INTERNATIONAL STANDARD

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Testing of concrete —

Part 6: Sampling, preparing and testing of concrete cores

Essais du béton —

Partie 6: Échantillonnage, préparation et essais sur des carottes de béton

Reference number
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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 1920-6 was prepared by Technical Committee ISO/TC 71, *Concrete, reinforced concrete and pre-stressed concrete*, Subcommittee SC 1, *Test methods for concrete*.

ISO 1920 consists of the following parts, under the general title *Testing of concrete*:

— *Part 1: Sampling of fresh concrete*

— *Part 2: Properties of fresh concrete*

— *Part 3: Making and curing test specimens*

— *Part 4: Strength of hardened concrete*

— *Part 5: Properties of hardened concrete other than strength*

— *Part 6: Sampling, preparing and testing of concrete cores*

— *Part 7: Non-destructive tests on hardened concrete*

Testing of concrete —

Part 6:
Sampling, preparing and testing of concrete cores

1 Scope

This part of ISO 1920 specifies a method for taking cores from hardened concrete, their examination, preparation for testing and determination of compressive strength.

The part of ISO 1920 does not give guidance on the decision to drill cores or on the locations for drilling nor does it provide procedures for interpreting the core strength results.

NOTE It is recommended that before coring, full agreement should be reached by all parties on the need for core testing and how the results should be interpreted.

2 Normative references

The following referenced documents are essential for the application of this part of ISO 1920. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 1920-4, *Testing of concrete — Part 4: Strength of hardened concrete*

ISO 1920-5, *Testing of concrete — Part 5: Properties of hardened concrete other than strength*

EN 12390-4:2000, *Testing hardened concrete — Part 4: Compressive strength — Specification for testing machines*

3 Definitions

For the purposes of this document, the following definition applies.

3.1
core strength
compressive strength of the cored specimen, as determined by the test defined in this part of ISO 1920

4 Apparatus

4.1 **Core drill**, capable of extracting cores from the hardened concrete to the dimensions specified in 5.3 with the tolerances specified in Clause 7.

4.2 **Compression testing machine**, conforming to EN 12390-4 or to an equivalent national document and related to the size of specimens and their expected failure load.

NOTE Concrete compression testing machines conforming to EN 12390-4 might need adaptation in order to test cores smaller than 90 mm diameter for compression.

4.3 Balance or **scale**, capable of determining the mass of the core, as tested, to within an accuracy of 0,1 % of the mass.

4.4 Callipers and/or **rules**, capable of measuring the dimensions of the core and the steel reinforcement to a tolerance of ± 1 %.

4.5 Gauge, capable of establishing that the relevant flatness of the specimen is within the requirements of Clause 7.

4.6 Squares and **gauges**, capable of establishing that the perpendicularity and parallelism of specimens and moulds are within the requirements of Clause 7.

5 Taking of cores

5.1 Location

Possible structural implications resulting from taking a core shall be considered prior to drilling and the location where the cores are to be taken specified.

Cores should preferably be taken at points not near to joints or edges of the concrete element to avoid as far as possible any reinforcement.

5.2 Drilling

Unless otherwise specified, the cores shall be drilled perpendicular to the surface in such a manner as not to damage the cores. The drill frame shall be rigidly positioned during coring. Water shall be applied as a cooling fluid to the cutting edge of the core drill.

5.3 Diameter of cores

The diameter of the cores to be taken shall be specified.

The ratio of diameter to the maximum aggregate size should generally be greater than 3. The core diameter should generally be 100 mm ± 10 mm or 125 mm ± 10 mm or 150 mm ± 10mm, with the preferred diameter being 100 mm.

Other smaller diameters, which will make drilling easier and reduce the damage to the element, may be used, provided the effect this has on the accuracy of the result is taken into account.

5.4 Length of cores

The length of core to be taken and the length the core has to be cut to shall be specified.

In deciding the length of cores for strength testing, take the following into account:

a) the diameter of the core;

b) the possible method of adjustment;

c) whether comparison will be made with cube strength or cylinder strength (see Clause 7 for preferred diameter/length ratios).

5.5 Marking and identification

Immediately after drilling, mark each core clearly and indelibly. Record its location and orientation within the element from which it was drilled. If a core is subsequently cut to produce a number of specimens, mark each specimen to indicate its position and orientation within the original core.

5.6 Reinforcement

Drilling through reinforcement shall be avoided. Cores containing any reinforcing bars in or close to the direction of the longitudinal axis shall not be used for strength testing.

6 Examination

6.1 Visual inspection

Carry out visual examination of the cored specimen to identify abnormalities.

6.2 Measurements and calculations

Take the following measurements:

a) core diameter: Take pairs of measurements at right angles, at the half and quarter points of the length of the core to an accuracy of ± 1 %. Determine the average diameter (d_m).

b) core length: Measure the maximum and minimum lengths after completion of the end preparation in accordance with Clause 7 (excluding capping material) to an accuracy of ± 1 %. Determine the average length.

c) mass: Where specified, each specimen shall be weighed as received and/or saturated. The mass shall be recorded to the nearest 0,1 % of the mass of the specimen.

d) density: Where specified, the density of each specimen shall be determined as received and/or saturated in accordance with ISO 1920-5 and the result recorded to the nearest 10 kg/m^3.

e) reinforcement: Measure the diameter (size) of any reinforcement, and the position of the reinforcement measured from the centre of the exposed bar to the end and/or axis of the core both as received and after end preparation. The measurements shall be to the nearest 1 mm.

All measurements shall be recorded.

7 Preparation of cores

7.1 General

The ends of cores for compression tests shall be prepared in accordance with Annex B of ISO 1920-4:2004.

NOTE The preferred method of preparing the ends of cores is by grinding.

7.2 Length/diameter ratios

The preferred length/diameter ratios are as follows:

a) if the strength result is to be compared to cylinder strength, 2,0 ± 5 %;

b) if the strength result is to be compared to cube strength, 1,0 ± 5 %.

In the case of using a specimen with a length-to-diameter ratio smaller than 2,0, it is permissible to convert, by an appropriate method, the test value of the compressive strength corresponding to a value for a length-to-diameter ratio of 2,0.

7.3 Tolerances

Prepare the specimen to within the following tolerances:

a) flatness: The tolerance on flatness of the prepared end surfaces shall be $\pm$ 0.000 3d_m, where d_m is the average core diameter.

b) perpendicularity: The tolerance on perpendicularity of the prepared end, with respect to the axis of the specimen as datum, shall be ± 0,5 mm.

c) parallelism: The tolerance on parallelism of the prepared top surface, with respect to the bottom surface of the specimen as datum, shall be ± 1,0 mm.

d) straightness: The tolerance on straightness of any surface parallel to the centre line of the core shall be ± 3 % of the average core diameter (d_m).

If cores with diameters less than the values recommended in 5.3, the tolerances above should be considered with regard to their adequacy and narrowed if necessary, for example, reduced in proportion to the actual specimen diameter of 100 mm.

8 Compression test

8.1 Storage

Record the storage condition(s) of the specimen.

If it is required to test the specimen in the saturated condition, soak in water at 20°C ± 2 °C for at least 40 h before testing.

If it is required to test the specimen in air-dry conditions, store in laboratory air for at least 40 h prior to testing, record the storage time, ambient temperature and relative humidity of the storage conditions during air-dry storage of the specimens.

8.2 Testing

Carry out the testing in accordance with ISO 1920-4 using a calibrated compression-testing machine. Do not test cores with cracked, hollow or loose caps. All the measuring apparatus shall be in calibration at the time of the test.

Remove any loose sand or other material on the surface of the specimen.

If the specimen is to be tested whilst it is still wet, remove any surface water.

Record the surface moisture condition (wet/dry) of the specimen at the time of test.

9 Test results

Determine the compressive strength of each specimen by dividing the maximum load by the cross-sectional area, calculated from the average diameter and express the results to the nearest 0.5 MPa.

10 Test report

The report shall include:

a) description and identification of the test specimen;

b) date and time of test;

c) characterization of test specimen (if supplied): cement content and water/cement ratio, maximal nominal size of aggregate, type of admixture, date of casting, date of taking core samples, etc.;

d) condition of test specimen on receipt: average diameter, in millimetres, maximum length, in millimetres, minimum length, in millimetres, mass in air, in grams (if appropriate), mass in water, in grams, (if appropriate), density, in kilograms per cubic metre (if appropriate);

e) visual inspection noting any abnormalities identified;

f) reinforcement (when appropriate): diameter(s), in millimetres, position(s), in millimetres;

g) method used for the preparation of specimen: cutting/grinding/capping;

h) dimensions of prepared specimen: average length, in millimetres, average diameter, in millimetres, length/diameter ratio;

i) storage: on receipt, prior to end preparation, after end preparation;

j) surface moisture condition at time of test;

k) test result: maximum load, in newtons or kilonewtons average area, in square millimetres, core compressive strength, in megapascals;

l) any deviations from the standard method of examination or compression testing;

m) a declaration by the person responsible for the examination and testing that these were done in accordance with ISO 1920-6:2004 except as detailed in 10 l).