BRITISH STANDARD

BS EN
1170-7 : 1998

Precast concrete products — Test method for glass-fibre reinforced cement

Part 7. Measurement of extremes of dimensional variations due to moisture content

The European Standard EN 1170-7 : 1997 has the status of a British Standard

ICS 91.100.30

National foreword

This British Standard is the English language version of EN 1170-7 : 1997. This standard, together with BS EN 1170 Parts 1 to 6, supersedes BS 6432 : 1984 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee B/524, Precast concrete products, 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.

The UK voted against this standard at the CEN Formal Vote stage but the analysis of voting, in accordance with CEN/CENELEC Internal Regulations Part 2 : *Common rules for standards work* resulted in a positive vote. In consequence, the document was accepted as a European Standard.

A list of organizations represented on this committee 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.

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

Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 4, an inside back cover and a back cover.

This British Standard, having been prepared under the direction of the Sector Board for Building and Civil Engineering, was published under the authority of the Standards Board and comes into effect on 15 March 1998

ISBN 0 580 29200 2

Amendments issued since publication

Amd. No.	Date	Text affected

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 1170-7

November 1997

ICS 91.100.30

Descriptors: Concrete products, prefabricated elements, composite materials, cements, glass, verification, conformity tests, measurements, dimensional stability, determination of content, water, weather resistance

English version

Precast concrete products — Test method for glass-fibre reinforced cement — Part 7: Measurement of extremes of dimensional variations due to moisture content

Produits préfabriqués en béton — Méthode d'essai des composites ciment-verre — Partie 7: Mesure des variations dimensionnelles extrêmes en fonction de la teneur en eau

Vorgefertigte Betonerzeugnisse — Prüfverfahren für Glasfaserbeton — Teil 7: Bestimmung der feuchtigkeitsabhängigen Längenänderungen

This European Standard was approved by CEN on 29 October 1997.

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.

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CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

Central Secretariat: rue de Stassart 36, B-1050 Brussels

Foreword

This European Standard has been prepared by Technical Committee CEN/TC 229, Precast concrete products, the secretariat of which is held by AFNOR.

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 1998, and conflicting national standards shall be withdrawn at the latest by May 1998.

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.

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1 Scope

This European Standard specifies a test method for identifying the maximum dimensional variations (residual hydraulic shrinkage and reversible expansion) of a GRC composition attributable to variations in the water content to which products exposed to the elements may be subjected.

2 Symbols and abbreviations

2.1 Symbols

l_0 distance between pads measured at the beginning of the test, in micrometres;

l_1 distance between pads measured after 96 h immersion, in micrometres;

l_2 distance between pads measured after 21 days drying in the oven and 6 h stabilization, in micrometres;

m_0 mass of test piece at the beginning of the test, in grams;

m_1 mass of test piece after 96 h immersion, in grams;

m_2 mass of test piece after 21 days oven drying and 6 h stabilization, in grams;

$\frac{\Delta l_c}{l}$ value of extreme dimensional variation, in millimetres per metre;

$\frac{\Delta l_e}{l}$ value of expansion, in millimetres per metre. This is the arithmetic mean of the expansion values of the three test pieces tested;

$\frac{\Delta l_s}{l}$ value of residual shrinkage, in millimetres per metre. This is the arithmetic mean of the shrinkage values of the three test pieces tested.

2.2 Abbreviation

GRC Glass-fibre reinforced cement.

3 Apparatus

The apparatus comprises:

– *a scale*, with a measuring range 0 kg to 2 kg, accurate to 0,1 g;

– *a ventilated drying oven*, maintained at a temperature of (33 ± 3) °C;

– *a test board*, made of smooth, easily cleaned material, approximately (500×800) mm. With 'premix' production, provide a frame of thickness equal to that of the product manufactured;

– *a rule*, accurate to 0,5 mm;

– *a flat bottomed tank*, approximately $(500 \times 200 \times 100)$ mm filled with water maintained at (20 ± 2) °C;

– *an extensometer*, with a minimum gauge length of 200 mm, accurate to 0,002 mm;

– *stainless steel measuring pads*, with a minimum surface area of 25 mm^2;

– *epoxy resin*, suitable for fixing the gauge pads.

4 Procedure

4.1 Test pieces

On the flat board, make a sample panel with its facing layer under the same conditions as for the actual production it represents: premix or spray.

After 24 h, demould and store the sample panel in the same conditions as for the actual production which it represents until it is 6 days old.

Cut by sawing, (50^{+1}_{0}) mm from the edges of the panel, six test pieces from the positions illustrated in figure 1.

NOTE. The test pieces may also be cut out on the day of demoulding.

Dimensions of the test pieces:

– width: (50 ± 2) mm;

– length: (400 ± 2) mm.

Mark the test pieces as shown in figure 1.

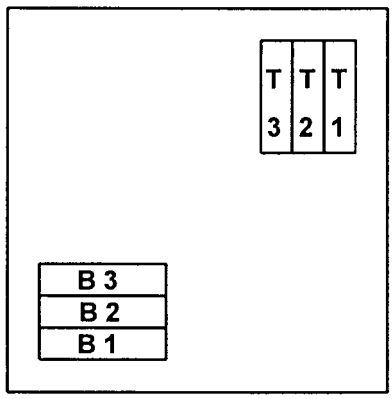

Figure 1. Positions for cutting out test pieces

Store the test pieces in the laboratory at a temperature of (20 ± 3) °C and relative humidity of (60 ± 5) % until the products have reached the test age defined by agreement between the producer and the customer. If no information is provided, the test age adopted is conventionally 10 days after manufacture.

The test pieces shall be placed individually into leaktight bags for transportation from the production site to the test laboratory. The transportation time shall not be taken into account when calculating the age.

4.2 Test method

Bond two location pads, using an epoxy resin suitable for gauge fixing, to the two faces of each test piece.

Mark each face, i.e. 'U' for the top face and 'D' for the bottom face.

Weigh each test piece, i.e. m_0 (in grams).

Measure the distance, expressed in μm, between the pads on each test piece face, i.e.:

– $l_{0,U}$ for the 'U' face;

– $l_{0,D}$ for the 'D' face.

4.2.1 *Measurement of residual shrinkage by drying*

Place the three test pieces T_1, T_3, B_1 in the ventilated oven adjusted to (33 ± 3) °C. Place the test pieces on an edge so that the hot air circulates correctly over the two measuring faces.

After 21 days, remove the test pieces from the oven and place them in the laboratory at a temperature of (20 ± 3) °C.

After stabilizing for 6 h:

– weigh each test piece, i.e. m_2 (in grams);

– measure the distance between pads on each face, expressed in μm, i.e.:

– $l_{2,U}$ for the 'U' face;

– $l_{2,D}$ for the 'D' face.

4.2.2 *Measurement of reversible expansion by immersion*

Place the three test pieces T_2, B_2 and B_3 in the tank filled with water at a temperature of (20 ± 2) °C. Place the test pieces on an edge and ensure that the test pieces are completely immersed.

After 96 h of immersion in the water at (20 ± 2) °C, remove the test pieces, wipe with a damp cloth, and:

– weigh each test piece, i.e. m_1 (in grams);

– measure the distance between the pads on each face, expressed in μm, i.e.:

– $l_{1,U}$ for the 'U' face;

– $l_{1,D}$ for the 'D' face.

5 Expression of results

5.1 Shrinkage value

The residual shrinkage value of each test piece $\frac{\Delta l_s}{l}$, expressed in mm/m, is the arithmetic mean of the value obtained for each face (face 'U' and face 'D'), each calculated from the equation:

$$\frac{\Delta l_s}{l} = \frac{l_0 - l_2}{l_0} \times 10^3$$

The shrinkage value of a GRC composition is characterized by the arithmetic mean of the shrinkage values of the three test pieces.

5.2 Expansion value

The expansion value of each test piece $\frac{\Delta l_e}{l}$, expressed in mm/m, is equal to the arithmetic mean of the two values (face 'U' and face 'D'), each being calculated from the equation:

$$\frac{\Delta l_e}{l} = \frac{l_1 - l_0}{l_0} \times 10^3$$

The expansion value of a GRC composition is characterized by the arithmetic mean of the expansion values of the three test pieces.

5.3 Value of extreme dimensional variations

The value of the extreme dimensional variation as a function of the water content of a GRC composition is given by the equation:

$$\frac{\Delta l_c}{l} = \frac{\Delta l_s}{l} + \frac{\Delta l_e}{l}$$

NOTE. The results $\frac{\Delta l_s}{l}$ and $\frac{\Delta l_e}{l}$ are supplemented by the expression of variations of the mean mass observed, in percentage, i.e:

$\frac{m_0 - m_2}{m_0} \times 100$ for the shrinkage;

$\frac{m_1 - m_0}{m_0} \times 100$ for the extension.

6 Interpreting the test

$\frac{\Delta l_s}{l}$ is the expression of residual hydraulic shrinkage. The result is a function of three parameters: the GRC composition, the hygrometric conditions beforehand and the age of products when tested.

$\frac{\Delta l_e}{l}$ is the expression of reversible expansion. The result is a function of two parameters: the GRC composition and the age of products when tested.

It is evident that the results $\frac{\Delta l_s}{l}$ and $\frac{\Delta l_e}{l}$ cannot be taken separately and that the result $\frac{\Delta l_c}{l}$ is the expression of the maximum conventional value.

7 Test report

The test report shall give the following information:

– the identification of the laboratory (notably measuring accuracy, characteristics of the extensometer, the name of the test supervisor);

– the complete identification of the test pieces (especially the origin, the GRC composition, the curing, storage and transportation conditions, date of manufacture of the panels, marking of test pieces);

– the dates of beginning and end of tests;

– all the individual results;

– the mean values $\frac{\Delta l_s}{l}$, $\frac{\Delta l_e}{l}$ and $\frac{\Delta l_c}{l}$;

– the reference to this standard.

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