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Second edition
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Testing of concrete —

Part 3: Making and curing test specimens

Essais du béton —

Partie 3: Confection et prise des éprouvettes

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 71, *Concrete, reinforced concrete and prestressed concrete*, Subcommittee SC 1, *Test methods for concrete.*

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

This second edition cancels and replaces the first edition (ISO 1920-3:2004), which has been technically revised.

The main changes compared to the previous edition are as follows:

— tolerances of specimens and moulds have been redefined;

— the concept of preparation and filling has been is redrafted;

— preferred methods of compaction on the basis of slump value have been included and defined;

— the capping of cylindrical specimens for compressive strength has been included and defined;

— the curing of test specimens under hot climate has been defined.

A list of all parts in the ISO 1920 series can be found on the ISO website.

Testing of concrete —

Part 3:
Making and curing test specimens

WARNING — Some concrete specimens can be too heavy for one person to carry and it is necessary that appropriate means be arranged to carry them. The use of vibrating equipment, such as vibration tables, can cause damage to joints and loss of sensation due to nerve damage. It is necessary that moulds, density containers, etc., be clamped to the table and not held in position using one's hands while they are being vibrated.

1 Scope

This document specifies the shape and dimensions of concrete test specimens for strength tests and the methods of making and curing these test specimens.

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.

ISO 1920-1, *Testing of concrete — Part 1: Sampling of fresh concrete*

ISO 1101, *Geometrical product specifications (GPS) — Geometrical tolerancing — Tolerances of form, orientation, location and run-out*

3 Terms and definitions

For the purpose of this document, the terms and definitions given in ISO 1101 and the following apply.

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

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
nominal size
<specimen> range of commonly used specimen sizes among which a preferred size is specified in this document

3.2
designated size
<specimen> specimen size selected and declared by the user of this document from among the permitted range of *nominal sizes* (3.1)

Note 1 to entry: The size of specimens is expressed in millimetres.

4 Shape, dimensions and tolerances of specimens and moulds

4.1 General

For each shape of test specimen, e.g. cube, cylinder, and prism, the basic dimensions, *l* or *d* (Figures 1, 2 and 3), should be chosen to be at least four times the maximum size of the aggregate in the concrete.

NOTE A procedure for wet screening as described in Annex A can be used when the maximum size of the aggregate is larger than ¼ of the basic dimension, *l* or *d*.

4.2 Cubes

4.2.1 Nominal sizes

The nominal sizes are as shown in Figure 1, where *l* is 100 mm, 120 mm, 150 mm, 200 mm, 250 mm, 225 mm or 300 mm.

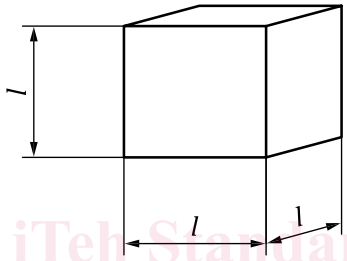

Figure 1 — Nominal sizes of a cube

The preferred sizes are 100 mm and 150 mm.

4.2.2 Designated sizes

The designated size shall be selected from one of the nominal sizes given in 4.2.1.

4.2.3 Tolerances

The following tolerances apply.

a) The tolerance on the designated size shall be ±0,5 %;

b) The tolerance on the flatness of the load-bearing surfaces shall be:

   i) for new moulds: 0,03 mm;

   ii) for moulds in use: 0,05 mm;

c) The load-bearing surfaces shall be parallel to a tolerance of not greater than 0,5 mm;

d) The tolerance on the perpendicularity of the sides of the cube with reference to the base shall be ±0,5 mm.

For the definitions of flatness, parallelism, perpendicularity and straightness, see Annex B.

4.3 Cylinders

4.3.1 Nominal sizes

The nominal sizes are as shown in Figure 2, where the diameter, *d*, equal 100 mm, 113 mm, 125 mm, 150 mm, 200 mm, 250 mm or 300 mm.

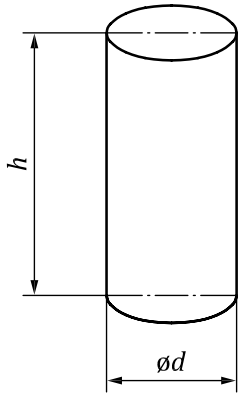

Figure 2 — Nominal sizes of a cylinder

NOTE The diameter of 113 mm corresponds to a load-bearing area of 10 000 mm^2.

The preferred sizes are 100 mm × 200 mm, 125 mm × 250 mm and 150 mm × 300 mm.

The height, *h*, of the cylinder shall be 2*d* except for specimens used for the tensile splitting test. In the latter case, the height of the specimen shall be between *d* and 2*d*.

4.3.2 Designated sizes

Designated sizes may be selected within ±10 % of a nominal size.

4.3.3 Tolerances

The following tolerances apply:

a) the tolerance on the designated diameter, *d*, shall be ±0,5 %;

b) the tolerance on the flatness of the load-bearing surfaces shall be ±0,000 5 *d*, expressed in millimetres, except for cylinders tested by unbonded capping methods;

c) the tolerance on the flatness of the load-bearing surfaces of cylinders tested by unbonded capping methods, such as sand box or elastomeric pads, shall be ±0,02 *d*, expressed in millimetres;

d) the load-bearing surfaces shall be parallel to a tolerance of not greater than 0,5 millimetres;

e) the tolerance on the perpendicularity of the sides of the cylinder with reference to the end faces shall be ±0,5 mm;

f) the tolerance on the height, *h*, of the cylinders shall be ±0,5 %;

g) the straightness tolerance on any surface parallel to the centre line of the cylinders to be used in compression tests shall be ±0,5 mm;

h) the straightness tolerance of any surface parallel to the centre line of the cylinders to be used in tensile splitting tests shall be ±0,2 mm.

4.4 Prisms

4.4.1 Nominal sizes

The nominal sizes are as shown in Figure 3, where l equal 100 mm, 150 mm, 200 mm, 250 mm or 300 mm, and length, L, is $L \geq 3{,}5\ l$.

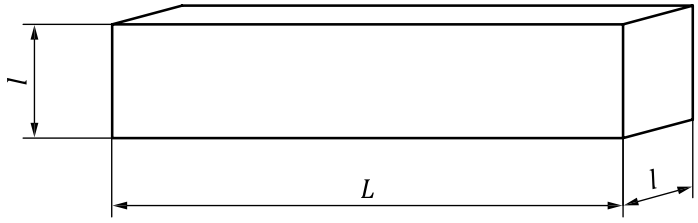

Figure 3 — Nominal sizes of prisms

The preferred sizes are:

— l = 100 mm and L = 400 mm; or

— l = 150 mm and L = 600 mm.

4.4.2 Designated sizes

The designated size, l, of prisms shall be selected from one of the nominal sizes given in 4.4.1.

The designated length, L, of prisms shall be not less than 3,5 l.

4.4.3 Tolerances

The following tolerances apply:

a) the tolerance on the designated size l, shall be ±0,5 %;

b) the tolerance on the designated length, l, shall be ±0,5 %;

c) the load-bearing surfaces shall be parallel to a tolerance not greater than 0,5 mm;

d) the tolerance on the perpendicularity of the sides of the prism with reference to the base shall be ±0,5 mm;

e) the tolerance on the straightness of the load-bearing area for specimens to be used for bending (flexural) tests shall be ±0,2 mm.

5 Apparatus

5.1 Apparatus for measuring the test specimens.

5.1.1 Callipers and/or **rules**, capable of establishing that the relevant dimensions of specimens or moulds are within ±0,5 % of the dimension.

5.1.2 Gauge, capable of establishing that the relevant flatness of specimens or moulds is within ±0,000 5 l or d.

5.1.3 Squares and **gauges** (or other similar means), capable of establishing the perpendicularity and parallelism of specimens and moulds within ±0,5 mm.

5.2 Apparatus for making test specimens

5.2.1 Moulds, capable of providing test specimens with the dimensions and tolerances that conform to this document.

The moulds shall be made of steel or cast-iron, which shall be the reference materials. If moulds are manufactured from other materials, performance test data shall be available that demonstrate equivalence with the steel or cast-iron moulds. Lightweight cylindrical moulds shall conform to the requirements in Annex C.

Moulds shall be watertight and shall be non-absorbent.

Moulds shall be checked at intervals of not more than 1 year. If the mould is in calibration at time of use, the checking of parallelism, verticality and flatness of specimens is not required, provided the size measurements are within tolerance.

Individual moulds shall be identifiable. The designation should be an identification number either welded on the mould body or securely tagged to the moulds.

5.2.2 Filling frame, fitted tightly to the mould and used to simplify the filling of the moulds.

The use of a filling frame is optional, but if used, this shall be stated in the test report (see Clause 9).

5.2.3 Means of compacting the concrete in the mould, which shall be one of the following:

5.2.3.1 Internal vibrator, with a minimum frequency of 120 Hz (7 200 cycles per minutes). The diameter of the tube shall not exceed one-quarter of the smallest dimension of the test specimen;

5.2.3.2 Vibrating table, with a minimum frequency of 40 Hz (2 400 cycles per minute);

5.2.3.3 Compacting rod, of circular cross-section, straight, made of steel, having a diameter of 16 mm ± 1 mm and a length of 600 mm ± 5 mm, and with rounded, roughly hemispherical, ends;

5.2.3.4 Compacting bar, 380 mm long steel bar, weighs 1,8 kg and has a square end of 25 mm × 25 mm or circular cross-section of 25 mm diameter for ramming.

5.2.4 General tools, including the following:

5.2.4.1 Scoop, approximately 100 mm wide;

5.2.4.2 Steel floats, two;

5.2.4.3 Sampling tray, with minimum dimensions of 900 mm × 900 mm × 50 mm deep, of rigid construction and made from a non-absorbent material not readily attacked by cement paste;

5.2.4.4 Shovel, square-bladed;

5.2.4.5 Release material, non-reactive;

5.2.4.6 Mallet;

5.2.4.7 Timer, having an accuracy of ±1 s.

6 Preparation of test specimens

6.1 Sampling

The samples shall be taken in accordance with ISO 1920-1.

The samples shall be remixed before filling the mould. Concrete mixed in a laboratory need not be remixed.

6.2 Preparation and filling of the mould

Before filling, cover the inner surface of the mould with a thin film of mineral oil or any other material to prevent the concrete from adhering to the mould.

Place the mould on a firm and level area.

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.

Place the concrete in the mould by means of a scoop, in such a way as to remove as much entrapped air as possible (without significantly reducing the amount of entrained air, if present). The concrete shall be placed in layers of approximately equal depth and not more than 50 mm thick each. The thickness of the layers may be increased proportionally if the minimum size of the specimen exceeds 150 mm.

Use the quantity of material in the final layer that, as nearly as possible, is just sufficient to fill the container without having to remove excess material. A small quantity of additional concrete may be added if necessary and further compacted in order to just fill the container, but the removal of excess material should be avoided.

6.3 Compaction of the concrete

Compact the concrete immediately after each layer is placed in the moulds in such a way as to produce full compaction of the concrete with neither excessive segregation nor laitance. Compact each layer by using one of the methods described in Annex D. The preferred method of compaction may be selected from the guidance given in Table 1.

Table 1 — Methods of compaction

SL. No.	Slump	Preferred methods of compaction
1	Less than 50 mm	Vibrating table or internal vibrator
2	50 mm to 100 mm	Vibrating table or internal vibrator or tamping bar/tamping rod
3	More than 100 mm	Tamping bar/tamping rod
NOTE These methods of compaction are not applicable in case of fibre reinforced concrete and self-compacting concrete.		

6.4 Surface levelling

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

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

6.5 Marking

Identify the test specimens with a clear and durable marking, and without damaging the specimen.

Keep records to ensure that the specimen identity is known from sampling to testing.