SLOVENSKI STANDARD
SIST EN 12390-5:2001

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Preskušanje strjenega betona - 5. del: Upogibna trdnost preskušancev

Testing hardened concrete - Part 5: Flexural strength of test specimens

Prüfung von Festbeton - Teil 5: Biegezugfestigkeit von Probekörpern

Essai pour béton durci - Partie 5: Résistance a la flexion sur éprouvettes

Ta slovenski standard je istoveten z: **EN 12390-5:2000**

ICS:

91.100.30	Beton in betonski izdelki	Concrete and concrete products

SIST EN 12390-5:2001 **en**

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English version

Testing hardened concrete - Part 5: Flexural strength of test specimens

Essai pour béton durci - Partie 5: Résistance à la flexion sur éprouvettes

Prüfung von Festbeton - Teil 5: Biegezugfestigkeit von Probekörpern

This European Standard was approved by CEN on 18 February 2000.

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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.

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

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Contents

Foreword

This European Standard has been prepared by Technical Committee CEN/TC 104 "Concrete (performance, production, placing and compliance criteria)", the secretariat of which is held by DIN.

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of an identical text or by endorsement, at the latest by April 2001, and conflicting national standards shall be withdrawn at the latest by December 2003.

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.

This standard is one of a series concerned with testing concrete.

It is based on the International Standard ISO 4013 - Concrete - Determination of flexural strength of test specimens.

It is recognized good practice to include measurement of density prior to the determination of flexural strength, as a check on compaction of the concrete.

The two-point method of loading has been taken as the reference method, but the use of centre-point loading has been included as a normative annex. An inter-comparison of the two-point and the centre-point methods has been made as part of a test programme, part-funded by the EC under the Measurement and Testing Programme, contract MAT I-CT-94-CO43. The centre-point method gave results which were consistently 13 % higher than those from the two-point method.

A draft for this standard was published in 1996 for CEN enquiry as prEN 12359. It was one of a series of individually numbered test methods for fresh or hardened concrete. For convenience it has now been decided to combine these separate draft standards into three new standards with separate parts for each method, as follows:

- Testing fresh concrete (EN 12350)
- Testing hardened concrete (EN 12390)
- Testing concrete in structures (EN 12504)

The series prEN 12390 includes the following parts where the brackets give the numbers under which particular test methods were published for CEN enquiry:

EN 12390
Testing hardened concrete

Part 1:	Shape, dimensions and other requirements of specimens and moulds (former prEN 12356 : 1996)
Part 2:	Making and curing specimens for strength tests (former prEN 12379 : 1996)
Part 3:	Compressive strength of test specimens (former prEN 12394 : 1996)
Part 4:	Compressive strangth - Specification for testing machines (former prEN 12390 : 1996)
Part 5:	Flexural strength of test specimens (former prEN 12359 : 1996)
Part 6:	Tensile splitting strength of test specimens (former prEN 12362 : 1996)
Part 7:	Density of hardened concrete (former prEN 12363 : 1996)
Part 8:	Depth of penetration of water under pressure (former prEN 12364 : 1996)

1 Scope

This standard specifies a method for the determination of the flexural strength of specimens of hardened concrete.

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).

EN 12350-1, *Testing fresh concrete – Part 1: Sampling.*

EN 12390-1: 2000, *Testing hardened concrete – Part 1: Shape, dimensions and other requirements of specimens and moulds.*

EN 12390-2, *Testing hardened concrete – Part 2: Making and curing specimens for strength tests.*

EN 12390-4, *Testing hardened concrete – Part 4: Compressive strength - Specification for testing machines.*

3 Principle

Prismatic specimens are subject to a bending moment by the application of load through upper and lower rollers. The maximum load sustained is recorded and the flexural strength is calculated.

4 Apparatus

4.1 Testing machine

The test shall be carried out using a testing machine conforming to prEN 12390-4.

4.2 Force application

The device for applying loads (see figure 1) shall consist of:

- two supporting rollers;
- two upper rollers carried by an articulated cross member, which divides the load applied by the machine equally between the two rollers.

All rollers shall be manufactured from steel and shall have a circular cross-section with a diameter of 20 mm to 40 mm. They shall be at least 10 mm longer than the width of the test specimen.

Three rollers, including the two upper ones, shall be capable of rotating freely around their axis and of being inclined in a plane normal to the longitudinal axis of the test specimen.

The distance, *l*, between the outer rollers (i.e. the span) shall be equal to 3d, where d is the width of the specimen. The distance between the inner rollers shall be equal to d. The inner rollers shall be equally spaced between the outer rollers as shown in figure 1. All rollers shall be adjusted to the positions illustrated in figure 1 to an accuracy of ± 2,0 mm.

5 Test specimens

5.1 General

The test specimens shall be prisms conforming to EN 12390-1. Specimens cast in moulds shall conform to EN 12350-1 and EN 12390-2. The direction of casting shall be identified on the specimen.

Sawn specimens which meet the requirements of EN 12390-1 may also be tested.

The specimens shall be examined and any abnormalities observed shall be reported.

5.2 Adjustment of test specimens

Where the dimensions or shapes of test specimens do not conform to 4.3 of EN 12390-1 because they exceed the respective tolerances, they shall be rejected or adjusted as follows:

– uneven surfaces shall be levelled by grinding;
– the deviation of angles shall be corrected by cutting and/or grinding.

6 Procedures

6.1 Preparation and positioning of specimens

For specimens stored in water, wipe excess moisture from the surface of the specimen before placing in the testing machine.

Wipe clean all testing machine bearing surfaces and remove any loose grit or other extraneous material from the surfaces of the specimen that will be in contact with the rollers.

Place the test specimen in the machine, correctly centred and with the longitudinal axis of the specimen at right angles to the longitudinal axis of the upper and lower rollers.

Ensure that the reference direction of loading is perpendicular to the direction of casting of the specimen.

NOTE The test result may be affected by the direction of loading with respect to the direction of casting.

6.2 Loading

Do not apply the load until all loading and supporting rollers are resting evenly against the test specimen.

Select a constant rate of stress within the range 0,04 MPa/s (N/mm².s) to 0,06 MPa/s (N/mm².s). Apply the load without shock and increase continuously, at the selected constant rate ± 1 %, until no greater load can be sustained.

NOTE The required loading rate on the testing machine is given by the formula:

$$R = \frac{s \cdot d_1 \cdot d_2^2}{l}$$

where:

R is the required loading rate, in newtons per second;

s is the stress rate, in megapascals per second (newtons per square millimetre per second);

d_1 and d_2 are the lateral dimensions of the specimen, in millimetres;

l is the spacing of the lower rollers, in millimetres.

When using manually controlled testing machines, correct, by appropriate adjustment of the controls, any tendency for the selected rate of loading to decrease, as specimen failure is approached.

Record the maximum load indicated.

Report a fracture outside the loading rollers. (see figure 1).

7 Expression of rules

The flexural strength is given by the equation:

$$f_{cf} = \frac{F \cdot l}{d_1 \cdot d_2^2}$$

where

f_{cf} is the flexural strength, in megapascals (newtons per square millimetre);

F is the maximum load, in newtons;

l is the distance between the supporting rollers, in millimetres;

d_1 and d_2 are the lateral dimensions of the specimen, in millimetres (see Figure 1).

Express the flexural strength to the nearest 0,1 MPa (N/mm²)

8 Test report

The report shall include:

a) identification of the test specimen;

b) designated or measured dimensions of the specimen;

c) details of adjustment by grinding (if appropriate);

d) type of apparatus: two point/centre point;

e) surface moisture condition of specimen at time of test (saturated/moist);

f) date of test;

g) maximum load at fracture, in kilonewtons;

h) flexural strength of specimen to nearest 0,1 MPa (N/mm²);

i) location of fracture (if outside upper rollers);

j) appearance of the concrete (if unusual);

k) any deviation from the standard test method;

l) a declaration from the person technically responsible for the test that the testing was carried out in accordance with this standard, except as detailed in item k).

The report may include:

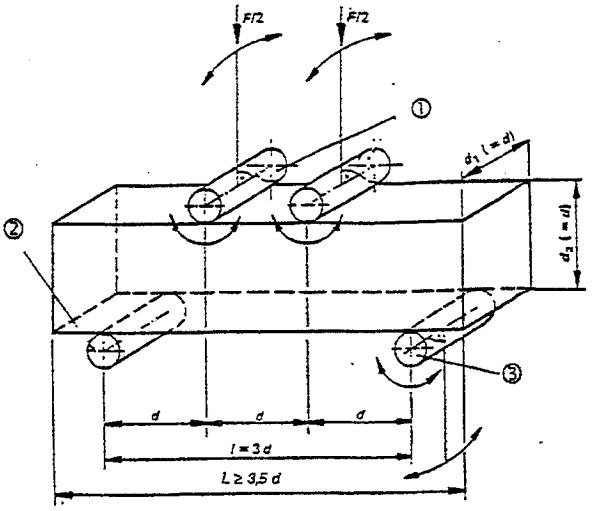
m) condition of specimen at receipt for storage;

n) age of specimen at time of test (if known);

o) appearance of the concrete (if unusual).

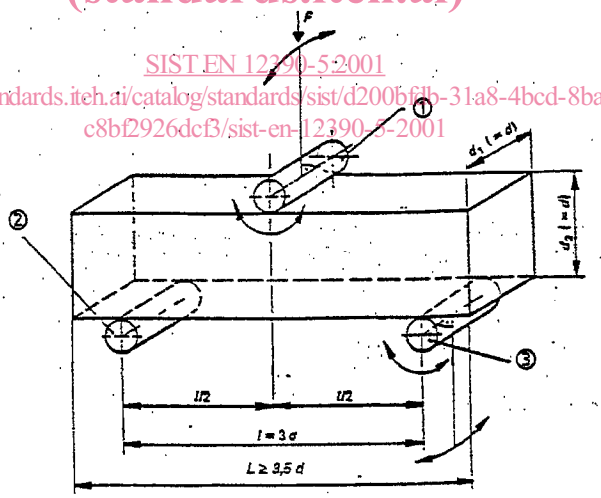
9 Precision

There is currently no precision data for this test, or the alternative test set out in annex A.



Key
1 Loading roller (capable of rotation and of being inclined)
2 Supporting roller
3 Supporting roller (capable of rotation and of being inclined)

Figure 1 – Arrangement of loading of test specimen (two-point loading)



Key
1 Loading roller (capable of rotation and of being inclined)
2 Supporting roller
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Figure 2 – Arrangement of loading of test specimen (centre-point loading)