

Testing concrete in structures —

Part 1: Cored specimens — Taking, examining and testing in compression

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British Standard

ICS 91.100.30

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National foreword

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Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 8, an inside back cover and a back cover.

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CONTENTS

	Page
Foreword	3
1 Scope	3
2 Normative References	3
3 Principle.....	4
4 Apparatus.....	4
5 Taking cores.....	4
6 Examination	5
7 Preparation of cores.....	6
8 Compression test.....	6
9 Expression of results.....	6
10 Test report.....	7
11 Precision.....	7
Annex A (informative)	
The effect of aggregate size and core diameter on core specimen strength	8

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of an identical text or by endorsement, at the latest by September 2000, and conflicting national standards shall be withdrawn at the latest by December 2003.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 ISO Standard ISO/DIS 7034 Cores of hardened concrete - Taking examination and testing in compression. Consideration has been given to the results of the research programme, part funded by the EC under the Measurement and Testing Programme, contract MAT1-CT94-0043.

The standard includes simple guidance on the process of taking cores, but does not consider a sampling plan. It also provides procedures for visual examination and compressive strength testing, but not the interpretation of the results.

A draft for this standard was published in 1996 for CEN enquiry as prEN 12504. 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)

This series prEN 12504 includes the following parts where the brackets give the numbers under which particular test methods were published for CEN enquiry:

prEN 12504 Testing concrete in structures

- Part 1: Cored specimens - Taking, examining and testing in compression (former prEN 12504: 1996)
- Part 2: Non-destructive testing - Determination of rebound number (former prEN 12398: 1996)
- Part 3: Determination of pull-out force (former prEN 12399: 1996)
- Part 4: Determination of ultrasonic pulse velocity (former prEN 12396: 1998)

Annex A of this European Standard is informative.

1 Scope

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

NOTE 1 The standard does not give guidance on the decision to drill cores or on the locations for drilling.

NOTE 2 This standard does not provide procedures for interpreting the core strength results.

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.

prEN 12390-1:1999

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

prEN 12390-3:1999

Testing hardened concrete - Part 3: Compressive strength of test specimens

prEN 12390-4 :1999

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

3 Principle

Cores extracted using a core drill are carefully examined, prepared by grinding or capping and tested in compression using standard procedures.

4 Apparatus

4.1 Core drill, equipment capable of extracting cores from the hardened concrete to the dimensions set out in 5.4 to the tolerances set out in 7.3.

4.2 Compression testing machine, conforming to prEN 12390-4:1999 and related to the size of specimens and their expected failure load.

4.3 Balance or scale, capable of determining the mass of the core, as tested, to 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 7.3.a).

4.6 Squares and gauges (or other means), capable of establishing that the perpendicularity and straightness of specimens are within the requirements of 7.3.b) and 7.3.c).

5 Taking cores

5.1 General

The ratio of the maximum aggregate size in the concrete to the diameter of the core has a significant influence on the measured strength when it approaches values greater than about 1:3.

It is essential that full consideration is given to the aims of the testing and the interpretation of the data, before deciding to drill cores.

NOTE 1 Informative Annex A provides information on the effect of aggregate size and core diameter on the strength of core specimens.

NOTE 2 Concrete compression testing machines conforming to prEN 12390-4:1999 may need adaptation to test cores smaller than 90 mm diameter in compression. (see the Foreword of prEN 12390-4:1999).

5.2 Location

Consider any structural implications resulting from taking a core prior to drilling.

NOTE Cores should preferably be taken at points away from joints or edges of the concrete element and where there is little or no reinforcement.

5.3 Drilling

Unless otherwise specified, drill the cores perpendicular to the surface in such a manner as not to damage the cores. Keep the drill rigidly positioned during coring.

5.4 Length of cores

In deciding the length of cores to be taken for strength testing, take into account:

- a) the diameter of the core;
- b) the possible method of adjustment;
- c) whether comparison is to be made with cube strength or cylinder strength.

5.5 Marking and identification

Immediately after drilling, clearly and indelibly mark each core. Record its location and orientation within the element from which it has been 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 wherever possible. Ensure that cores for determination of compressive strength do not contain any reinforcing bars in, or close to, the direction of the longitudinal axis.

6 Examination

6.1 Visual inspection

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

6.2 Measurements

Measurements shall be as follows:

- a) core diameter d_m shall be measured to within $\pm 1\%$, from pairs of measurements taken at right angles, at the half and quarter points of the length of the core.
- b) core length, the maximum and minimum lengths shall be measured to $\pm 1\%$ as received and the length after completion of the end preparation, in accordance with Clause 7.
- c) reinforcement, the diameter [size] of any reinforcement shall be measured and the position, measuring from the centre of the exposed bar to the end(s) and/or axis of the core, both as received and after end preparation. Measurement shall be to the nearest 1 mm.

NOTE All measurements should be recorded.

7 Preparation of cores

7.1 General

Prepare the ends of cores for compression tests in accordance with Annex A of prEN 12390-3:1999.

7.2 Length/diameter ratios

The preferred length diameter/ratios are:

- a) 2,0 if the strength result is to be compared to cylinder strength;
- b) 1,0 if the strength result is to be compared to cube strength.

7.3 Tolerances

Prepare the specimen to within the following tolerances :

- a) for flatness, the tolerance for the end surfaces prepared by grinding or capping, using high alumina cement or sulphur, shall conform to prEN 12390-1:1999.
- b) for perpendicularity, the tolerance for the prepared ends, with respect to the side, shall comply with prEN 12390-1:1999.
- c) for straightness, the tolerance on the generating line of the core shall be 3 % of the average core diameter.

NOTE If other smaller diameter cores are tested then 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 to 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 a saturated condition, soak in water at (20 ± 2) °C for at least 40 h before testing.

8.2 Testing

Carry out the testing in accordance with prEN 12390-3:1999 using a compression testing machine conforming to prEN 12390-4:1999. (see the Note 2 to 5.1).

Do not test cores with cracked, hollow, or loose caps.

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 Expression of 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 result to the nearest 0,5 MPa or 0,5 N/mm².

10 Test report

The report shall include:

- a) description and identification of the test specimen;
- b) maximum nominal size of aggregate;
- c) date of coring;
- d) visual inspection, noting any abnormalities identified;
- e) reinforcement (when appropriate): diameter, in millimetres, position(s) in millimetres;
- f) method used for the preparation of specimen (cutting, grinding, or capping);
- g) the length and diameter of the core;
- h) length/diameter ratio of prepared specimen;
- i) surface moisture condition at time of test;
- j) date of performance of test;
- k) core compressive strength, in megapascals or newtons per square millimetre;
- 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 the standard except as detailed in item l).

11 Precision

No estimate of repeatability or reproducibility is given with this test, but it is likely to be inferior to that for standard cast specimens.

Annex A (informative)

The effect of aggregate size and core diameter on core specimen strength

Experiments, where cores of 25 mm, 50 mm and 100 mm diameters containing aggregates of maximum sizes 20 mm and 40 mm were tested showed that:

- a) for 20 mm aggregate:
 - 100 mm diameter cores were approximately 7 % stronger than 50mm diameter cores;
 - 50 mm diameter cores were approximately 20 % stronger than 25mm diameter cores;
- b) for 40 mm aggregate:
 - 100 mm diameter cores were approximately 17 % stronger than 50 mm diameter cores;
 - 50 mm diameter cores were approximately 19 % stronger than 25 mm diameter cores.

NOTE The above data is based on the results of the research programme, part funded by the EC under the Measurement and Testing Programme, contract MAT1-CT94-0043.

BS EN
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