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Method of making and curing
concrete specimens

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Foreword

This Japanese Industrial Standard has been revised by the Minister of Land, Infrastructure, Transport and Tourism through deliberations at the Japanese Industrial Standards Committee as the result of proposal for revision of Japanese Industrial Standard submitted by Japan Concrete Institute (JCI) with a draft being attached, based on the provision of Article 12, paragraph (1) of the Industrial Standardization Act applied mutatis mutandis pursuant to the provision of Article 16 of the said Act. This edition replaces the previous edition (**JIS A 1132**:2014), which has been technically revised.

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NOTE Based on Article 9 of the Supplementary Provisions to the Unfair Competition Prevention Act etc., any submission of proposal, or employment of procedures such as deliberation by the Japanese Industrial Standards Committee under the previous Industrial Standardization Act shall be deemed to have been conducted pursuant to the provision of Article 12, paragraph (1) of the revised Industrial Standardization Act.

Method of making and curing concrete specimens

Introduction

This Japanese Industrial Standard has been prepared based on **ISO 1920-3:2004**, Edition 1, with some modifications of the technical contents.

The vertical lines on both sides and dotted underlines indicate changes from the corresponding International Standard. A list of modifications with the explanations is given in Annex JB. The comparison table between previous and current editions of this Standard on technically significant revisions is given in Annex JC.

1 Scope

This Standard specifies the methods of making and curing test specimens to be used for compressive strength test (**JIS A 1108**), flexural strength test (**JIS A 1106**) and splitting tensile strength test (**JIS A 1113**) of concrete.

NOTE The International Standard corresponding to this Standard and the symbol of degree of correspondence are as follows.

ISO 1920-3:2004 *Testing of concrete—Part 3: Making and curing test specimens* (MOD)

In addition, symbols which denote the degree of correspondence in the contents between the relevant International Standard and **JIS** are **IDT** (identical), **MOD** (modified), and **NEQ** (not equivalent) according to **ISO/IEC Guide 21-1**.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. The most recent editions of the standards (including amendments) indicated below shall be applied.

JIS A 0203 *Concrete terminology*

JIS A 1106 *Method of test for flexural strength of concrete*

JIS A 1108 *Method of test for compressive strength of concrete*

JIS A 1113 *Method of test for splitting tensile strength of concrete*

JIS A 1115 *Method of sampling fresh concrete*

JIS A 1138 *Method of making test sample of concrete in laboratory*

JIS A 8610 *Building construction machinery and equipment—Internal vibrators for concrete*

JIS A 8611 *Building construction machinery and equipment—External vibrators for concrete*

3 Terms and definitions

For the purpose of this Standard, the terms and definitions given in **JIS A 0203**, and the following apply.

3.1

spading

removing large and small air bubbles by inserting a metal spatula or similar tool into the surface where the concrete sample comes into contact with the side surface and the end surface of the mould, and shaking it up and down to improve compatibility on the contact surface of the concrete and the mould

4 Concrete test samples

4.1 Samples prepared in laboratories

When concrete samples are prepared in laboratories, the method shall be in accordance with **JIS A 1138**.

4.2 Samples taken at other points

When concrete samples are taken from mixers, hoppers, agitator trucks or placed concrete, the method shall be in accordance with **JIS A 1115**.

5 Test specimens for compressive strength test

5.1 Dimensions of test specimens

Compressive strength test specimens shall be cylinders with the height twice the diameter. The diameter shall be not less than three times the maximum size of coarse aggregate and not less than 100 mm. The standard diameters of test specimens are 100 mm, 125 mm and 150 mm.

NOTE When the maximum size of the coarse aggregate exceeds 40 mm, it is permissible to remove aggregates larger than 40 mm by sifting through a sieve of 40 mm mesh and to use a 150-mm diameter test specimen. The 40 mm sieve above refers to the metal wire cloth with 37.5 mm nominal aperture specified in **JIS Z 8801-1**.

5.2 Apparatus

The apparatus shall be as follows.

- Moulds shall be made of materials which are non-absorbent and not affected by cement.
- Moulds shall be free from water leakage during moulding of test specimens. When moulds consist of a few parts to be assembled, they shall be assembled with oily clay or hard grease thinly applied to the joints.
- The moulds shall be capable of providing the test specimens with the specified accuracy¹⁾.

NOTE The moulds shall be periodically checked for accuracy.

Note ¹⁾ When a mould with a verified accuracy is used, depending on the purpose of tests, procedures in **5.5 a)** to **d)**, **6.4 a)** to **c)** and **7.4 a)** to **b)** may be omitted.

- d) The inner surface of the moulds shall be covered with a thin film of mineral oil or unreactive release agent before filling the concrete.
- e) A compacting rod, if used for compacting concrete in the mould, shall be of circular cross-section, made of steel, having a diameter of 16 mm and a length of approximately 500 mm to 600 mm with rounded, roughly hemispherical ends.
- f) An internal vibrator, if used for compacting the concrete in the mould, shall be as specified in **JIS A 8610**. The diameter of the tube shall not exceed one-quarter ²⁾ of the smallest dimension of the test specimen.

Note ²⁾ For test specimens having a 100 mm diameter, a tube of 28 mm diameter may be used.

- g) A vibration table type vibrator, if used for compacting the concrete in the mould, shall be as specified in **JIS A 8611**.

When a vibration table type vibrator or other means is used for compacting concrete, it shall be ensured that it is capable of compacting the subject concrete sample adequately for the test.

5.3 Compaction of concrete

5.3.1 Filling of the mould

The concrete shall be placed in a minimum of two layers approximately equal in depth. The thickness of each layer shall not exceed 160 mm.

5.3.2 Means of compacting the concrete in the mould

The means of compacting the concrete in the mould shall be as follows.

- a) **Compacting rod** Subject each layer to rod strokes, distributing one stroke per 1 000 mm². Deliver each stroke ensuring that the rod reaches the previous layer. Where the specified number of strokes may cause segregation of materials, reduce the number of strokes appropriately to avoid segregation.

After tamping, tap the side wall of the mould with a mallet until the dents produced by the compacting rod are no longer observed.

- b) **Internal vibrator** Insert the internal vibrator vertically into the concrete. For compacting the bottom layer, insert the vibrator up to a depth of about 20 mm above the bottom of the mould. For compacting a layer other than the bottom layer, insert the vibrator so that it penetrates the previous layer through about 20 mm depth.

Continue vibration until large bubbles of air cease to appear and a thin mortar layer covers the surface of large aggregates, and pull out the vibrator slowly.

Then, tap the side wall of the mould with a mallet until the dents produced by the vibrator are no longer observed.

- c) **Vibrating table type vibrator** The mould shall be attached or firmly held against the table. Continue vibration until large bubbles of air cease to appear and a thin mortar layer covers the surface of large aggregates. Avoid over-vibration.

5.3.3 Surface levelling

Remove the concrete above the upper rim of the mould and level the surface carefully.

In the case of performing capping, ensure that the surface of concrete is slightly below the upper rim of the mould.

5.4 Finishing of surface of test specimens

5.4.1 In the case of capping

Capping shall be as follows.

- Materials for capping shall ensure good adhesion to concrete and have no adverse effect on concrete.
- The compressive strength of the capping layer shall not be lower than the expected strength of the concrete.
- The thickness of the capping layer shall not exceed 2 % of the diameter of the test specimen.

Annex JA shows the capping method of test specimens for reference.

5.4.2 In the case of polishing

When the concrete surface is finished by polishing, the work shall be performed so as not to adversely affect the concrete.

5.4.3 In the case of unbonded capping

In compaction of concrete for test specimen, the concrete surface shall be finished so that the flatness³⁾ after hardening is not more than 2 mm. In the case of applying this test specimen to the strength test, refer to the procedure described in Annex A of JIS A 1108.

Note ³⁾ The flatness referred to here is the distance between two parallel planes, one including the highest point and the other including the lowest point of the plane.

5.5 Tolerances on dimensions and shape of test specimens

The tolerances on dimensions and shape of test specimens shall be as follows.

- The tolerances on the dimensions of the test specimen shall be within 0.5 % of the diameter and 5 % of the height.
- The tolerance on flatness³⁾ of the load-bearing surface of the test specimen shall be within 0.05 % of the diameter. However, when it is in accordance with Annex A of **JIS A 1108**, the upper surface is excluded.
- The tolerance on parallelism⁴⁾ of the load-bearing surface (upper surface) and the base of the test specimen shall be within 1 mm.

Note ⁴⁾ The parallelism referred to here indicates the difference between the maximum and minimum values of the height of the test specimen.

- d) The angle between the load-bearing surface and the sides of the cylinder shall be $90^\circ \pm 0.5^\circ$.

NOTE The tolerance on the perpendicularity ($90^\circ \pm 0.5^\circ$) can be confirmed by placing the test specimen on the surface plate and measuring the distance (gap) between the square and the side surface of test specimen.

- With a test specimen of diameter 100 mm × height 200 mm, the distance (gap) meeting the requirement for perpendicularity tolerance is within 1.745 mm.
- With a test specimen of diameter 125 mm × height 250 mm, the distance (gap) meeting the requirement for perpendicularity tolerance is within 2.181 mm.
- With a test specimen of diameter 150 mm × height 300 mm, the distance (gap) meeting the requirement for perpendicularity tolerance is within 2.617 mm.

6 Test specimens for flexural strength test

6.1 Dimensions of test specimens

Test specimens shall be prisms with a square cross-section, and the length of one side shall be four times or greater ⁵⁾ than the maximum size of the coarse aggregate, and be 100 mm or longer. The length of test specimens shall be at least 80 mm greater than three times the length of one side of the cross-section.

The standard size of cross-section of test specimens is 100 mm × 100 mm or 150 mm × 150 mm.

NOTE When the maximum size of the coarse aggregate exceeds 40 mm, it is permissible to remove aggregates larger than 40 mm by sifting through a sieve of 40 mm mesh, and to use a test specimen with a 150 mm × 150 mm cross-section.

Note ⁵⁾ When the maximum size of the coarse aggregate is 40 mm, the length of one side may be 150 mm.

6.2 Apparatus

The apparatus used for making test specimens shall be as specified in 5.2.

6.3 Compaction of concrete

6.3.1 Filling of mould

When a compacting rod is used, the concrete shall be placed in a minimum of two layers approximately equal in depth. When a vibrator is used, the concrete shall be placed in either one layer or a minimum of two layers approximately equal in depth.

6.3.2 Means of compacting the concrete in the mould

The means of compacting the concrete in the mould shall be as follows.

- a) **Compacting rod** When the concrete is compacted with a compacting rod, in addition to the procedure in **5.3.2 a)** and before tapping with a mallet, perform spading along the side surface and the end surface of the mould with a metal spatula or similar tool.
- b) **Internal vibrator** When the concrete is compacted with an internal vibrator, in addition to the procedure in **5.3.2 b)** and before tapping with a mallet, perform spading along the side surface and the end surface of the mould with a metal spatula or similar tool.
- c) **Vibrating table type vibrator** When the concrete is compacted with a vibration table type vibrator, the procedure shall be as specified in **5.3.2 c)**.

6.3.3 Surface levelling

The surface levelling shall be as specified in **5.3.3**.

6.4 Tolerances on dimensions and shape of test specimens

The tolerances on dimensions and shape of test specimens shall be as follows.

- a) The tolerances on dimensions of the test specimens shall be within 1 % for the width ⁶⁾, within 2 % for the height ⁶⁾, and within 5 % for the length.
- b) The tolerance on straightness ⁷⁾ in the part of the load-bearing line and supporting line of test specimen shall be within ± 0.1 % of the width.
- c) The angle ⁸⁾ between the side surface and the base of the test specimen shall be $90^\circ \pm 0.5^\circ$.

Notes ⁶⁾ In the flexural strength test, since the sides of the test specimen as the concrete is compacted in the mould are taken as the upper and lower load-bearing surfaces to be subjected to the load, the width and height as referred to in this clause correspond to the height and width of the broken cross-section in the flexural strength calculation, respectively.

⁷⁾ The straightness referred to here is the distance between two parallel lines, one including the highest point and the other including the lowest point at the place where the test specimen contacts with the loading apparatus (L_1 to L_4 of roller part in Figure 1).

⁸⁾ The tolerance on perpendicularity ($90^\circ \pm 0.5^\circ$) can be confirmed by placing the test specimen on the surface plate and measuring the distance (gap) between the square and the side surface of test specimen.

— With a test specimen of sectional dimension 100 mm × 100 mm, the distance (gap) meeting the requirement for perpendicularity tolerance is within 0.872 mm.

— With a test specimen of sectional dimension 150 mm × 150 mm, the distance (gap) meeting the requirement for perpendicularity tolerance is within 1.308 mm.

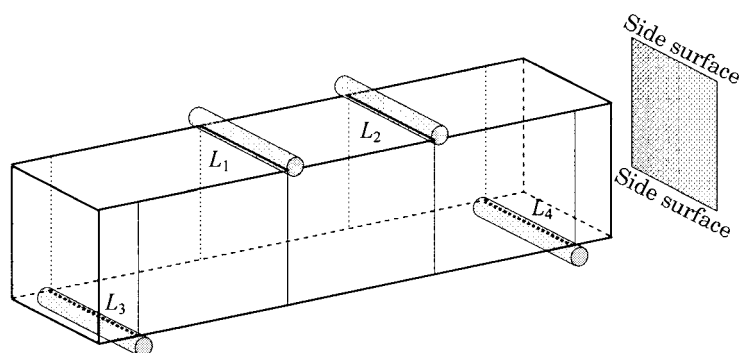


Figure 1 Supplemental drawing for measurement part of straightness

7 Test specimens for splitting tensile strength test

7.1 Dimensions of test specimens

The test specimens shall be cylinders and the dimensions shall be as specified in Table 1.

Table 1 Dimensions of test specimens for splitting tensile strength test

Diameter	At least four times the maximum size of the coarse aggregate, and 100 mm or longer ^{a)}
Length ^{b)}	<u>From equal to the diameter up to twice the diameter</u>
Notes ^{a)} When the maximum size of the coarse aggregate is 40 mm, the diameter may be 150 mm.	
^{b)} The length of a test specimen should be determined considering the length of a loading platen of the testing machine.	

7.2 Apparatus

The apparatus used for making test specimens shall be as specified in **5.2**.

7.3 Compaction of concrete

Compaction of the concrete shall be as specified in **5.3**.

7.4 Tolerances on dimensions of test specimens

The tolerances on dimensions of test specimens shall be as follows.

- The tolerance on the specified diameter of the test specimens shall be within 0.5 %.
- The straightness ¹⁰⁾ of the side of cylinder ⁹⁾ shall be within 0.1 % of the diameter.

Notes ⁹⁾ When splitting tensile strength test is performed, the sides of cylinder where upper and lower loading platens come into contact with the test specimen are taken as contact lines.

- ¹⁰⁾ The straightness referred to here is the distance between two parallel lines, one including the highest point and the other including the lowest point of the side of the cylinder.

8 Removal of mould and curing of test specimens

The removal of mould and the curing of test specimens shall be as follows.

- a) Concrete placed in the moulds shall be demoulded after it has hardened. The time for demoulding shall be at least 16 h, but not longer than 3 days ¹¹⁾ after the end of placing. During this period, the placed concrete shall be protected against shock, vibration and water evaporation.

Note ¹¹⁾ Basically, within the time when the hardened concrete is not adversely affected.

- b) The curing temperature of the test specimens shall be $20\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$, unless otherwise specified to suit a particular purpose of the test ¹²⁾. The test specimens shall be cured under the given conditions ¹³⁾ until just before the strength test after removal of moulds. When cured in water, the test specimens shall not be exposed to running water.

Notes ¹²⁾ When test specimens have been cured at a temperature other than $20\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$, this temperature shall be recorded.

¹³⁾ The test specimens should be stored in water or in a humid ambient atmosphere (relative humidity of at least 95 %) to keep them humid.

9 Conveyance of test specimens

During conveyance of the test specimens, they shall be kept in the given curing conditions. When cured under humid conditions until just before the strength test, the test specimen shall be protected against loss of moisture.

10 Report

The report shall include the following.

- a) Mandatory matters
- 1) Method of preparation of sample or sampling method
 - 2) Mix proportion of concrete
 - 3) Temperature and humidity at the time of making the test specimen
 - 4) Date and time of making the test specimen
 - 5) Curing method and curing temperature
 - 6) Shape, dimensions and compacting method of the test specimen
- b) Matters to be reported if necessary
- 1) Identification number of the test specimen
 - 2) Purpose of tests
 - 3) Type and quality of materials used