INTERNATIONAL STANDARD

ISO 3290

Third edition
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Rolling bearings — Balls — Dimensions and tolerances

Roulements — Billes — Dimensions et tolérances

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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 3.

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 International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 3290 was prepared by Technical Committee ISO/TC 4, *Rolling bearings*.

This third edition cancels and replaces the second edition (ISO 3290:1998) which has been technically revised.

Annexes A and B form a normative part of this International Standard.

Rolling bearings — Balls — Dimensions and tolerances

1 Scope

This International Standard specifies requirements for finished steel balls for rolling bearings.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 1132-1:2000, *Rolling bearings — Tolerances — Part 1: Terms and definitions*

ISO 4288:1996, *Geometrical Product Specifications (GPS) — Surface texture: Profile method — Rules and procedures for the assessment of surface texture*

ISO 4291:1985, *Methods for the assessment of departure from roundness — Measurement of variations in radius*

ISO 5593:1997, *Rolling bearings — Vocabulary*

ISO 15241:2001, *Rolling bearings — Symbols for quantities*

3 Terms and definitions

For the purposes of this International Standard, the terms and the definitions given in ISO 1132-1, ISO 5593 and ISO 15241 and the following apply.

3.1
nominal ball diameter
D_w
diameter value which is used for the general identification of a ball size

3.2
single ball diameter
D_{ws}
distance between two parallel planes tangential to the actual surface of a ball

3.3
mean ball diameter
D_{wm}
arithmetical mean of the largest and the smallest of the single diameters of a ball

3.4
variation of ball diameter
V_{Dws}
difference between the largest and the smallest of the single diameters of a ball

3.5
surface irregularities and form parameters
various types of deviation from the perfect spherical ball surface, uniformly distributed and repeated around the ball surface

NOTE The deviations to which limits can be attributed are:

— deviation from spherical form;

— waviness;

— surface roughness.

3.5.1
deviation from spherical form
greatest radial distance, in any equatorial plane, between the smallest circumscribed sphere and the greatest inscribed sphere, with their centres common to the least square sphere centre

NOTE Information about the measurement of this deviation is given in annex A.

3.5.2
waviness
surface irregularities of random or periodical deviation from the ideal spherical form

NOTE It is recommended that waviness be evaluated as velocity amplitude. In practice, the waviness components are separated from the real surface by a waviness analyser (filters).

3.5.3
surface roughness
surface irregularities with relatively small spacings, which usually include irregularities resulting from the method of manufacture being used and/or other influences

NOTE These irregularities are considered within the limits that are conventionally defined, e.g., within the limits of the sampling length.

3.6
surface defect
element, irregularity or group of elements and irregularities of the real surface, unintentionally or accidentally caused during manufacture, storage, handling or use of the surface

NOTE These types of element or irregularity differ considerably from those constituting the surface roughness and should not be considered during the measurement of the surface roughness (see 4.2, note 2). Surface defects (and their limits) are not specified in this International Standard.

3.7
ball lot
definite quantity of balls manufactured under conditions presumed uniform and which is considered as an entity

3.8
mean diameter of ball lot
D_{wmL}
arithmetical mean of the mean diameters of the largest ball and the smallest ball in a ball lot

3.9
variation of ball lot diameter
V_{DwL}
difference between the mean diameters of the largest ball and the smallest ball in a ball lot

3.10
ball grade
G
specific combination of dimensional, form, surface roughness and sorting tolerances for balls

NOTE Ball grade is identified by the letter G and a number.

3.11
ball gauge
S
amount by which the mean diameter of a ball lot should differ from the nominal ball diameter, this amount being one of an established series

NOTE 1 Each ball gauge is a whole multiple of the ball gauge interval established for the ball grade in question (see Table 3 and annex B).

NOTE 2 A ball gauge, in combination with the ball grade and nominal diameter, should be considered as the most exact ball size specification to be used by a customer for ordering purposes.

3.12
deviation of a ball lot from ball gauge
Δ_S
difference between the mean diameter of a ball lot and the sum of the nominal ball diameter and the ball gauge

$$\Delta_S = D_{\mathrm{wmL}} - \left(D_{\mathrm{w}} + S\right)$$

See Table 3 and annex B.

3.13
ball subgauge
amount of an established series of amounts, which is the nearest to the actual deviation from the ball gauge of a ball lot

NOTE 1 Each ball subgauge is a whole multiple of the ball subgauge interval established for the ball grade in question (see Table 3 and annex B).

NOTE 2 The ball subgauge, in combination with the nominal ball diameter and the ball gauge, is used by ball manufacturers to denote the mean diameter of a ball lot and should not be used by customers for ordering purposes.

3.14
hardness
measure of resistance to penetration as determined by specific methods

4 Requirements

4.1 Ball size

The preferred nominal ball diameters are given in Table 1. Where applicable, the corresponding inch sizes are given for reference purposes only.

4.2 Quality of geometry and surface

Requirements for:

— variation of ball diameter, see Table 2;

— deviation from spherical form, see Table 2;

— waviness, see note 1;

— surface roughness, see Table 2;

— surface appearance and defects, see note 2.

Measurement of surface roughness shall be made in accordance with ISO 4288.

NOTE 1 Limits and measuring methods for waviness should be agreed upon between customer and supplier.

NOTE 2 Surface appearance characteristics, local defects, scratches and the like are subject to agreement between customer and supplier.

4.3 Sorting accuracy and ball gauges

Table 3 comprises the applicable values for:

— variation of ball lot diameter;

— gauge interval;

— preferred gauges;

— subgauge interval;

— subgauges.

4.4 Hardness

Hardness values and the measuring method shall be agreed upon between customer and supplier.

Table 1 — Preferred nominal ball diameters

Nominal ball diameter D_w mm	Corresponding inch size (reference) in	Nominal ball diameter D_w mm	Corresponding inch size (reference) in	Nominal ball diameter D_w mm	Corresponding inch size (reference) in
0,3		9,525	3/8	30,162 5	1 3/16
0,396 88	1/64	9,921 88	25/64	31,75	1 1/4
0,4		10		32	
0,5		10,318 75	13/32	33	
0,508	0,02	10,5		33,337 5	1 5/16
0,6		11		34	
0,635	0,025	11,112 5	7/16	34,925	1 3/8
0,68		11,5		35	
0,7		11,509 38	29/64	36	
0,793 75	1/32	11,906 25	15/32	36,512 5	1 7/16
0,8		12		38	
1		12,303 12	31/64	38,1	1 1/2
1,190 62	3/64	12,5		39,687 5	1 9/16
1,2		12,7	1/2	40	
1,5		13		41,275	1 5/8
1,587 5	1/16	13,493 75	17/32	42,862 5	1 11/16
1,984 38	5/64	14		44,45	1 3/4
2		14,287 5	9/16	45	
2,381 25	3/32	15		46,037 5	1 13/16
2,5		15,081 25	19/32	47,625	1 7/8
2,778 12	7/64	15,875	5/8	49,212 5	1 15/16
3		16		50	
3,175	1/8	16,668 75	21/32	50,8	2
3,5		17		53,975	2 1/8
3,571 88	9/64	17,462 5	11/16	55	
3,968 75	5/32	18		57,15	2 1/4
4		18,256 25	23/32	60	
4,365 62	11/64	19		60,325	2 3/8
4,5		19,05	3/4	63,5	2 1/2
4,762 5	3/16	19,843 75	25/32	65	
5		20		66,675	2 5/8
5,159 38	13/64	20,5		69,85	2 3/4
5,5		20,637 5	13/16	70	
5,556 25	7/32	21		73,025	2 7/8
5,953 12	15/64	21,431 25	27/32	75	
6		22		76,2	3
6,35	1/4	22,225	7/8	79,375	3 1/8
6,5		22,5		80	
6,746 88	17/64	23		82,55	3 1/4
7		23,018 75	29/32	85	
7,143 75	9/32	23,812 5	15/16	85,725	3 3/8
7,5		24		88,9	3 1/2
7,540 62	19/64	24,606 25	31/32	90	
7,937 5	5/16	25		92,075	3 5/8
8		25,4	1	95	
8,334 38	21/64	26		95,25	3 3/4
8,5		26,193 75	1 1/32	98,425	3 7/8
8,731 25	11/32	26,987 5	1 1/16	100	
9		28		101,6	4
9,128 12	23/64	28,575	1 1/8	104,775	4 1/8
9,5		30			