SLOVENSKI STANDARD
oSIST prEN 1170:2024

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Montažni betonski izdelki - Preskusne metode za steklocementni kompozit

Precast concrete products - Test methods for Glass fibre Reinforced Concrete

Betonfertigteile - Prüfverfahren für Glasfaserbeton

Produits préfabriqués en béton - Méthodes d'essai des composites ciment-verre

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Will supersede EN 1170-1:1997, EN 1170-2:1997, EN 1170-3:1997, EN 1170-4:1997, EN 1170-5:1997, EN 1170-6:1997, EN 1170-7:1997, EN 1170-8:2008

English Version

Precast concrete products - Test methods for Glass fibre Reinforced Concrete

Produits préfabriqués en béton - Méthodes d'essai des composites ciment-verre

Betonfertigteile - Prüfverfahren für Glassfaserbeton

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 229.

If this draft becomes a European Standard, 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.

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Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

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

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European foreword

This document prEN 1170:2023 has been prepared by Technical Committee CEN/TC 229 “Precast Concrete Products”, the secretariat of which is held by AFNOR.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 1170-1:1997, EN 1170-2:1997, EN 1170-3:1997, EN 1170-4:1997, EN 1170-5:1997, EN 1170-6:1997, EN 1170-7:1997 and EN 1170-8:2008.

EN 1170:2023 includes the following significant technical changes with respect to EN 1170-1:1997, EN 1170-2:1997, EN 1170-3:1997, EN 1170-4:1997, EN 1170-5:1997, EN 1170-6:1997, EN 1170-7:1997 and EN 1170-8:2008:

— Removal of the tests previously described in parts 1 to 4, not referred to in EN 1169,

— Modification of the dimensions of the mould for test boards,

— Increase of the load speed for the flexural strength test,

— Introduction of a sample volume determination by weighing in water,

— Provisions to allow the cutting of test coupons directly from products.

1 Scope

This document specifies test methods for identifying the performance of a GRC composition in terms of bending strength, water absorption, dry density, and dimensional variations.

These methods can be used for type testing or for the evaluation of the uniformity of the production process. They can be used on GRC coupons prepared as described in this document, or on samples cut out of GRC products.

A cyclic weathering type test is also described for information in Annex C.

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 ISO 7500-1, *Metallic materials - verification of static uniaxial testing machines - Part 1: Tensile testing machines*

3 Symbols and abbreviated terms

For the purposes of this document, the following symbols and abbreviated terms apply.

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

— ISO Online browsing platform: available at https://www.iso.org/obp/

— IEC Electropedia: available at https://www.electropedia.org/

3.1 Symbols

B	width of test piece, in millimetres
d	thickness of test piece, in millimetres
F_{LOP}	load at limit of proportionality, in newtons
F_{MOR}	failure load, in Newtons
l	length of test piece, in millimetres
L	span, in millimetres
l_n	distance between washers measured at the beginning of the test, in micrometres
l_1	distance between washers measured after 96 h immersion, in micrometres
l_2	distance between washers measured after 21 days drying in oven and 6 h stabilization, in micrometres
m_a	mass of a test piece in air, in grammes
m_d	mass of a test piece after drying, "dry mass", in grammes
m_{st}	apparent mass of the immersed stirrup, in grammes
m_w	apparent mass of the immersed test piece, in grammes

m_{wj}	mass of a test piece after immersion for "j" days, "wet mass", in grammes
m_0	mass of test piece at the beginning of the test, in grammes
m_1	mass of test piece after 96 h immersion, in grammes
m_2	mass of test piece after 21 days oven drying and 6 h stabilisation, in grammes
V	volume of a test piece, in cm3
Υ	water absorption by immersion, in percentage by mass
Δ_{LOP}	deflection at limit of proportionality, in millimetres
Δ_{MOR}	deflection at failure, in millimetres
$\frac{\Delta l_c}{l}$	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
ε_{LOP}	strain at limit of proportionality
ε_{MOR}	strain at failure
ρ_d	dry density, in kg/m3
ρ_w	density of water, at 20 °C, taken as 998 kg/m3
σ_{LOP}	stress at limit of proportionality, in megapascals
σ_{MOR}	stress at failure, in megapascals

3.2 Abbreviated terms

GRC	Glass fibre reinforced concrete
LOP	Limit of proportionality
MOR	Modulus of rupture

4 Sampling and preparation of test pieces

4.1 Apparatus

Flat test board moulds with internal dimensions of not less than 500 mm × 500 mm with a (12 ± 0,5) mm) upstand around the edges from which a minimum of 4 test coupons, each 275 mm minimum × (50 ± 2) mm can be cut; the test coupons shall be taken from the central area within a border approximately 50 mm from each edge.

4.2 Test coupons

Make sample boards using the moulds described in clause 4 for each spray team, if Sprayed GRC, or mixer, if Premix GRC, per day or production shift, with no facing layer (solid GRC only) under the same conditions as for the actual production they represent.

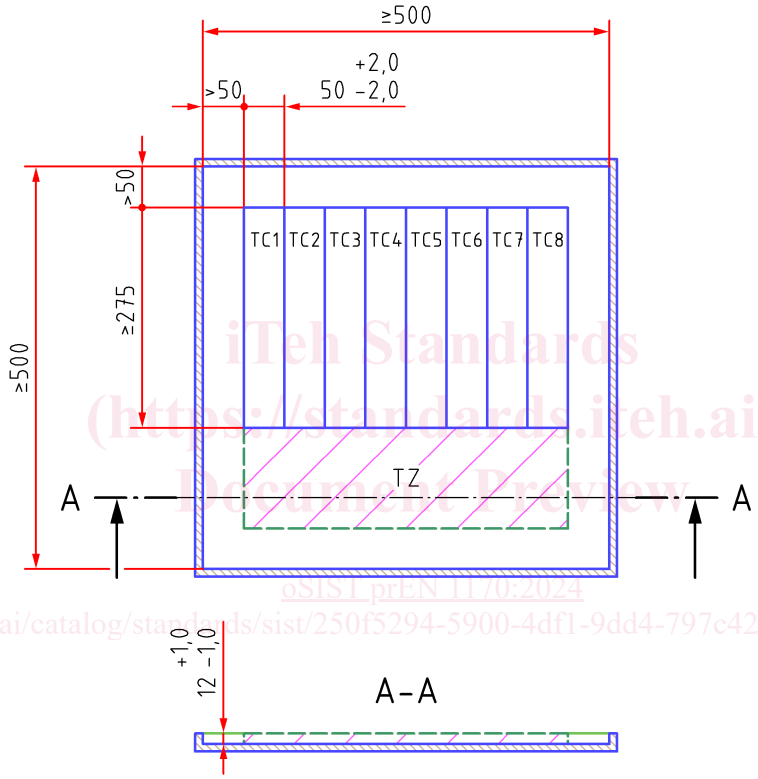
Where the direction of production can have an influence on the results, Annex A may apply.

Demould and store the sample boards under the same conditions as for the actual production they represent.

Cut out by sawing in each panel, at a minimum distance of 50 mm from the edges, 4 test coupons from the positions illustrated in Figure 1.

Mark the test coupons as shown in Figure 1.

Dimensions in mm



Key

TC1 to TC4	test coupons for bending strength
TC5 to TC8	test coupons for water absorption and dry density
TZ	test zone

Figure 1 — Position and identification of test coupons

Dimensions of the test coupons:

— width: (50 ± 2) mm,

— length: minimum 275 mm.

The test board method is the reference method, but in some cases, it may be considered necessary to cut coupons directly from products. In this case, Annex B applies.

Storage of the test boards/coupons:

The test coupons shall be stored/cured under the same conditions as the products which they represent.

5 Bending strength

5.1 General

This clause specifies a test method for identifying the stress and deformation performance, at the limit of proportionality and on failure, of a GRC composition subjected to bending.

It is used for the evaluation of the uniformity of the production process. It can also be used to establish, for a given composition of GRC, the relationship between the conventional strength at 28 days and the strength at 7 days, or at other ages.

This method can be used on GRC coupons prepared as described in this document, or on samples cut out of GRC products.

5.2 Apparatus

The apparatus comprises:

— a bending test machine of accuracy meeting the class 1 requirements specified in EN ISO 7500-1. It shall be fitted with a four-point bending device (minimum diameter of supports: 6 mm) which must contain sufficient articulation to enable the load to be applied evenly across the test specimen at each position of contact. The machine shall incorporate a displacement sensor (accurate to 0,01 mm) to track the movement of the crosshead which applies the load. The test machine shall incorporate or be connected to a computer with software suitable for plotting the load/displacement curve and detecting the loads and displacements at the limit of proportionality (LOP) modulus of rupture (MOR). The LOP and MOR stress and strain values may be calculated manually or by using the test machine's software if included,

— a flat-bottomed tank filled with water maintained at (20 ± 5) °C; the size of the tank shall be sufficient to hold the test coupons from 1 day production; multiple tanks may be used,

— a rule graduated to 0,5 mm,

— a calliper graduated to 0,1 mm.

5.3 Procedure

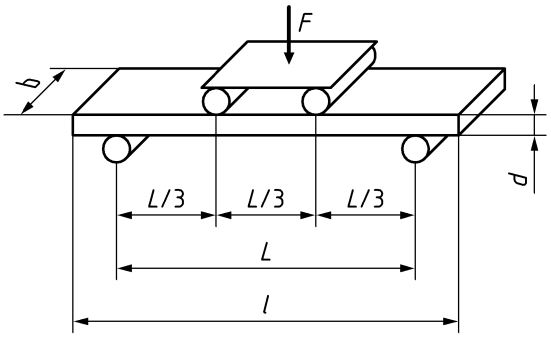
Test coupons may be "wet" or "dry" conditioned prior to testing provided that the conditioning process is noted on the test report.

If the test coupons are to be wet conditioned (see note below) immerse them in water at (20 ± 5) °C for 24 h. Dry the surfaces with a towel prior to testing.

If the test coupons are not wet conditioned, they shall be stored in the same environment as the test machine for a minimum of 24 hours before testing.

NOTE It is normal to test GRC containing thermosetting pure acrylic ester co-polymer dispersions dry (i.e., without wet conditioning for 24 hours prior to testing).

Position the test coupons in the testing machine, as shown in Figure 2.



Key

F load
L span
b width
d thickness
l length

Figure 2 — Position of test coupons in the testing machine

For each test panel, the test coupons marked "1" and "3" are tested with the "mould" face down on the two bottom supports and those marked "2" and "4" with the "mould" face in contact with the top supports.

To start the test, set the test speed to (5 ± 0,5) mm/min.

Continue the test until the test coupon fails and the load reduces to approximately 90 % of the maximum load.

NOTE Most test machines can be programmed to stop at a pre-set limit. If not, operator intervention is required.

Using a vernier calliper, measure the thickness of the test coupon at four points, two from each side of the line of failure (see Figure 3), and the width of the test piece coupon as close as possible to failure zone to the nearest 0,1 mm.

Record the results and calculate the average thickness at the line of failure.