
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

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 1920-3 was prepared by Technical Committee ISO/TC 71, *Concrete, reinforced concrete and prestressed concrete*, Subcommittee SC 1, *Test methods for concrete*.

This first edition of ISO 1920-3 cancels and replaces ISO 1920:1976 and ISO 2736-2:1986 which have been technically revised.

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 of concrete*

Testing of concrete —

Part 3: Making and curing test specimens

WARNING — Some concrete specimens might 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 part of ISO 1920 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 referenced documents are essential for the application 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 1101:1983, *Technical drawings — Geometrical tolerancing — Tolerancing of form, orientation, location and run-out — Generalities, definitions, symbols, indications on drawings*

3 Terms and definitions

For the purpose of this document, the terms and definitions given in ISO 1101:1983 and the following apply.

3.1

nominal sizes of specimens

range of commonly used specimen sizes amongst which a preferred size is specified in this part of ISO 1920

3.2

designated size of specimens

specimen size selected and declared by the user of this part of ISO 1920 from amongst the permitted range of nominal sizes

NOTE The size of specimens is designated in millimetres.

4 Shape, dimensions and tolerances of specimens and moulds

4.1 General

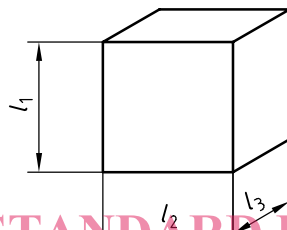
For each shape of test specimen, e.g. cube, cylinder, and prism, the basic dimensions, l or d , should be chosen to be at least four times the maximum size of the aggregate in the concrete.

NOTE A procedure for wet screening as described in Annex A can be used when the maximum size of the aggregate is larger than $1/4$ 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 ($= l_1$ or l_2 or l_3) equals 100 mm, 120 mm, 150 mm, 200 mm, 250 mm or 300 mm.



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Figure 1 — Nominal sizes of a cube

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The preferred sizes are 100 mm and 150 mm.
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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.

- The tolerance on the designated size shall be $\pm 0,5 \%$.
- The tolerance on the flatness of the load-bearing surfaces shall be $\pm 0,000 5 l$, expressed in millimetres.
- The load-bearing surfaces shall be parallel to a tolerance of not greater than 1,0 mm.
- The tolerance on the perpendicularity of the sides of the cube with reference to the base shall be $\pm 0,5$ 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 d equals 100 mm, 113 mm, 125 mm, 150 mm, 200 mm, 250 mm or 300 mm.

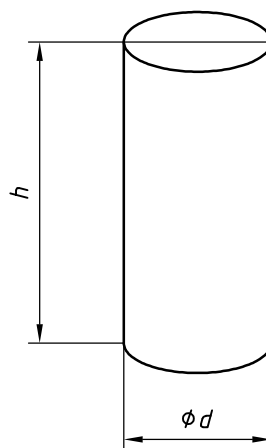


Figure 2 — Nominal sizes of a cylinder

NOTE The diameter of 113 mm corresponds to a load-bearing area of 10 000 mm².

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

4.3.2 Designated sizes

Designated sizes may be selected within $\pm 10\%$ of a nominal size.

4.3.3 Tolerances

The following tolerances apply.

- a) The tolerance on the designated diameter, d , shall be $\pm 0,5\%$.
- b) The tolerance on the flatness of the load-bearing surfaces shall be $\pm 0,000\ 5\ d$, 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 $\pm 0,02\ d$, expressed in millimetres.
- d) The load-bearing surfaces shall be parallel to a tolerance of not greater than 1,0 millimetres.
- e) The tolerance on the perpendicularity of the sides of the cylinder with reference to the end faces shall be $\pm 0,5\text{ mm}$.
- f) The tolerance on the height, h , of the cylinders shall be $\pm 5\%$.
- g) The straightness tolerance on any surface parallel to the centre line of the cylinders to be used in compression tests shall be $\pm 0,5\text{ mm}$.
- h) The straightness tolerance of any surface parallel to the centre line of the cylinders to be used in tensile splitting tests shall be $\pm 0,2\text{ mm}$.

4.4 Prisms

4.4.1 Nominal sizes

The nominal sizes are as shown in Figure 3, where l ($=l_1$ or l_2) equals 100 mm, 150 mm, 200 mm, 250 mm or 300 mm and $L \geq 3,5 l$.

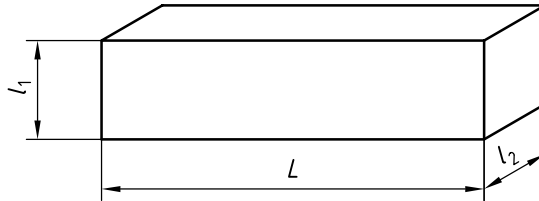


Figure 3 — Nominal sizes of prisms

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 depth, l_1 , and width, l_2 , 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 $3,5 l$.

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4.4.3 Tolerances

The following tolerances apply.

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- a) The tolerance on the designated depth, l_1 , and width, l_2 , shall be $\pm 0,5$ %.
- b) The tolerance on the designated length, L , shall be ± 5 %.
- c) The load-bearing surfaces shall be parallel to a tolerance not greater than 1,0 mm.
- d) The tolerance on the perpendicularity of the sides of the prism with reference to the base shall be $\pm 0,5$ mm.
- e) The tolerance on the straightness of the load-bearing area for specimens to be used for bending (flexural) tests shall be $\pm 0,2$ 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 $\pm 0,5$ % of the dimension.

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

5.1.3 Squares and **gauges** (or other similar means), capable of establishing the perpendicularity and parallelism of specimens and moulds within $\pm 0,5$ 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 part of ISO 1920.

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 \pm 1 mm and a length of 600 mm \pm 5 mm, and with rounded, roughly hemispherical, ends;

5.2.3.4 compacting bar, made of steel having a square or circular cross-section and a mass greater than 1,8 kg.

5.2.4 General tools, including the following:

- a) **scoop**, approximately 100 mm wide;
- b) **steel floats**, two;
- c) **sampling tray**, with minimum dimensions of 900 mm \times 900 mm \times 50 mm deep, of rigid construction and made from a non-absorbent material not readily attacked by cement paste;
- d) **shovel**, square-bladed;
- e) **release material**, non-reactive;
- f) **mallet**;
- g) **timer**, having an accuracy of \pm 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 a minimum of two layers approximately equal in depth and each not more than 100 mm thick.

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.

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.

7 Curing of test specimens

Leave the test specimens in the mould for at least 16 h, but not longer than three days, and protect against shock, vibration and water evaporation at a temperature of $20^{\circ}\text{C} \pm 5^{\circ}\text{C}$ (or $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$ when the climate is hot).

After removal from the mould, store the test specimens in water at a temperature of $20^{\circ}\text{C} \pm 2^{\circ}\text{C}$ or in a chamber at $20^{\circ}\text{C} \pm 2^{\circ}\text{C}$ and a relative humidity of at least 95 % until just before testing.

Loss of moisture and deviations from the required curing temperature shall be avoided at all stages of transport. The test specimens should, therefore, be packed, for example, in wet sand or wet sawdust or wet cloths, or sealed in plastic bags containing water.

8 Measurement of dimensions and shape

8.1 Specimens made in calibrated moulds

If specimens have documentation to show that they were made in calibrated moulds, it is unnecessary to verify by measurement their conformity to the requirements for tolerances for flatness, perpendicularity, parallelism and straightness.

Specimens shall be checked to establish that each dimension is within 0,5 % of the designated size.

8.2 Specimens made in uncalibrated moulds

If specimens are not made in calibrated moulds, or there is no documentation to verify that they were made in calibrated moulds, the specimens shall be checked for conformity to the relevant requirements of Clause 4. The following shall be checked:

- a) each dimension of the specimen;
 - b) the flatness of all the potential load-bearing surfaces;
 - c) the parallelism of all the potential load-bearing surfaces;
 - d) the perpendicularity of the sides;
 - e) the straightness of any surface parallel to the centre line of the cylinder.
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9 Report

9.1 The report shall include the following with regards to making the specimens:

- a) identification of the test sample;
- b) reason for making the specimens (e.g. compression testing), when known;
- c) time of making the specimen(s);
- d) temperature of the remixed concrete (optional);
- e) density of the concrete (optional);
- f) time passing between sampling and making the test specimens;
- g) method of compaction of the concrete in the mould(s);
- h) depending on the method of compaction, either the duration of compaction or the number of tamps;
- i) use of a filling frame (if appropriate);
- j) any deviation from the standard method of making specimen(s) (if appropriate).