure the specimens under sacks kept damp throughout the curing period or store in a conditioning chamber at a relative humidity of greater than 90 %. Cure for a period sufficient to ensure the mortar achieves the minimum strength specified in 7.2.5.1.

7.3 Conditioning of specimens before testing

7.3.1 General

Specimens shall be conditioned using a prescribed regime of moisture conditions or to a prescribed moisture condition as appropriate. The method of conditioning shall be as described in this clause. The method shall be as specified in Annex B. In all cases, except for conditioning by immersion, free air circulation around each specimen shall be ensured during conditioning.