SLOVENSKI STANDARD
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Preskušanje strjenega betona - 4. del: Tlačna trdnost - Specifikacija za stiskalnice

Testing hardened concrete - Part 4: Compressive strength - Specification for testing machines

Prüfung von Festbeton - Teil 4: Bestimmung der Druckfestigkeit - Anforderungen an Prüfmaschinen

Essais pour béton durci - Partie 4 : Résistance à la compression - Caractéristiques des machines d'essai

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Testing hardened concrete - Part 4: Compressive strength - Specification for testing machines

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Prüfung von Festbeton - Teil 4: Bestimmung der Druckfestigkeit - Anforderungen an Prüfmaschinen

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 104.

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

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European foreword

This document (prEN 12390-4:2018) has been prepared by Technical Committee CEN/TC 104 "Concrete and related products", the secretariat of which is held by DIN.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 12390-4:2000.

In comparison with EN 12390-4:2000, the following modifications have been made:

a) the text is aligned with EN ISO 7500-1 to avoid duplication;

b) machines to be Class 1 except those manufactured before 2000 where Class 2 is acceptable;

c) increase in verification points and new limits of acceptance over working range;

d) description of verification procedure for strain gauge column;

e) deletion of Annex B.

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

The series EN 12390, *Testing hardened concrete*, is composed of the following parts:

— *Part 1: Shape, dimensions and other requirements for specimens and moulds;*

— *Part 2: Making and curing specimens for strength tests;*

— *Part 3: Compressive strength of test specimens;*

— *Part 4: Compressive strength – Specification for testing machines;*

— *Part 5: Flexural strength of test specimens;*

— *Part 6: Tensile splitting strength of test specimens;*

— *Part 7: Density of hardened concrete;*

— *Part 8: Depth of penetration of water under pressure;*

— *Part 10: Determination of the carbonation resistance of concrete at atmospheric levels of carbon dioxide;*

— *Part 11: Determination of the chloride resistance of concrete, unidirectional diffusion;*

— *Part 13: Determination of secant modulus of elasticity in compression;*

— *Part 14: Semi-adiabatic method for the determination of heat released by concrete during its hardening process (in preparation);*

— *Part 15: Adiabatic method for the determination of heat released by concrete during its hardening process (in preparation);*

— *Part 16: Determination of shrinkage of concrete (in preparation);*

— *Part 17: Determination of creep of concrete in compression (in preparation).*

Introduction

The requirements for testing machines set out in this standard have been formulated to satisfy the needs of those compressive tests on concrete specimens which are specified in EN 206. Machines conforming to this standard can be suitable for other uses, but this needs to be carefully considered on an individual test basis. Particular care needs to be taken before using machines conforming to this standard for compressive tests on small specimens, e.g. those with lateral dimensions significantly less than 100 mm. The main concern is that the ball-seating fitted to the upper platen can be too large to align satisfactorily on the top of such small specimens and special adaptations can be required. Another concern is the ability to accurately determine the failure load of small or low strength specimens.

1 Scope

This document specifies the requirements for the performance of compression testing machines for the measurement of the compressive strength of concrete.

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 12390-1, *Testing hardened concrete - Part 1: Shape, dimensions and other requirements for specimens and moulds*

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

EN ISO 7500-1, *Metallic materials - Calibration and verification of static uniaxial testing machines - Part 1: Tension/compression testing machines - Calibration and verification of the force-measuring system (ISO 7500-1)*

EN ISO 4287, *Geometrical product specifications (GPS) - Surface texture: Profile method - Terms, definitions and surface texture parameters (ISO 4287)*

3 Terms and definitions

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

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

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1
auxiliary platen
separate platen usually of a size equal to the designated size of the specimen being tested

3.2
contact area
part of the platen that comes into contact with the specimen

3.3
indicated force
force indicated on the machine scale(s) or display

3.4
indication range
total force range, from zero to maximum, displayed on the machine

3.5
machine platens
lower platen and upper platen both centred on the central vertical axis of the machine

Note 1 to entry: The upper platen is spherically seated.

3.6
measuring range
part of an indication range over which the machine conforms with the accuracy values specified in EN ISO 7500-1

3.7
spacing block
metal block to adjust the space available to test specimens

3.8
true force
force indicated on a calibrated force proving device

4 Construction of machines

4.1 Machine platens, auxiliary platens and spacing blocks

NOTE The use of auxiliary platens is optional.

4.1.1 Machine and auxiliary platens shall be made of a material which shall not deform irreversibly when the machine is used.

4.1.2 Machine and auxiliary platens shall have a hardness value of at least 570HV30 (or 53HRC) when tested in accordance with EN ISO 6507-1.

4.1.3 The flatness tolerance for machine platens and auxiliary platens shall be 0,03 mm for the area in contact with the specimen.

NOTE For the purpose of this European Standard, flatness can be assessed by the measurement of straightness in four positions (see EN 12390-1:2012, Annex B).

4.1.4 The roughness value (R_a) for the surface texture of machine and auxiliary platens shall be in the range 0,4 µm to 3,2 µm, when assessed in accordance with EN ISO 4287 for the area in contact with the specimens.

4.1.5 The area of machine platens in contact with the specimen shall be at least as great as the area of the specimen being tested.

4.1.6 For auxiliary platens, the distance between either pair of opposite edges of a square platen, or the diameter of a circular platen, shall be not less than the designated size of the specimen.

4.1.7 The two contact faces of an auxiliary platen shall be parallel to a tolerance of 0,05 mm.

4.1.8 Auxiliary platens shall be at least 23 mm thick.

4.1.9 Spacing blocks may be used if there is a requirement to reduce the distance between the machine platens.

For stability reasons, it is recommended to limit the number of piled spacing blocks; the total number should not exceed four.

4.1.10 A spacing block may be either circular or square in section and shall be rigidly supported from below.

A minimum diameter or length of side of 200 mm is recommended for spacing blocks.

4.1.11 Spacing blocks shall comply with the flatness and parallelism tolerances required for auxiliary platens (see 4.1.3 and 4.1.7).

4.1.12 Spacing blocks shall be positioned below the lower machine platen and not in contact with the specimen.

4.1.13 Spacing blocks shall be positively located, centrally on the vertical machine axis.

4.2 Force measurement

4.2.1 Force indicator

The machine shall be provided with:

— dials or digital displays which allow the force to be read to the accuracy specified in 4.2.2;

— a system which allows the maximum force sustained to be read after completion of the test, until reset;

— displays readable from the operating position.

The machine force indication system shall not be affected by explosive failure of the specimen.

The lowest verifiable value of each measuring range shall be less than or equal to 20 % of the maximum value of the range. If the machine is equipped with several indication ranges, the above requirement shall apply to each range.

4.2.2 Force indicator accuracy

For machines built after the publication of the first edition of this standard (year 2000), the required accuracy of the force indication shall be class 1 according to EN ISO 7500-1 (max. relative error of indication = ± 1 %). National provisions may be available for machines built before this date.

Machines built before the publication of the first edition of this standard (year 2000) shall at least conform to the requirements of EN ISO 7500-1 Class 2 (max. relative error of indication = ± 2 %).

The accuracy of force indication shall be maintained under any or all of the following circumstances:

— mains voltage fluctuations of −14 % to +10 %;

— at a temperature of 10 °C to 35 °C;

— at a relative humidity of up to 80 %.

NOTE Where electrical or other interference exists, this can affect the accuracy of force indication and special provisions to overcome this interference can be necessary.

4.3 Force control

4.3.1 The compression testing machine shall be provided with a control system. The control system shall enable the machine to be verified and to allow force to be applied smoothly and without shock. It shall also allow the force to be applied at prescribed constant rates.

4.3.2 The control system may be operated either by manual or automatic means.

4.3.3 A load rate indicator and/or a pacer shall be fitted on the machine. The pacer shall indicate a rate within at least ±5 % of the specified rate.

It is recommended that the machine is provided with digital or analogical recorder of the load rate.

4.4 Force transfer

4.4.1 The upper platen shall incorporate a ball-seating. The upper platen and the ball-seating may be constructed separately or in one piece.

4.4.2 At the design stage, the manufacturer shall ensure that the centre of rotation of the ball-seating shall coincide with the centre of the contact area of the machine platen and permit a rotation of at least three degrees.

4.4.3 At the start of a test, the upper platen shall align itself with the surface of the specimen when the initial contact is made, before locking into position for the remainder of the test.

4.4.4 The machine shall be designed to enable the use of a force transfer verification device (strain-gauged column) as set out in Annex A or equivalent.

4.4.5 When verified in accordance with Annex A, the machine shall conform to Table 1.

The table indicates different load levels, for which each load level requires three verifications and the limits of acceptance are indicated.

The three verifications are:

— alignment of component parts of the machine;

— self-alignment of the upper machine plate;

— restraint of movement of the upper plate.

Table 1 — Limits for Proving procedure for compression testing machines (see Annex A)

<table>
<tr><th rowspan="3">Load levels

kN</th><th colspan="3">Requirements to the test machine</th></tr>
<tr><th colspan="3">Limits for</th></tr>
<tr><th>Alignment of machine components
Maximum permissible mean strain ratio
$\bar{R}_n$</th><th>Self-alignment of upper machine platen
Maximum permissible difference in the strain ratio
ΔR_n</th><th>Restraint on movement of upper platen
Maximum permissible strain ratio per mm of displacement
W_{ac} or W_{bd}</th></tr>
<tr><td>200</td><td>± 0,15</td><td>0,15</td><td>0,06</td></tr>
<tr><td>400
(optional)</td><td rowspan="4">± 0,10</td><td rowspan="4">0,10</td><td rowspan="2">0,05</td></tr>
<tr><td>800</td></tr>
<tr><td>1600
(optional)</td><td rowspan="2">0,04</td></tr>
<tr><td>2000</td></tr>
</table>

The highest force shall be the maximum capacity of the machine or 2 000 kN whichever is lesser.