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**Aggregates for concrete — Test  
methods for mechanical and physical  
properties —**

**Part 4:  
Determination of ten percent fines  
value (TFV)**

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ISO copyright office  
CP 401 • Ch. de Blandonnet 8  
CH-1214 Vernier, Geneva  
Phone: +41 22 749 01 11  
Fax: +41 22 749 09 47  
Email: [copyright@iso.org](mailto:copyright@iso.org)  
Website: [www.iso.org](http://www.iso.org)

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# Contents

	Page
Foreword .....	iv
<b>1 Scope</b> .....	<b>1</b>
<b>2 Normative references</b> .....	<b>1</b>
<b>3 Terms and definitions</b> .....	<b>1</b>
<b>4 Principle</b> .....	<b>2</b>
<b>5 Sampling</b> .....	<b>2</b>
<b>6 Apparatus</b> .....	<b>2</b>
6.1 General apparatus .....	2
6.2 Additional apparatus .....	4
<b>7 Preparation of test portions and specimens</b> .....	<b>4</b>
7.1 Test portions .....	4
7.2 Test specimens in a dry condition .....	5
7.3 Test specimens in a soaked condition .....	5
<b>8 Procedure</b> .....	<b>6</b>
8.1 Aggregates in dry condition .....	6
8.2 Aggregates in a soaked condition .....	7
<b>9 Calculations and expression of results</b> .....	<b>7</b>
<b>10 Test report</b> .....	<b>7</b>
<b>Annex A (informative) Recommended method for determining the ten per cent fines value for other size fractions of aggregate</b> .....	<b>8</b>

ISO 20290-4:2019

<https://standards.iteh.ai/catalog/standards/sist/002af4d7-a0fd-4cb9-af2b-70b0756f0ec0/iso-20290-4-2019>

## 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.

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](http://www.iso.org/directives)).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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](http://www.iso.org/iso/foreword.html).

This document was prepared by Technical Committee ISO/TC 71, *Concrete, reinforced concrete and pre-stressed 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](http://www.iso.org/members.html).

A list of all parts in the ISO 20290 series can be found on the ISO website.

# Aggregates for concrete — Test methods for mechanical and physical properties —

## Part 4: Determination of ten percent fines value (TFV)

### 1 Scope

This document gives the test method for determination of ten percent fines value (*TFV*) of aggregates. This method gives a relative measure of the resistance of the aggregate crushing under the gradually applied compressive load.

It covers two sets of procedures:

- the first procedure is applicable for aggregates tested in dry condition; and
- the second procedure is applicable for aggregates tested in a soaked condition.

NOTE 1 Generally, the test can be done under dry conditions. However, the engineer in charge can choose to test them in soaked condition, if necessary.

The method is applicable to aggregates of different strengths covering both weak and strong aggregates. It is applicable to standard aggregates, i.e. passing a 14,0 mm test sieve and retained on 10,0 mm test sieve.

National standards can also exist for the aggregate size fraction to be taken for this test. In case this definite size fraction is not available, the test can be made on other sizes, given in [Annex A](#). The comparison of results of non-standard sizes with standard size aggregates is not possible due to lack of available data.

NOTE 2 Minor variations in grading divisions can be allowed in respective national standards.

### 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 565, *Test sieves — Metal wire cloth, perforated metal plate and electroformed sheet — Nominal sizes of openings*

### 3 Terms and definitions

For the purposes of this document, the following terms and definitions 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**  
**ten percent fines value**  
*TFV*

force required to produce ten percent fines with the percentage of material passing in the range 7,5 % to 12,5 %, from [Formula \(1\)](#):

$$TFV = \frac{14 F_{\max}}{m + 4} \tag{1}$$

where

$F_{\max}$  is the maximum force (in kN);

$m$  is the percentage of material passing the 2,36 mm test sieve at the maximum force.

**4 Principle**

A test sample of aggregates is compacted in a specified manner into a steel cylinder fitted with a freely moving plunger. The sample is then subjected to a load applied through the plunger. The aggregate gets crushed under this load. The degree of crushing depends on the crushing resistance of the aggregates, which is assessed by a sieving test on the crushed sample. The procedures repeated with various loads to determine the maximum force which generates a given sieve analysis. This maximum force is taken as the *TFV*.

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**5 Sampling**

The sample used for the test (the laboratory sample) may be taken in accordance with the procedure described in the relevant national standards. [ISO 20290-4:2019](#)

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**6 Apparatus**

**6.1 General apparatus**

**6.1.1 Compression testing machine**, capable of applying any force up to 500 kN and which can be operated to give a uniform rate of loading so that this force is reached in 10 min (see [8.1.2](#)).

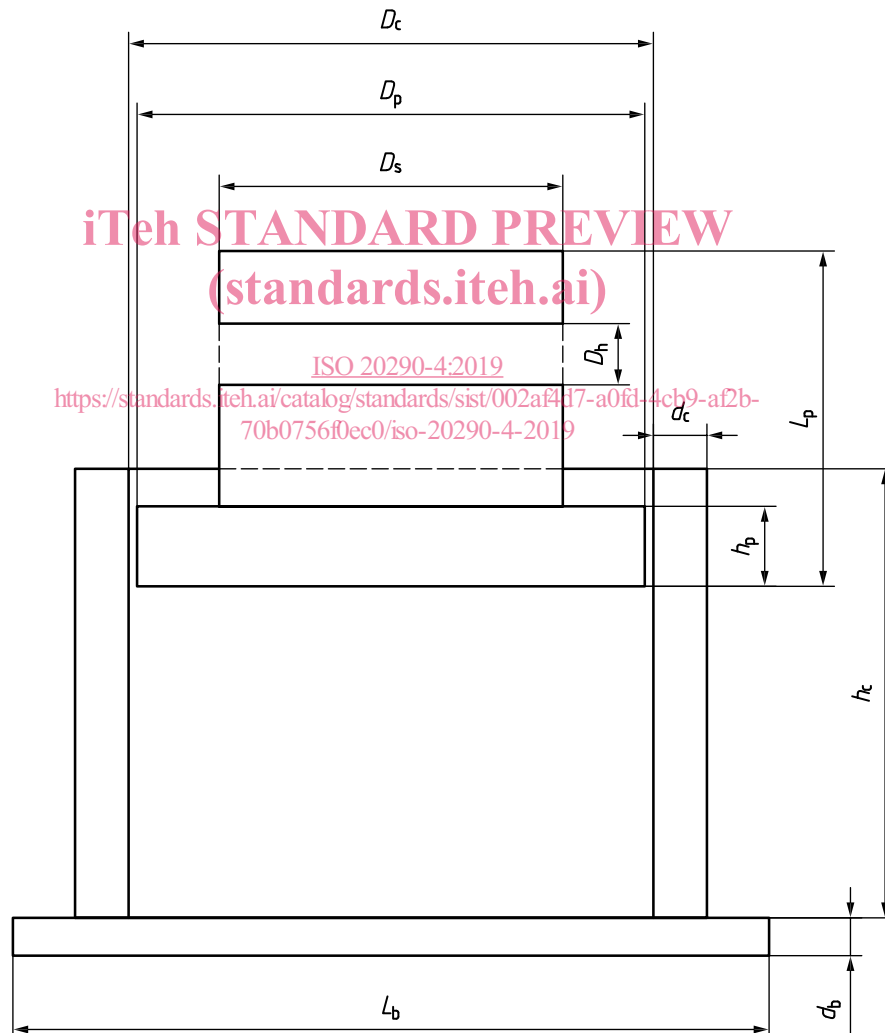
**6.1.2 Steel cylinder and plunger**, with an open-ended steel cylinder of nominal 150 mm internal diameter and with plunger and base plate as per [Figure 1](#) and [Table 1](#).

**Table 1 — Principal dimensions of cylinder and plunger apparatus**

Component	Dimensions (see <a href="#">Figure 1</a> )	Nominal 150 mm internal diameter of cylinder mm	Nominal 75 mm internal diameter of cylinder (see <a href="#">Annex A</a> ) mm
Cylinder	Internal diameter, $D_c$	154 ± 0,5	78,0 ± 0,5
	Internal depth, $h_c$	125 to 140	70,0 to 85,0
	Minimum wall thickness, $d_c$	16,0	8,0

Table 1 (continued)

Component	Dimensions (see <a href="#">Figure 1</a> )	Nominal 150 mm internal diameter of cylinder	Nominal 75 mm internal diameter of cylinder (see <a href="#">Annex A</a> )
		mm	mm
Plunger	Diameter of piston, $D_p$	$152 \pm 0,5$	$76,0 \pm 0,5$
	Diameter of stem, $D_s$	$>95$ to $\leq D_p$	$>45$ to $\leq D_p$
	Overall length of piston plus stem, $L_p$	100 to 115	60,0 to 80,0
	Minimum depth of piston, $h_p$	not less than 25,0	not less than 19,0
	Diameter of hole, $D_h$	$20,0 \pm 0,1$	$10,0 \pm 0,1$
Baseplate	Minimum thickness, $d_b$	10	10
	Length of each side of square, $L_b$	200 to 230	110 to 115



NOTE See [Table 1](#).

**Figure 1 — Outline form of cylinder and plunger apparatus for ten per cent fines test**

The surfaces in contact with the aggregate shall be machined and maintained in a smooth condition and case hardened or otherwise treated to have a hardness value of 650 HV.

**6.1.3 Tamping rod**, made out of straight iron or steel bar of circular cross-section,  $(16 \pm 1)$  mm diameter and  $(600 \pm 5)$  mm long, with both end semi-spherical.

**6.1.4 Balance**, of at least 3 kg capacity readable to 1 g.

**6.1.5 Cylindrical metal measure**, for measuring the sample, of sufficient rigidity to retain its form under rough usage and having an internal diameter of  $(115 \pm 1)$  mm and an internal depth of  $(180 \pm 1)$  mm.

**6.1.6 Test sieves** with square-hole perforated plate of sizes 14,0 mm and 10,0 mm and a woven wire 2,36 mm test sieve. The test sieves shall comply with ISO 565.

**6.1.7 Well-ventilated oven**, thermostatically controlled at a temperature of  $(105 \pm 5)$  °C.

**6.1.8 Metal tray**, of known mass large enough to contain 3 kg of aggregate.

**6.1.9 Rubber mallet**, of suitable handle and minimum weight of 400 g.

**6.1.10 Brush**, with stiff bristles.

NOTE Minor variations in apparatus ranges/dimensions can exist in national standards.

## 6.2 Additional apparatus

**6.2.1 Drying cloths or absorbent paper**, for the surface drying of the aggregate after it has been soaked in water, e.g. two hand towels of a size not less than 750 mm × 450 mm or rolls of absorbent paper of suitable size and absorbency.

**6.2.2 One or more wire-mesh baskets**, having apertures not larger than 6,5 mm or a perforated container of convenient size with hangers for lifting purposes.

**6.2.3 Stout watertight container**, in which the basket(s) can be immersed.

## 7 Preparation of test portions and specimens

### 7.1 Test portions

Reduce the laboratory sample using the standard procedures to produce a test portion of sufficient mass to produce three test specimens of 14 mm to 10 mm size fraction.

NOTE A single test specimen is that quantity of material required to fill the cylinder (see [8.1.1](#) and [Table 2](#)).



**Table 2 — Guide to minimum mass of test: Portions required to obtain a suitable mass of material to determine the ten percent fine value**

Grading of the aggregate mm	Minimum mass of the test portion <sup>a</sup> kg
All-in aggregate 40 max. size	60
All-in aggregate 20 max. size	45
Graded aggregate 40 to 5	40
Graded aggregate 20 to 5	25
Graded aggregate 14 to 5	15
<sup>a</sup> For normal density aggregates.	

NOTE In case of single size aggregates being supplied for the test, the minimum mass of the test portion can vary accordingly.

## 7.2 Test specimens in a dry condition

**7.2.1** Thoroughly sieve the entire surface dry test portion on the 14 mm and 10 mm test sieves to remove the oversize and undersize fractions. Divide the resulting 14 mm to 10 mm fraction to produce three test specimens each of mass such that the depth of the material in the cylinder is approximately 100 mm after tamping as described in 8.1 (see NOTE).

NOTE The appropriate quantity of aggregate can be found conveniently by filling the cylindrical measure in three layers of approximately equal depth. Tamp each layer 25 times, from a height of approximately 50 mm above the surface of the aggregate, with the rounded end of the tamping rod. Level off using the tamping rod as a straight edge.

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**7.2.2** Dry the test specimens by heating at a temperature of  $(105 \pm 5)$  °C for a period of not more than 4 h. Cool to room temperature before testing. For temperature-sensitive recycled aggregates, a drying temperature of  $(40 \pm 5)$  °C shall be used. Record the mass of material comprising the test specimens.

## 7.3 Test specimens in a soaked condition

**7.3.1** Prepare the test specimens using the procedure described in 7.2 except that the test portion is tested in the as-received condition and not as oven-dried material. Place each test specimen (see NOTE) in the wire basket and immerse it in the water in the container with a cover of at least 50 mm of water above the top of the basket.

Immediately after immersion remove the entrapped air from the specimen by lifting the basket 25 mm above the base of the container and allowing it to drop 25 times at a rate of about once a second. Keep the basket and aggregate completely immersed during the operation and for a subsequent period of between  $(24 \pm 2)$  h and maintain the water temperature at  $(20 \pm 5)$  °C [ $(27 \pm 5)$  °C for tropical countries].

NOTE The appropriate quantity of aggregate to use can be found as described in 7.2.

**7.3.2** After soaking, remove the specimen of aggregate from the basket and blot the free water from the surface with the absorbent cloths. Test specimens in a soaked condition shall be tested immediately after this operation.