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## Natural aggregates for concrete

*Granulats pour béton*

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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.

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 on 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 the following URL: [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html).

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# Natural aggregates for concrete

## 1 Scope

This document specifies the properties and requirements of aggregates obtained by processing natural materials and mixtures of these aggregates for use in concrete. It is applicable to aggregates with an oven-dried particle density greater than 2,00 Mg/m<sup>3</sup> (2 000 kg/m<sup>3</sup>) in accordance with ISO 22965 (all parts).

This document incorporates a general requirement that natural aggregates are not intended to release any harmful substances in excess of the maximum permitted levels specified for the material or permitted in the national regulations of the place in use.

National provisions, preferably given in a national annex or a project specification, can specify additional or deviating requirements.

NOTE Requirements for the end use of aggregates in concrete are specified in ISO 22965 (all parts).

## 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 6274, *Concrete — Sieve analysis of aggregates*

ISO 6782, *Aggregates for concrete — Determination of bulk density*

ISO 6783, *Coarse aggregates for concrete — Determination of particle density and water absorption — Hydrostatic balance method*

ISO 7033, *Fine and coarse aggregates for concrete — Determination of the particle mass-per-volume and water absorption — Pycnometer method*

## 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:

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

— ISO Online browsing platform: available at <http://www.iso.org/obp>

### 3.1

#### **aggregate**

granular material of natural, manufactured or recycled origin used in construction

### 3.2

#### **natural aggregate**

aggregate from mineral sources which has been subjected to nothing more than mechanical processing, such as crushing, washing and sieving

### 3.3

#### **aggregate size**

designation of aggregate in terms of lower (d) and upper (D) sieve sizes expressed as d/D

Note 1 to entry: This designation accepts the presence of some particles which are retained on the upper sieve (oversize) and some which pass the lower sieve (undersize).

Note 2 to entry: Other designations may be used where specified in a national standard.

### 3.4

#### **grading**

particle size distribution expressed as the percentages by mass passing a specified set of sieves

### 3.5

#### **fines**

particle size fraction of an aggregate that passes the 0,063 mm sieve

Note 1 to entry: The 0,075 mm sieve may be used where specified in a national standard.

### 3.6

#### **coarse aggregate**

designation given to the larger aggregate sizes with D greater than 4 mm and d greater than or equal to 1 mm

Note 1 to entry: Aggregates that do not fit the definitions for fine or coarse (1 mm to 3 mm or 2 mm to 4 mm) are treated as coarse aggregate.

Note 2 to entry: Coarse aggregate may be separated by other sizes where specified in a national standard.

### 3.7

#### **fine aggregate**

designation given to the smaller aggregate sizes with D less than or equal to 4 mm and d = 0

Note 1 to entry: Fine aggregate can be produced from natural disintegration of rock or gravel and/or by the crushing of rock or gravel or processing of manufactured aggregates.

Note 2 to entry: Fine aggregate may be separated by other sizes where specified in a national standard.

### 3.8

#### **all-in aggregate**

aggregate consisting of a mixture of coarse and fine aggregates and fines with D greater than 4 mm and d = 0

Note 1 to entry: It can be produced without separating into coarse and fine fractions or it can be produced by combining coarse and fine aggregates.

### 3.9

#### **filler aggregate**

aggregate, most of which passes a 0,063 mm sieve, which can be added to construction materials to provide certain properties

Note 1 to entry: Other sieve sizes, as the 0,075 mm sieve, may be used where specified in a national standard.

### 3.10

#### **declared value**

value declared and documented by a manufacturer, which is derived from measured values under specified conditions and rules, for identification of performance requirements



## 4 Symbols and abbreviated terms

Symbol	Description
<i>AAV</i>	resistance to surface abrasion — aggregate abrasion value
<i>AN</i>	resistance to abrasion from studded tyres — Nordic abrasion value
<i>AS</i>	acid soluble sulfate content
<i>F</i>	resistance to freezing and thawing — percentage loss of mass
<i>f</i>	finer content
<i>F<sub>EC</sub></i>	resistance to freezing and thawing in the presence of salt (extreme conditions) — percentage loss of mass
<i>FI</i>	particle shape of coarse and all-in aggregates — flakiness index
<i>LA</i>	resistance to fragmentation — Los Angeles coefficient
<i>MB</i>	finer quality — methylene method
<i>MD</i>	resistance to wear — micro-Deval coefficient
<i>MS</i>	magnesium sulfate value
<i>PSV</i>	resistance to polishing of surface courses — polished stone value
<i>S</i>	total sulfur content
<i>SC</i>	shell content of coarse and all-in aggregates
<i>SE</i>	finer quality — sand equivalent method
<i>SI</i>	particle shape of coarse and all-in aggregates — shape index
<i>SS</i>	sodium sulfate value
<i>SZ</i>	resistance to fragmentation — impact value
<i>WA</i>	water absorption value after 24 h

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## 5 Geometrical requirements

### 5.1 General

The necessity for testing and declaring all properties specified in this clause shall be limited according to the particular application at end use or origin of the aggregate. When required, the aggregates shall be tested as specified in this clause to determine the relevant geometrical properties.

NOTE Guidance on selection of appropriate categories for specific applications can be found in national provisions in the place of use of the aggregate.

### 5.2 Aggregate sizes

All aggregates shall be described in terms of aggregate sizes using the designations  $d/D$  and shall conform to the grading requirements specified in 5.3, except for aggregates added as fillers, which shall be specified as filler aggregate.

Aggregate sizes shall be specified using a pair of sieve sizes selected from one of the basic sets given in Table 1. The basic sets are based on the R 20 series in ISO 565.

Other sieves specified in national standards may be used.

**Table 1 — Sieve sizes for specifying aggregate sizes**

Basic set 1 mm	Basic set 2 mm	Basic set 3 mm	Basic set 4 mm
0	0	0	0
1	1	1	1,25 (1,2)
2	2	2	2,5
4	4	4	-
—	5,6 (5)	—	5,0
—	—	6,3 (6)	—
8	8	8	—
—	—	10	10
—	11,2 (11)	—	—
—	—	12,5 (12)	—
—	—	14	—
16	16	16	—
—	—	20	20
—	22,4 (22)	—	—
31,5 (32)	31,5 (32)	31,5 (32)	31,5 (30)
—	—	40	40
—	45	—	—
—	56	—	50
63	63	63	63 (60)
80	80	80	80
100	100	100	100

NOTE Rounded sizes shown in parentheses can be used as simplified descriptions of aggregate sizes.

### 5.3 Grading

#### 5.3.1 General

The grading of the aggregate shall be determined in accordance with ISO 6274 and shall conform to the requirements of 5.3.2 to 5.3.5 as appropriate to its aggregate size d/D.

Aggregates may comprise single sizes, all-in aggregates or combinations of two or more sizes.

Aggregates supplied as a mixture of different sizes or types should be uniformly blended. When aggregates of significantly different density are blended, caution is necessary to avoid segregation.

Where the specification requires the use of sieves which are a fraction of the upper sieve size (e.g. D/2 or D/1,4) the sieve chosen shall be the next nearest from basic set plus set 1 or basic set plus set 2.

NOTE When a sieve size of the ISO 565 R 20 series is closer to the calculated d/2, D/1,4 or D/2 size, the producer can choose to use this R 20 size.

#### 5.3.2 Coarse aggregates

Coarse aggregates shall conform to the general requirements specified in Table 2, appropriate to their size designation D/d.

**Table 2 — Overall limits and tolerances for coarse aggregate**

Coarse aggregate			
Property	Requirement		
	Tolerance class 1	Tolerance Class 2	Tolerance Class 3
Particle distribution (grading):			
— percentage > d/2	Declared value ± 7,0 %	Declared value ± 5,0 %	Declared value ± 3,0 %
— percentage > d	Declared value ± 5,0 %	Declared value ± 10,0 %	Declared value ± 7,0 %
— percentage > mid sieve, if D > 2d	Declared value ± 20,0 %	Declared value ± 15,0 %	Declared value ± 12,0 %
— percentage > D	Declared value ± 15,0 %	Declared value ± 10,0 %	Declared value ± 7,0 %
— percentage < 2D	100 %	100 %	100 %
Fines	Declared value ± 3,0 %	Declared value ± 2,0 %	Declared value ± 1,0 %
Particle density	Declared value ± 0,09 Mg/m <sup>3</sup>	Declared value ± 0,07 Mg/m <sup>3</sup>	Declared value ± 0,05 Mg/m <sup>3</sup>
Water absorption	Declared value ± 0,5 %	Declared value ± 0,3 %	Declared value ± 0,2 %
Particle shape (flakiness index)	Declared value ± 9	Declared value ± 7	Declared value ± 5

### 5.3.3 Fine aggregates

Fine aggregates shall conform to the general requirements of [Table 3](#), appropriate to their upper sieve size D.

National standards specifying other sieve sizes may be used where available.

NOTE Guidance on the description of coarseness/fineness of fine aggregates is given in [Annex A](#).

**Table 3 — Overall limits and tolerances for fine aggregate**

Fine aggregate			
Property	Requirement		
	Tolerance class 1	Tolerance Class 2	Tolerance Class 3
Particle distribution (grading):			
— percentage > 0,125 mm	Declared value ± 5,0 %	Declared value ± 3,0 %	Declared value ± 2,0 %
— percentage > 0,5 mm	Declared value ± 8,0 %	Declared value ± 5,0 %	Declared value ± 3,0 %
— percentage > 2 mm	Declared value ± 15,0 %	Declared value ± 10,0 %	Declared value ± 7,0 %
— percentage > D	Declared value ± 9,0 %	Declared value ± 7,0 %	Declared value ± 6,0 %
Fines	Declared value ± 5,0 %	Declared value ± 3,0 %	Declared value ± 2,0 %
Particle density	Declared value ± 0,05 Mg/m <sup>3</sup>	Declared value ± 0,03 Mg/m <sup>3</sup>	Declared value ± 0,02 Mg/m <sup>3</sup>
Water absorption	Declared value ± 0,5 %	Declared value ± 0,3 %	Declared value ± 0,2 %

### 5.3.4 All-in aggregates

All-in aggregates shall conform to the general requirements of [Table 4](#), appropriate to their upper sieve size D.

National Standards specifying other sieve sizes may be used where available.