BRITISH STANDARD

BS EN
772-14:2002

Methods of test for masonry units —

Part 14: Determination of moisture movement of aggregate concrete and manufactured stone masonry units

The European Standard EN 772-14:2001 has the status of a British Standard

ICS 91.100.30

National foreword

This British Standard is the official English language version of EN 772-14:2001.

EN 772-14 is a supporting standard to the forthcoming 'harmonized' European product standard specifications on aggregate concrete masonry unit, EN 771-3, and manufactured stone units, EN 771-5. These standards are the subject of transitional arrangements agreed under the Commission mandate. The Member States have agreed a nominal transition period for the co-existence of these standards and their corresponding national standard(s). It is intended that this period will comprise a nominal nine month period during which any required changes to national regulations are to be made, followed by a further nominal twelve month period for the implementation of CE marking. At the end of this co-existence period, the national standard(s) will be withdrawn. In the UK, the corresponding national standard to EN 772-14, EN 771-3 and EN 771-5 is:

— BS 6073-1:1981, *Precast concrete masonry units — Part 1*: *Specification for precast concrete masonry units.*

As EN 772-14 is a supporting standard to the forthcoming 'harmonized' EN 771-3 and EN 771-5, the nominal transition period of twenty-one months for EN 772-14 will commence upon the date of availability of either EN 771-3 or EN 771-5, whichever is the later. At the end of this period BS 6073-1:1981 will be withdrawn.

NOTE Users of BS 6073-1:1981 should contact BSI Customer Services for confirmation of withdrawal.

The UK participation in its preparation was entrusted by Technical Committee B/519, Masonry and associated testing, to Subcommittee B/519/1, Masonry units, which has the responsibility to:

— aid enquirers to understand the text;

— present to the responsible European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;

— monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this subcommittee can be obtained on request to its secretary.

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the BSI Standards Catalogue under the section entitled "International Standards Correspondence Index", or by using the "Find" facility of the BSI Standards Electronic Catalogue.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

This British Standard, having been prepared under the direction of the Sector Policy and Strategy Committee for Building and Civil Engineering, was published under the authority of the Standards Policy and Strategy Committee on 31 January 2002

Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 10, an inside back cover and a back cover.

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EUROPEAN STANDARD

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EN 772-14

November 2001

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English version

Methods of test for masonry units - Part 14: Determination of moisture movement of aggregate concrete and manufactured stone masonry units

Méthode d'essai pour des éléments de maçonnerie - Partie: 14 détermination de la variation due à l'humidité des éléments de maçonnerie en béton de granulats et en pierre reconstituée

Prüfverfahren für Mauersteine - Teil 14: Bestimmung der feuchtebedingten Formänderung von Mauersteinen aus Beton und Betonwerksteinen

This European Standard was approved by CEN on 13 October 2001.

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 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 Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: rue de Stassart, 36 B-1050 Brussels

Ref. No. EN 772-14:2001 E

Contents

Foreword

This European Standard 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 May 2002, and conflicting national standards shall be withdrawn at the latest by March 2004.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

This European Standard specifies a method of measuring the moisture movement of aggregate concrete and manufactured stone masonry units between two specified extreme moisture conditions.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text, and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

prEN 771-3, *Specification for masonry units - Part 3: Aggregate concrete masonry units (dense and lightweight aggregates).*

prEN 771-5, *Specification for masonry units - Part 5: Manufactured stone masonry units.*

3 Principle

This test measures, on masonry units of the same concrete compositions and the same sampling:

a) the expansion between the initial condition and after soaking in water for 4 days;

b) the shrinkage between the initial condition and after drying for 21 days in a ventilated oven at 33 °C.

4 Symbols

l_{0i} is the initial distance between gauge location pads, (mm)

l_{1i} is the distance between gauge location pads after soaking, (mm)

l_{2i} is the distance between gauge location pads after drying, (mm)

$\Delta l_g / l$ is the mean moisture expansion coefficient, (mm/m)

$\Delta l_r / l$ is the mean drying shrinkage coefficient, (mm/m)

$\Delta l_c / l$ is the total movement coefficient, (mm/m)

$\Delta l_{gi}/l$ is the individual moisture expansion coefficient, (mm/m)

$\Delta l_{ri}/l$ is the individual drying shrinkage coefficient, (mm/m)

$m_{o,s}$ is the mass of specimen before drying, (g)

$m_{dry,s}$ is the mass of specimen after drying, (g)

w_s is the moisture content, (%) by mass

5 Apparatus

5.1 Gauge location pads.

5.2 Adhesive appropriate for use under the conditions given in 5.4 and 5.5.

5.3 Measuring device suitable for measuring changes in length with an accuracy of at least 0,002 mm.

5.4 Ventilated oven with a volume of at least 9 times the volume of the specimens to be dried at one time, capable of being maintained at a temperature of 33 °C ± 3°C. The oven is ventilated top and bottom for free convection or by a forced system that ensures at least 3 air changes per hour.

5.5 Tank of water, maintained at a temperature of 20 °C ± 2 °C and of sufficient volume to hold all the specimens to be soaked at one time and to ensure free access of the water to all faces.

5.6 Weighing instrument capable of weighing the specimens with an accuracy of 0,1 %.

5.7 Calibration rods of Invar steel.

5.8 Four **support pads** per specimen of 1 cm^2 maximum cross-section and with a minimum height of 10 mm.

6 Preparation of specimens

6.1 Sampling

The test specimens shall consist of whole masonry units or be cut from whole masonry units. In every case the samples shall be sealed in airtight bags immediately after sampling until they are prepared for test. The dates of manufacturing and sampling shall be declared. The age of the specimens at the beginning of the test shall be 28 days unless otherwise is specified.

The method of sampling shall be stated in the test report. 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.

6.2 Conditioning

Unless otherwise is specified, remove the specimens from the airtight bags after 14 days and store them for a further 14 days in the laboratory under the following conditions:

Temperature	≥ 15 °C
Relative humidity	≤ 65 %

In the laboratory store the specimens so that each one is similarly exposed.

At the end of the 14 day laboratory storage weigh every specimen and number them 1 to 6 from the lightest to the heaviest ($m_{o,s}$).

The test shall be deemed to have begun at the end of the 14 day laboratory conditioning period following the 14 days in airtight bags.

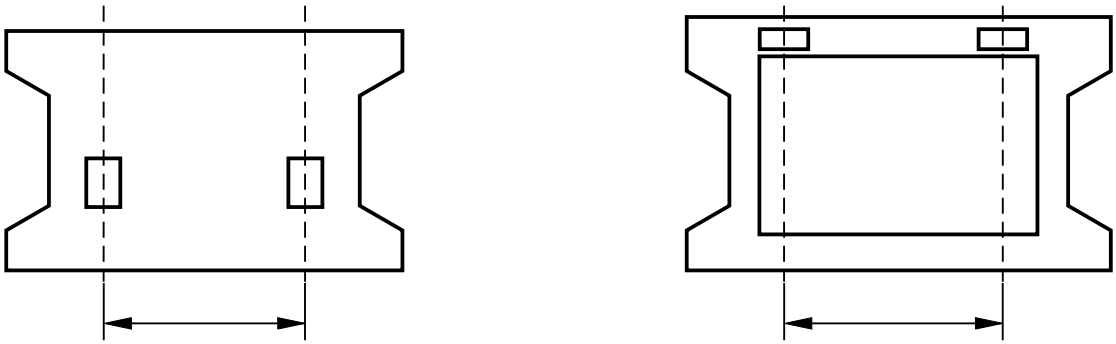
6.3 Preparation for measurements

Fix two gauge location pads (5.1) using appropriate adhesive glue (5.2) to each of the specimens at an appropriate gauge length apart (see Table 1) in an appropriate position (see Figure 1) and mark one of the pads on each specimen with a distinctive sign. A suitable template should be used to space the pads.

Table 1 - Gauge length for specimens

Dimensions in millimetres

Length of specimen	Minimum gauge length
100 to 200	80
201 to 300	180
over 300	280



a) Fix on bed face

b) Fix on the external shell

Figure 1 - Positioning of gauge location pads

a) For specimens which are whole units without voids passing right through, fix the gauge location pads on the bed face.

b) For specimens which are whole masonry units with voids passing right through, fix the gauge location pads on the shell.

c) For specimens which are parts of masonry units fix the gauge location pads on a surface which would be a bed face, see a) above.

7 Procedure

7.1 General

Carry out the test in laboratory maintained at a temperature of 20 °C ± 2 °C and a relative humidity of 50 % to 65 %.

Before taking any measurements calibrate the measuring device using the Invar calibration rods (5.7).

7.2 Initial measurement

Keep the specimen in the laboratory for 6 h before taking the first measurements. Measure the initial distance l_{oi} between the pads on the 6 specimens, taking care to place the mobile end of the gauge on the marked pad.

Record the results in mm at least to the nearest 0,002 mm.

7.3 Measurement of moisture expansion

Place the specimens Nos. 2, 4 and 6 in the water tank (5.5) at 20 °C ± 2 °C with the location pads uppermost. Use the support pads (5.8) to keep the specimens at least 10 mm from the bottom of the tank and ensure at least 50 mm of water over the top of them (see Figure 2).

Dimensions in millimetres

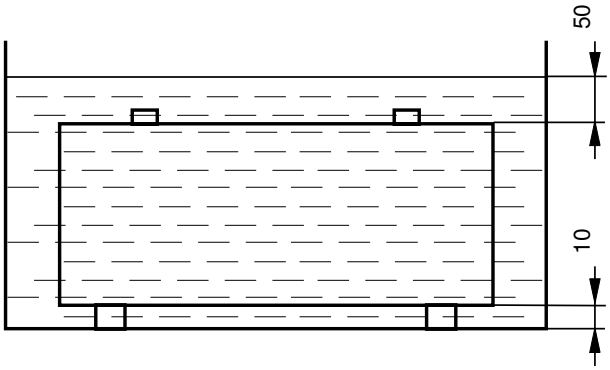


Figure 2 - Positioning of specimens in water tank

After 96 h in water remove the specimens from the water tank, allow them to drain for 10 min and then measure the distance l_{1i} between the pads on the 3 specimens, placing the mobile end of the gauge on the marked pad.

Record the results in mm at least to the nearest 0,002 mm.

7.4 Measurement of drying shrinkage

Place specimens Nos. 1, 3 and 5 in the ventilated oven (5.4) at 33 °C ± 3 °C oriented as they are expected to be used. Ensure that the hot air has free access to all faces.

After 21 days, remove the specimens from the oven and allow to stabilize in the laboratory for 6 h.

Measure the distance l_{2i} between the pads on the three specimens, placing the mobile end of the gauge on the marked pad.

Record the results in mm at least to the nearest 0,002 mm.

Weigh each specimen ($m_{dry,s}$).

8 Expression of results

8.1 Moisture expansion

Calculate the moisture expansion coefficient of each of the specimens using the formula:

$$\frac{\Delta l_{\mathrm{gi}}}{l} = \frac{l_{1\mathrm{i}} - l_{0\mathrm{i}}}{l_{0\mathrm{i}}} \times 1000\ \mathrm{mm/m}$$

8.2 Drying shrinkage

Calculate the drying shrinkage coefficient of each of the specimens using the formula:

$$\frac{\Delta l_{\mathrm{ri}}}{l} = \frac{l_{0\mathrm{i}} - l_{2\mathrm{i}}}{l_{0\mathrm{i}}} \times 1000\ \mathrm{mm/m}$$

Calculate the moisture content (w_s)of the specimens 1, 3 and 5 from the ratio of the loss in mass during drying to the dry mass expressed to the nearest 0,5%.

$$w_{\mathrm{s}} = \frac{m_{\mathrm{o,s}} - m_{\mathrm{dry,s}}}{m_{\mathrm{dry,s}}} \times 100\%$$

9 Evaluation of results

Calculate the arithmetic mean of the moisture expansion coefficients for the three specimens $\frac{\Delta l_{\mathrm{g}}}{l}$ to two decimal places.

Calculate the arithmetic mean of the drying shrinkage coefficients for the three specimens $\frac{\Delta l_{\mathrm{r}}}{l}$ to two decimal places.

Calculate the total movement coefficient of the sample

$$\frac{\Delta l_{\mathrm{c}}}{l} = \frac{\Delta l_{\mathrm{r}}}{l} + \frac{\Delta l_{\mathrm{g}}}{l}$$

and record it to 0,01 mm/m

Calculate the mean value of the moisture content of the specimens 1, 3 and 5 (w_s) to the nearest 1% and report as the moisture content of the sample.

10 Test report

The test report shall contain the following information:

a) the number, title and date of issue of this European Standard;

b) description of the masonry unit to the relevant standard prEN 771-3 or prEN 771-5;

c) the method of sampling and by which organization;

d) the date of production and the date of sampling of the specimens;

e) the date of preparation of the specimens, the dates of commencement[1)] and completion of the tests for moisture expansion and drying shrinkage;

f) the storage conditions between delivery and test;

g) the weight of each sample at the time of initial measurement, expressed in kg to 0,1 kg;

h) the individual drying shrinkage and moisture expansion coefficients in mm/m to 0,01 mm/m;

i) the mean shrinkage and expansion coefficients expressed in mm/m to 0,01 mm/m;

j) the total movement coefficient of the sample expressed in mm/m to 0,01 mm/m;

k) the individual values of moisture content of the specimens 1, 3 and 5 to the nearest 0,5% and mean value of moisture content to the nearest 1 %;

l) remarks, if any.

[1] The date of commencement of the test is defined in 6.1. The test will have two different end points, one for the specimens which have been subjected to soaking and another for the specimens subjected to drying.

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