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Testing hardened concrete - Part 2: Making and curing specimens for strength tests

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EUROPEAN STANDARD

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EN 12390-2

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English version

Testing hardened concrete - Part 2: Making and curing specimens for strength tests

Essai pour béton durci - Partie 2: Confection et conservation des éprouvettes pour essais de résistance

Prüfung von Festbeton - Teil 2: Herstellung und Lagerung von Probekörpern für Festigkeitsprüfungen

This European Standard was approved by CEN on 3 February 2000.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
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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of an identical text or by endorsement, at the latest by April 2001, and conflicting national standards shall be withdrawn at the latest by December 2003.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 of test methods for testing concrete.

It is based on the draft International Standard ISO 2736/2 - Concrete tests - Test specimens - Part 2: Making and curing of test specimens for strength tests. The results of a recent laboratory inter-comparison, part-funded by the EC under the Measurement and Testing Programme contract MATI-CT-94-0043, have been taken into account.

The compaction of specimens in the moulds using hand tamping, vibrating table, or internal (poker) vibrator are accepted as equivalent. However, the use of an internal vibrator to compact specimens containing entrained air should be done only with caution.

Curing specimens in a closely regulated humidity chamber is recognised as being equivalent to curing in water.

A draft for this standard was published in 1996 for CEN enquiry as prEN 12379. 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 EN 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 strength - 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)

Caution.
When cement is mixed with water, alkali is released. Take precautions to avoid dry cement entering the eyes, mouth and nose whilst mixing concrete. Prevent skin contact with wet cement or concrete by wearing suitable protective clothing. If cement or concrete enters the eye, immediately wash it out thoroughly with clean water and seek medical treatment without delay. Wash wet concrete off the skin immediately.

1 Scope

This standard specifies methods for making and curing test specimens for strength tests. It covers the preparation and filling of moulds, compaction of the concrete, levelling the surface, curing of test specimens and transporting test specimens.

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, *Testing hardened concrete – Part 2: Shape, dimensions and other requirements for test specimens and moulds.*

3 Apparatus

3.1 Moulds, conforming to EN 12390-1.

3.2 Filling frame (optional)

NOTE Filling of the moulds may be simplified by using a filling frame fitted tightly to the mould.

3.3 Means of compacting the concrete (one of the following):

a) Internal (poker) vibrator with a minimum frequency of 120 Hz (7200 cycles per minute), the diameter of the internal vibrator not exceeding one-quarter of the smallest dimension of the test specimen;

b) Vibrating table with a minimum frequency of 40 Hz (2400 cycles per minute);

c) Compacting rod of circular cross-section, made of steel, having a diameter of approximately 16 mm, of length approximately 600 mm and with rounded ends;

d) Compacting bar, straight, made of steel having a square cross-section of approximately 25 mm x 25 mm and length approximately 380 mm.

3.4 Scoop, with width approximately 100 mm.

3.5 Two steel trowels or floats.

3.6 Remixing container, flat tray of rigid construction and made from a non-absorbent material not readily attacked by cement paste. It shall be of appropriate dimensions such that the concrete can be thoroughly re-mixed, using the square-mouthed shovel.

3.7 Shovel, with square mouth.

NOTE The square mouth to ensures proper mixing of material on the remixing container.

3.8 Non-reactive mould release material.

3.9 Mallet

4 Sampling

The sample shall conform with EN 12350-1.

The sample shall be re-mixed, using the remixing container and square mouth shovel, before filling the moulds.

5 Procedures

5.1 Preparation and filling of the moulds

5.1.1 If a filling frame is used, the amount of concrete used to fill the mould shall be such that a layer of concrete remains in the filling frame after compaction. The thickness of this layer shall be 10 % to 20 % of the height of the test specimen.

5.1.2 Specimens shall be compacted in a minimum of two layers, but no layer should be more than 100 mm in thickness.

NOTE Before filling, the inner surface of the mould should be covered with a thin film of non-reactive release material to prevent the concrete from adhering to the mould.

5.2 Compaction of the concrete

5.2.1 General

The concrete shall be compacted immediately after placing in the moulds in such a way as to produce full compaction of the concrete with neither excessive segregation nor laitance. Each layer shall be compacted by using one of the methods described 5.2.2 and 5.2.3:

NOTE 1 Full compaction is achieved using mechanical vibration, when there no further appearance of large air bubbles on the surface of the concrete and the surface becomes relatively smooth with a glazed appearance, without excessive segregation.

NOTE 2 The number of strokes per layer required to produce full compaction by hand, will depend upon the consistence of the concrete.

5.2.2 Mechanical vibration

5.2.2.1 Compacting with internal vibrator

Apply the vibration for the minimum duration necessary to achieve full compaction of the concrete. Avoid over-vibration, which may cause loss of entrained air.

NOTE 1 Care should be taken not to damage the mould. The vibrator should be vertical and not allowed to touch the bottom or sides of the mould. The use of a filling frame is recommended.

NOTE 2 Laboratory tests have shown that great care is needed if loss of entrained air is to be avoided when using an internal vibrator.

5.2.2.2 Compacting with vibrating table

Apply the vibration for the minimum duration necessary to achieve full compaction of the concrete. The mould should preferably be attached to, or firmly held against the table. Avoid over-vibration, which may cause loss of entrained air.

5.2.3 Hand compaction

Compacting with compacting rod or bar. Distribute the strokes of the compacting rod, or bar, in a uniform manner over the cross section of the mould. Ensure that the compacting rod, or bar, does not forcibly strike the bottom of the mould when compacting the first layer, nor penetrate significantly any previous layer. Subject the concrete to at least 25 strokes per layer. In order to remove pockets of entrapped air but not the entrained air, after compaction of each layer, tap the sides of the mould smartly with the mallet until large bubbles of air cease to appear on the surface and depressions left by the compacting rod or bar, are removed.

5.3 Surface levelling

5.3.1 If a filling frame is used, remove it immediately after compaction is completed.

5.3.2 Remove the excess concrete above the upper edge of the mould using two steel trowels or floats, brought together with a sawing action and carefully level the surface.

5.4 Marking

5.4.1 The test specimens shall be marked clearly and indelibly, without damaging the specimen.

5.4.2 Records shall be kept to ensure the traceability of the specimen from sampling to testing.

5.5 Curing of test specimens

5.5.1 Leave the test specimens in the mould for at least 16 hours, but not longer than 3 days, protected against shock, vibration and dehydration at a temperature of 20 °C ± 5 °C (or 25 °C ± 5 °C in hot climates).

5.5.2 After removal from the mould, cure the test specimens till immediately before testing, in water at a temperature of 20 °C ± 2 °C, or in a chamber at 20 °C ± 2 °C and a relative humidity ≥ 95 %.

5.5.3 Forms of curing differing from those in 5.5.2 may be factorized to the methods described in 5.5.2.

NOTE 1 In case of dispute, curing in water shall be the reference method.

NOTE 2 Maintenance and measurement of high humidity ≥ 95 % at 20 °C ± 2 °C is not simple. Regular checks should be made that surfaces of specimens in the chamber are continuously wet.

5.6 Transport of test specimens

Avoid loss of moisture and deviations from the required temperature at all stages of transport, by, for example, packing the hardened test specimens in wet sand or wet sawdust or wet cloths, or sealed in plastic bags containing water.

6 Report

The report shall include:

a) identification of the test sample;

b) date and time of making the specimen(s);

c) details of storage of specimens prior to de-moulding, including duration and conditions;

d) method of curing specimens after de-moulding, during transportation, (if appropriate), giving temperature range and duration of curing;

e) any deviation from the standard method of making and curing the specimen(s);

f) a declaration by the person technically responsible that the specimens were prepared in accordance with this standard, except as noted in item e).

The report may include:

g) temperature of the re-mixed concrete;

h) method of compacting the concrete in the moulds and the number of strokes, in the case of hand compaction;

i) condition of specimen(s) on receipt, for curing (if appropriate).