INTERNATIONAL STANDARD 4012

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Concrete — Determination of compressive strength of test specimens

Béton — Détermination de la résistance à la compression des éprouvettes

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FOREWORD

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Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 4012 was developed by Technical Committee ISO/TC 71, *Concrete, reinforced concrete and pre-stressed concrete*, and was circulated to the member bodies in January 1976.

It has been approved by the member bodies of the following countries :

Australia	India	Romania
Austria	Israel	South Africa, Rep. of
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Bulgaria	Korea, Rep. of	Sweden
Canada	Mexico	Switzerland
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Denmark	Norway	U.S.A.
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The member bodies of the following countries expressed disapproval of the document on technical grounds :

France
Netherlands
United Kingdom

Printed in Switzerland

Concrete — Determination of compressive strength of test specimens

1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies a method for the determination of the compressive strength of test specimens of hardened concrete.

2 REFERENCES

ISO 1920, *Concrete tests — Dimensions, tolerances and applicability of test specimens.*

ISO 2736, *Concrete — Sampling, making and curing of test specimens.*[1)]

3 TEST SPECIMENS

3.1 Requirements

The test specimens shall meet the requirements of ISO 1920 and ISO 2736.

Test specimens damaged after leaving the mould and before being made ready for testing shall not be tested.

3.2 Checking of dimensions and shape

The dimensions of the test specimen shall be checked for compliance with ISO 1920.

If there is any doubt as to the compliance of the test specimens with the requirements of ISO 1920 with regard to angles and flatness of the load-bearing surfaces, these characteristics shall also be checked.

For checking, the following procedure shall be applied :

3.2.1 *Dimensions*

Measure the following dimensions to the nearest millimetre :

— on cubes, the lateral dimensions *d*;

— on cylinders, the diameter *d* and the height *h*;

— on half-prisms, the minimum length, the height and the width : the first dimension shall be greater than each of the other two.

The measurements shall be taken as shown in figure 1.

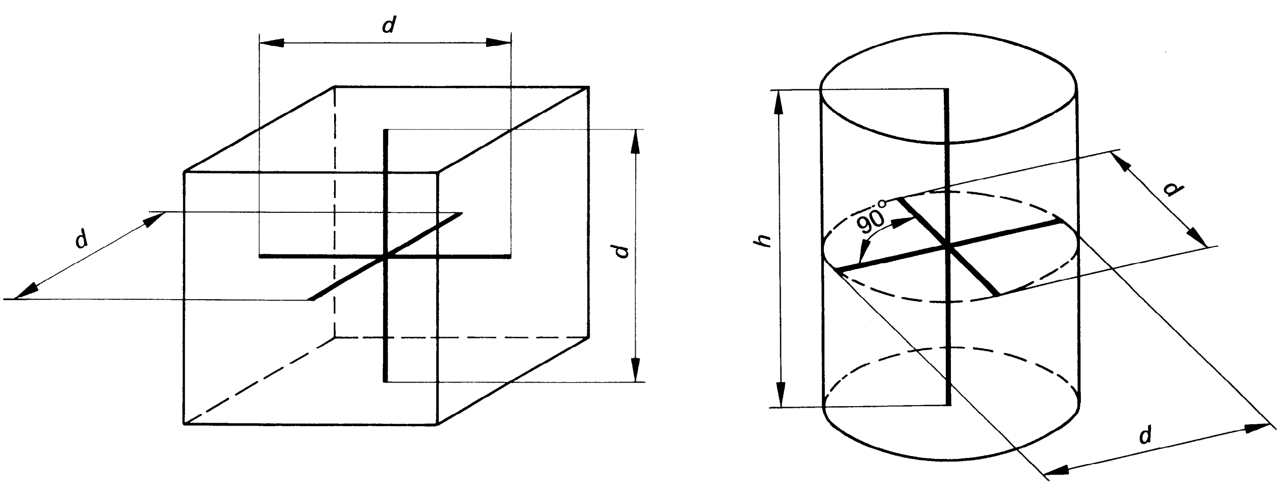

FIGURE 1 — **Checking of dimensions**

1) At present at the stage of draft.

3.2.2 *Angles*

The angles between the load-bearing surfaces and the adjacent surfaces shall be checked as shown in figure 2.

3.2.3 *Flatness of surfaces*

The flatness shall be checked for compliance with ISO 1920 (for example 0,05 mm per 100 mm of edge length) only for the load-bearing surfaces.

3.3 Adjustment of test specimens

Test specimens the dimensions or shapes of which do not comply with the requirements given in ISO 1920, sub-clauses 3.1 and 3.2, because they exceed the respective tolerances, shall be adjusted as follows :

— uneven surfaces may be levelled by grinding, or by capping;

— the deviation of angles shall be corrected exclusively by cutting and grinding.

3.3.1 *Cutting and grinding*

Cutting and grinding shall be carried out in such a way that structural changes of the test specimens are avoided.

3.3.2 *Capping of load-bearing surfaces*

The materials used for providing an equalizing layer on load-bearing surfaces of test specimens shall adhere well to concrete and shall not affect it in any way.

At the time of testing, the compressive strength of the equalizing layer shall not be less than the expected compressive strength of the concrete.

The thickness of equalizing layers on test specimens for compression tests shall not exceed 2 % of the lateral dimension or of the diameter of the load-bearing surface.

3.4 Determination of mass of test specimens

Before weighing test specimens which have been cured in water or in a moist atmosphere, wipe off all surplus water. Determine the mass of all test specimens with an accuracy of ± 0,25 %.

Note shall be taken of the moisture condition of the test specimen (for example oven-dried, air-dried, saturated).

4 APPARENT DENSITY

Calculate the apparent density of the test specimen by dividing its mass, determined in accordance with 3.4, by its volume, calculated from the dimensions determined in accordance with 3.2.1.

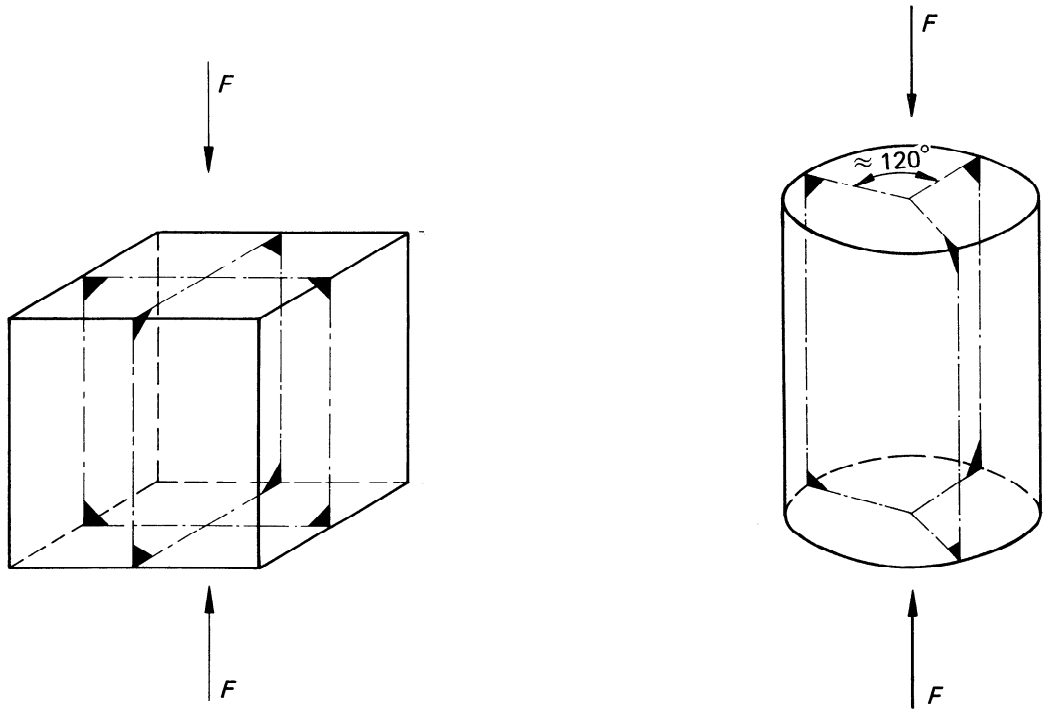

FIGURE 2 — **Checking of angles**

5 APPARATUS

Compression testing machine, suitable for use with stiff materials.

The measuring range shall be such that the ultimate load is higher than 1/10 of the range used. The precision of the machine and the load indication shall be such that the ultimate load can be determined with an accuracy of ± 1 %. For the purpose of rough production control, test machines with an accuracy of load indication of ± 3 % may be used.

The testing machine shall have two steel loading platens with faces having a Rockwell hardness of at least 55 HRC, and depth of hardened layer of approximately 5 mm.

In testing cubic or cylindrical specimens, the loading platens shall be at least as large as, and preferably larger than, the faces of the specimen to which the load is applied. Auxiliary platens having a minimum thickness of 25 mm and fulfilling the same requirements as the original platens may also be used, either on the lower platen or on the specimen.

The surfaces of contact shall have a machined finish. The tolerance of flatness[1] shall be 2/100 mm per 100 mm of edge of cube or of diameter of cylinder. When, with use, the lack of flatness exceeds the above value, the platens shall be re-machined.

One of the platens (preferably the upper one) shall have a spherical seating of dimensions such that the deformation of the platen under loads normally used does not exceed the tolerance of flatness (see above).

The spherical seating shall have its centre at the surface of the pertinent platen, or at a point whose distance from the surface is not more than 1/200 of the diagonal of the platen or of its diameter, as the case may be. The diameter of the sphere shall not be much larger than the largest dimension of the specimen in contact with the platen.

6 PROCEDURE

Clean the platens and the surfaces of the specimen which will be in contact with them.

Centre the specimen on the platens or on the auxiliary platens. The error of centring shall not be more than 1/100 of the diameter or of the edge of the specimen.

At the moment when contact between the specimen and the upper platen is achieved, adjust the spherical seating to achieve uniform contact.

Apply the load in a continuous and uniform manner, without shock, so as to obtain a uniform increase in stress of

$0{,}6 \pm 0{,}4\ \mathrm{N/(mm^2 \cdot s)}$

The lower loading rates should be chosen for low strength concretes, and the higher loading rates for high strength concretes.

When the specimen begins to deform rapidly prior to ultimate failure, stop adjusting the rate of application of load and allow failure to take place at the existing rate of strain.

Continue loading until failure of the specimen and note the maximum load.

7 EXPRESSION OF RESULTS

The compression strength, f_{cc}, in newtons per square millimetre, is given by the equation

$$f_{cc} = \frac{F}{A_c}$$

where

F is the maximum load, in newtons, at failure;

A_c is the cross-sectional area of the specimen, in square millimetres, on which the compressive force acts.

The compressive strength shall be expressed to the nearest 0,5 $\mathrm{N/mm^2}$.

8 TEST REPORT

Every report on compression tests of concrete specimens shall refer to this International Standard and shall include the following data :

8.1 Data to be given by the producer of the test specimen

8.1.1 *Mandatory data*

a) identification of the specimen;

b) date of production;

c) conditions of curing and storage;

d) required age of the specimen at the time of testing.

8.1.2 *Optional data*

e) building project;

f) part or component of the building;

g) required (class of) compressive strength;

h) type of cement and water/cement ratio;

i) type of admixture used (if any).

1) The tolerance of flatness is defined as the distance between two parallel planes enclosing the surface of contact.

8.2 Data to be given by the test laboratory

a) condition of specimen when received and any surface treatment;

b) type and dimensions of the specimen;

c) marking of the specimen;

d) date of receipt of the specimen;

e) conditions of curing and storage, and moisture condition;

f) date of test;

g) age of the specimen;

h) apparent density of the specimen;

i) compressive strength determined;

j) other remarks.

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