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Rolling bearings — Radial bearings, retaining slots — Dimensions, geometrical product specifications (GPS) and tolerance values

Roulements — Roulements radiaux, encoches de retenue — Dimensions, spécification géométrique des produits (GPS) et valeurs de tolérance

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Contents

Page

Foreword

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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).

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).

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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.

This document was prepared by Technical Committee ISO/TC 4, *Rolling bearings*, Subcommittee SC 12, *Ball bearings*.

This third edition cancels and replaces the second edition (ISO 20515:2012), which has been technically revised.

The main changes compared to the previous edition are as follows:

— the title has been updated;

— the geometrical product specification (GPS) has been modified;

— the specification for the location of the retaining slot's bottom surface has been changed from a distance to a position specification, whereas the tolerance values have to be recalculated and rounded;

— the structure of the tables has been revised.

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.

Introduction

This document is a machine element geometry standard as defined in the geometrical product specification system (GPS system) as presented in matrix model of ISO 14638[5].

The fundamental rules of ISO GPS given in ISO 8015[2] apply to this document and the default decision rules given in ISO 14253-1[3] apply to specifications made in accordance with this document, unless otherwise indicated.

The connection between functional requirements, measuring technique, and measuring uncertainty is always intended to be considered. For measurement uncertainty, it is intended that ISO 14253-2[4] should be considered.

Rolling bearings — Radial bearings, retaining slots — Dimensions, geometrical product specifications (GPS) and tolerance values

1 Scope

This document specifies dimensions and tolerances of retaining slots to be used for outer rings of single-row angular contact ball bearings, four-point-contact ball bearings and radial cylindrical roller bearings.

The retaining slots are not suitable for use in the outer rings of sealed and shielded radial ball bearings, nor in the outer rings of radial cylindrical roller bearings without ribs.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirement 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 15, *Rolling bearings — Radial bearings — Boundary dimensions, general plan*

ISO 1101, *Geometrical product specifications (GPS) — Geometrical tolerancing — Tolerances of form, orientation, location and run-out*

ISO 5593, *Rolling bearings — Vocabulary*

ISO 14405-1, *Geometrical product specifications (GPS) — Dimensional tolerancing — Part 1: Linear sizes*

ISO 15241, *Rolling bearings — Symbols for physical quantities*

ISO 22872[1], *Rolling bearings — Geometrical product specifications (GPS) — Symbols, terms and definitions associated with GPS*

3 Terms and definitions

For the purpose of this document the terms and definitions given in ISO 15, ISO 1101, ISO 5593, ISO 14405-1, ISO 15241, ISO 22872 and the following 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 https://www.electropedia.org/

3.1
retaining slot
angled slot in an outer ring at the intersection of the outside surface and the face of the ring

Note 1 to entry: See Figures 1 and 2; also outline illustration in ISO 5593:2019, Figure 155.

Note 2 to entry: The purpose of the slot is to provide a simple means of preventing rotation of the outer ring of a bearing in relation to the application where it is mounted.

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1) Under preparation. Stage at the time of publication: ISO/DIS 22872:2021.

[SOURCE: ISO 5593:2019, 3.2.2.25, modified — "See Figures 1 and 2; also outline illustration in" was added in Note 1 to entry.]

3.2
b
nominal retaining slot width

3.2.1
*Δb*g
lower limit deviation of a maximum inscribed size of retaining slot width

Note 1 to entry: The term "deviation" is defined in ISO 286-1:2010[1], 3.2.4 and the term "maximum inscribed size" is defined in ISO 14405-1:2016, 3.7.1.2.

3.2.2
*Δb*s
upper limit deviation of two-point size of retaining slot width

Note 1 to entry: The term "deviation" is defined in ISO 286-1:2010[1], 3.2.4 and the term "two-point size" is defined in ISO 14405-1:2016, 3.6.1.

3.3
PS2
position specification of retaining slots median planes with respect to the axis established from the outer ring outside surface

Note 1 to entry: The position specification of a median plane is specified in ISO 1101:2017, 17.13.4.

3.4
D
nominal bearing outside diameter

[SOURCE: ISO 15241:2012, 2.17]

3.5
h
nominal distance between the side face of outer ring and the intersection between the bottom surface of the retaining slot and the outer ring outside surface

3.6
PS1
position specification of retaining slot bottom surface with respect to the axis established from the outer ring outside surface and the outer ring side face

Note 1 to entry: The position specification of a planar surface is specified ISO 1101:2017, 17.13.5.

3.7
r_0
fillet radius at bottom of retaining slot

Note 1 to entry: The lower limit of r_0 should not be 0 and shall be appropriately dimensioned to avoid stress concentrations. Indicated values are tolerance values. This is expressed in Figures 1 and 2 by r_0 max. In technical drawings this is expressed by e.g. 0,5 max.

4 Graphical description

To express that the ISO GPS system, ISO 8015[2], is applied, the dimensional and geometrical characteristics shall be included in the technical product documentation (for example, on the drawing). The dimensional and geometrical specifications associated to these characteristics are described in Figure 1 and Figure 2.

The ISO/TC 4 symbols in context with tolerance values, deviation limits and limit values shall be preceded by letter "t" in figures and tables. The letter "t" is written in italic font. The symbol group shall be subscripted to "t" with all symbols in upright font.

EXAMPLE $t_{\Delta bs}$

For values of upper/lower limit of size the letter "t" shall not be indicated, because in the ISO/TC 4 context those values are usually interpreted as nominal dimensions.

According to ISO 8015 specifications shall be completed with specification operators, e.g. filtration. These may be agreed between manufacturer and customer case by case.
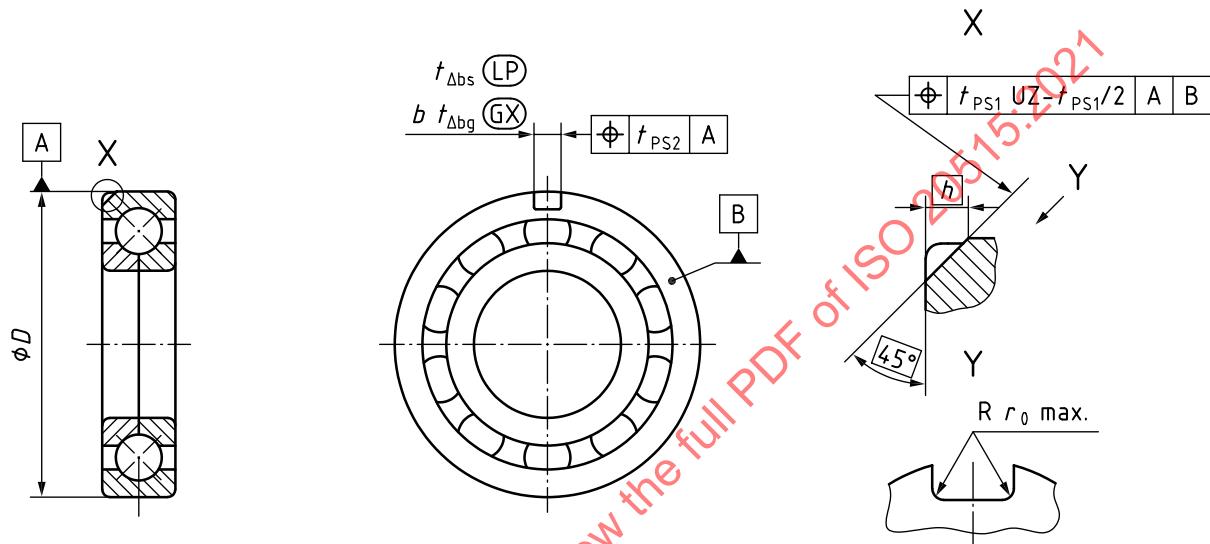
Figure 1 — Radial bearing with one retaining slot
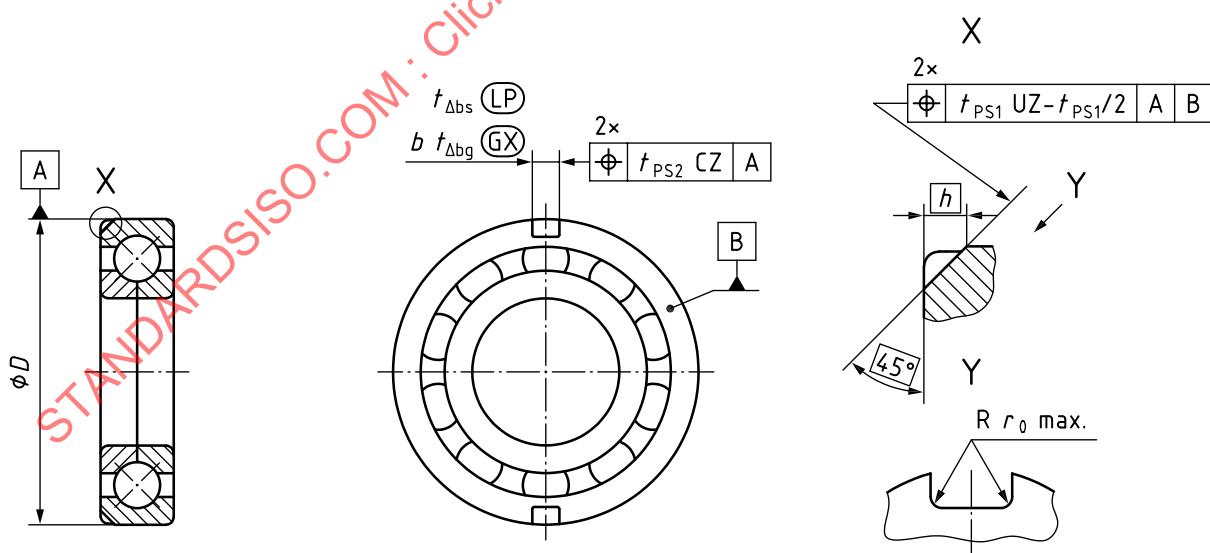
Figure 2 — Radial bearing with two diametrically opposed retaining slots

NOTE   Figures 1 and 2 show four-point-contact ball bearings with one retaining slot and two retaining slots, respectively. They are also appropriate for the other bearing types given in the scope.

For an example of drawing indications of characteristics with specification for retaining slot see Annex A. For an application example for a retaining slot, see Annex B.

5 Dimensions

5.1 General

The dimensions for retaining slots in single-row angular contact ball bearings and four-point-contact ball bearings of diameter series 0, 2, 3 and 4, and radial cylindrical roller bearings of dimension series 10, 02E, 22E, 03E, 23E and 04 are given in Tables 1 and 2, respectively.

The diameter series and dimension series referred to in Tables 1 to 2 are those defined in ISO 15.

NOTE   For radial cylindrical roller bearings of dimension series 02E, 22E, 03E and 23E, the E signifies that they are of a design having reinforced roller and cage assembly and increased radial load-carrying capacity.

5.2 Dimensions for single-row angular contact ball bearings and four-point-contact ball bearings

Table 1 — Diameter series 0, 2, 3 and 4

Dimensions in millimetres

D	Diameter series											
	0			**2**			**3**			**4**		
	h	b	r_0 [b] max.	h	b	r_0 [b] max.	h	b	r_0 [b] max.	h	b	r_0 [b] max.
40	—	—	—	2,5	3,5	0,5	—	—	—	—	—	—
47	2,5	3,5	0,5	3	4,5	0,5	3,5	4,5	0,5	—	—	—
50	—	—	—	3	4,5	0,5	—	—	—	—	—	—
52	3	3,5	0,5	3	4,5	0,5	3,5	4,5	0,5	3,5	4,5	0,5
55	3	3,5	0,5	—	—	—	—	—	—	—	—	—
56	—	—	—	—	—	—	3,5	4,5	0,5	—	—	—
58	3	3,5	0,5	3	4,5	0,5	—	—	—	—	—	—
62 [a]	3,5 [a]	4,5 [a]	0,5 [a]	3,5	4,5	0,5	3,5	4,5	0,5	3,5	4,5	0,5
65	—	—	—	3,5	4,5	0,5	—	—	—	—	—	—
68	3,5	4,5	0,5	—	—	—	3,5	4,5	0,5	—	—	—
72	—	—	—	3,5	4,5	0,5	3,5	4,5	0,5	3,5	4,5	0,5
75 [a]	4 [a]	5,5 [a]	0,5 [a]	—	—	—	4	5,5	0,5	—	—	—
80 [a]	4 [a]	5,5 [a]	0,5 [a]	4	5,5	0,5	4	5,5	0,5	4	5,5	0,5
85	—	—	—	4	5,5	0,5	—	—	—	—	—	—
90	4	5,5	0,5	4	5,5	0,5	4	5,5	0,5	4	5,5	0,5
95	4	5,5	0,5	—	—	—	—	—	—	—	—	—
100 [a]	5 [a]	6,5 [a]	0,5 [a]	5	6,5	0,5	5	6,5	0,5	5	6,5	0,5
110	5	6,5	0,5	5	6,5	0,5	5	6,5	0,5	5	6,5	0,5
115	5	6,5	0,5	—	—	—	—	—	—	—	—	—
120	—	—	—	6,5	6,5	0,5	8,1	6,5	1	8,1	6,5	1

[a]   These values are not suitable for single-row angular contact ball bearings or four-point-contact ball bearings with a contact angle of less than 35°.

[b]   The lower limit of r_0 should not be 0 and shall be appropriately dimensioned to avoid edge stresses. Indicated values are tolerance values. This is expressed in Figures 1 and 2 by r_0 max. In technical drawings this is expressed by e.g. 0,5 max.

Table 1 *(continued)*

D	Diameter series											
	0			**2**			**3**			**4**		
	h	b	r_0 b max.	h	b	r_0 b max.	h	b	r_0 b max.	h	b	r_0 b max.
125	5	6,5	0,5	6,5	6,5	0,5	—	—	—	—	—	—
130	5	6,5	0,5	6,5	6,5	0,5	8,1	6,5	1	8,1	6,5	1
140[a]	5	6,5	0,5	8,1[a]	6,5[a]	1[a]	8,1	6,5	1	8,1	6,5	1
145	5	6,5	0,5	—	—	—	—	—	—	—	—	—
150	6,5	6,5	0,5	8,1	6,5	1	10,1	8,5	2	10,1	8,5	2
160	6,5	6,5	0,5	8,1	6,5	1	10,1	8,5	2	10,1	8,5	2
170	6,5	6,5	0,5	8,1	6,5	1	10,1	8,5	2	—	—	—
180	6,5	6,5	0,5	10,1	8,5	2	11,7	10,5	2	11,7	10,5	2
190	—	—	—	10,1	8,5	2	11,7	10,5	2	11,7	10,5	2
200	8,1	6,5	1	10,1	8,5	2	11,7	10,5	2	11,7	10,5	2
210	8,1	6,5	1	—	—	—	—	—	—	11,7	10,5	2
215	—	—	—	11,7	10,5	2	11,7	10,5	2	—	—	—
225	8,1	6,5	1	—	—	—	11,7	10,5	2	11,7	10,5	2
230	—	—	—	11,7	10,5	2	—	—	—	—	—	—
240	10,1	8,5	2	—	—	—	11,7	10,5	2	11,7	10,5	2
250	—	—	—	11,7	10,5	2	—	—	—	11,7	10,5	2
260	11,7	10,5	2	—	—	—	11,7	10,5	2	11,7	10,5	2
270	—	—	—	11,7	10,5	2	—	—	—	—	—	—
280	11,7	10,5	2	—	—	—	12,7	10,5	2	12,7	10,5	2
290	11,7	10,5	2	12,7	10,5	2	—	—	—	—	—	—
300	—	—	—	—	—	—	12,7	10,5	2	—	—	—
310	12,7	10,5	2	12,7	10,5	2	—	—	—	12,7	10,5	2
320	—	—	—	12,7	10,5	2	12,7	10,5	2	—	—	—
340	12,7	10,5	2	12,7	10,5	2	12,7	10,5	2	12,7	10,5	2
360	12,7	10,5	2	12,7	10,5	2	12,7	10,5	2	12,7	10,5	2
380	—	—	—	—	—	—	12,7	10,5	2	12,7	10,5	2
400	12,7	10,5	2	12,7	10,5	2	12,7	10,5	2	12,7	10,5	2
420	15	12,5	2,5	—	—	—	15	12,5	2,5	15	12,5	2,5
440	—	—	—	15	12,5	2,5	—	—	—	15	12,5	2,5
460	15	12,5	2,5	—	—	—	15	12,5	2,5	15	12,5	2,5

[a] These values are not suitable for single-row angular contact ball bearings or four-point-contact ball bearings with a contact angle of less than 35°.

[b] The lower limit of r_0 should not be 0 and shall be appropriately dimensioned to avoid edge stresses. Indicated values are tolerance values. This is expressed in Figures 1 and 2 by r_0 max. In technical drawings this is expressed by e.g. 0,5 max.

Table 1 *(continued)*

D	Diameter series											
	0			**2**			**3**			**4**		
	h	b	r_0[b] max.	h	b	r_0[b] max.	h	b	r_0[b] max.	h	b	r_0[b] max.
480	15	12,5	2,5	15	12,5	2,5	—	—	—	15	12,5	2,5
500	—	—	—	15	12,5	2,5	15	12,5	2,5	—	—	—

[a]   These values are not suitable for single-row angular contact ball bearings or four-point-contact ball bearings with a contact angle of less than 35°.

[b]   The lower limit of r_0 should not be 0 and shall be appropriately dimensioned to avoid edge stresses. Indicated values are tolerance values. This is expressed in Figures 1 and 2 by r_0 max. In technical drawings this is expressed by e.g. 0,5 max.

5.3   Dimensions for radial cylindrical roller bearings

Table 2 — Dimension series 10, 02E, 22E, 03E, 23E and 04

Dimensions in millimetres

D	Dimension series											
	10			**02E, 22E**			**03E, 23E**			**04**		
	h	b	r_0[a] max.	h	b	r_0[a] max.	h	b	r_0[a] max.	h	b	r_0[a] max.
47	—	—	—	2,5	3,5	0,5	—	—	—	—	—	—
52	—	—	—	2,5	3,5	0,5	2,5	3,5	0,5	—	—	—
62	2,5	3,5	0,5	3	4,5	0,5	3	4,5	0,5	—	—	—
68	2,5	3,5	0,5	—	—	—	—	—	—	—	—	—
72	—	—	—	3,5	4,5	0,5	4	5,5	0,5	5	6,5	0,5
75	3	4,5	0,5	—	—	—	—	—	—	—	—	—
80	3	4,5	0,5	4	5,5	0,5	4	5,5	0,5	5	6,5	0,5
85	—	—	—	4	5,5	0,5	—	—	—	—	—	—
90	4	5,5	0,5	4	5,5	0,5	5	6,5	0,5	5	6,5	0,5
95	4	5,5	0,5	—	—	—	—	—	—	—	—	—
100	4	5,5	0,5	4	5,5	0,5	5	6,5	0,5	6,5	6,5	0,5
110	4	5,5	0,5	5	6,5	0,5	6,5	6,5	0,5	6,5	6,5	0,5
115	4	5,5	0,5	—	—	—	—	—	—	—	—	—
120	—	—	—	5	6,5	0,5	6,5	6,5	0,5	6,5	6,5	0,5
125	5	6,5	0,5	5	6,5	0,5	—	—	—	—	—	—
130	5	6,5	0,5	5	6,5	0,5	8,1	6,5	1	6,5	6,5	0,5
140	6,5	6,5	0,5	6,5	6,5	0,5	8,1	6,5	1	8,1	6,5	1
145	6,5	6,5	0,5	—	—	—	—	—	—	—	—	—
150	6,5	6,5	0,5	6,5	6,5	0,5	8,1	6,5	1	8,1	6,5	1
160	6,5	6,5	0,5	6,5	6,5	0,5	8,1	6,5	1	8,1	6,5	1
170	6,5	6,5	0,5	8,1	6,5	1	8,1	6,5	1	—	—	—

[a]   The lower limit of r_0 should not be 0 and shall be appropriately dimensioned to avoid edge stresses. Indicated values are tolerance values. This is expressed in Figures 1 and 2 by r_0 max. In technical drawings this is expressed by e.g. 0,5 max.

Table 2 (continued)

D	Dimension series											
	10			**02E, 22E**			**03E, 23E**			**04**		
	h	b	r_0[a] max.	h	b	r_0[a] max.	h	b	r_0[a] max.	h	b	r_0[a] max.
180	6,5	6,5	0,5	8,1	6,5	1	10,1	8,5	2	10,1	8,5	2
190	—	—	—	8,1	6,5	1	10,1	8,5	2	10,1	8,5	2
200	8,1	6,5	1	8,1	6,5	1	11,7	10,5	2	11,7	10,5	2
210	8,1	6,5	1	—	—	—	—	—	—	12,7	10,5	2
215	—	—	—	10,1	8,5	2	11,7	10,5	2	—	—	—
225	10,1	8,5	2	—	—	—	11,7	10,5	2	12,7	10,5	2
230	—	—	—	10,1	8,5	2	—	—	—	—	—	—
240	10,1	8,5	2	—	—	—	11,7	10,5	2	12,7	10,5	2
250	—	—	—	11,7	10,5	2	—	—	—	12,7	10,5	2
260	11,7	10,5	2	—	—	—	11,7	10,5	2	12,7	10,5	2
270	—	—	—	11,7	10,5	2	—	—	—	—	—	—
280	11,7	10,5	2	—	—	—	12,7	10,5	2	15	12,5	2,5
290	11,7	10,5	2	12,7	10,5	2	—	—	—	—	—	—
300	—	—	—	—	—	—	15	12,5	2,5	—	—	—
310	12,7	10,5	2	12,7	10,5	2	—	—	—	15	12,5	2,5
320	—	—	—	12,7	10,5	2	15	12,5	2,5	—	—	—
340	12,7	10,5	2	12,7	10,5	2	15	12,5	2,5	15	12,5	2,5
360	12,7	10,5	2	12,7	10,5	2	—	—	—	15	12,5	2,5
380	—	—	—	—	—	—	—	—	—	20	15,5	3
400	—	—	—	—	—	—	—	—	—	20	15,5	3
420	—	—	—	—	—	—	—	—	—	20	15,5	3
440	—	—	—	—	—	—	—	—	—	20	15,5	3
460	—	—	—	—	—	—	—	—	—	20	15,5	3
480	—	—	—	—	—	—	—	—	—	20	15,5	3

[a] The lower limit of r_0 should not be 0 and shall be appropriately dimensioned to avoid edge stresses. Indicated values are tolerance values. This is expressed in Figures 1 and 2 by r_0 max. In technical drawings this is expressed by e.g. 0,5 max.

6 Tolerance values

6.1 General

In Table 5, the symbols U and L mean:

— U = upper deviation limit or upper limit of size;

— L = lower deviation limit or lower limit of size.

6.2 Tolerance values for retaining slots

Tolerance values for retaining slots are given in Tables 3 to 6.

Table 3 — Position specification of retaining slot bottom surface for single-row angular contact ball bearings and four-point-contact ball bearings

Dimensions and tolerance values in millimetres

h	Diameter series	
	0	**2, 3 and 4**
	t_{PS1}	t_{PS1}
2,5	0,4	0,7
3		
3,5		
4		
5		
6,5		
8,1		
10,1		
11,7		
12,7	1,0	1,0
15		

Table 4 — Position specification of retaining slot bottom surface for radial cylindrical roller bearings

Dimensions and tolerance values in millimetres

h	Dimension series	
	10	**02E, 22E, 03E, 23E and 04**
	t_{PS1}	t_{PS1}
2,5	0,4	0,7
3		
3,5		
4		
5		
6,5		
8,1		
10,1		
11,7		
12,7	1,0	1,0
15		
20	1,4	1,4

Table 5 — Retaining slot width

Dimensions and tolerance values in millimetres

b	$t_{\Delta bs}$	$t_{\Delta bg}$
	U	L
3,5	+0,2	0
4,5		
5,5		

Table 5 *(continued)*

b	$t_{\Delta bs}$	$t_{\Delta bg}$
	U	L
6,5		
8,5	+0,4	0
10,5		
12,5	+0,6	0
15,5		

Table 6 — Position specification of median plane of retaining slot width
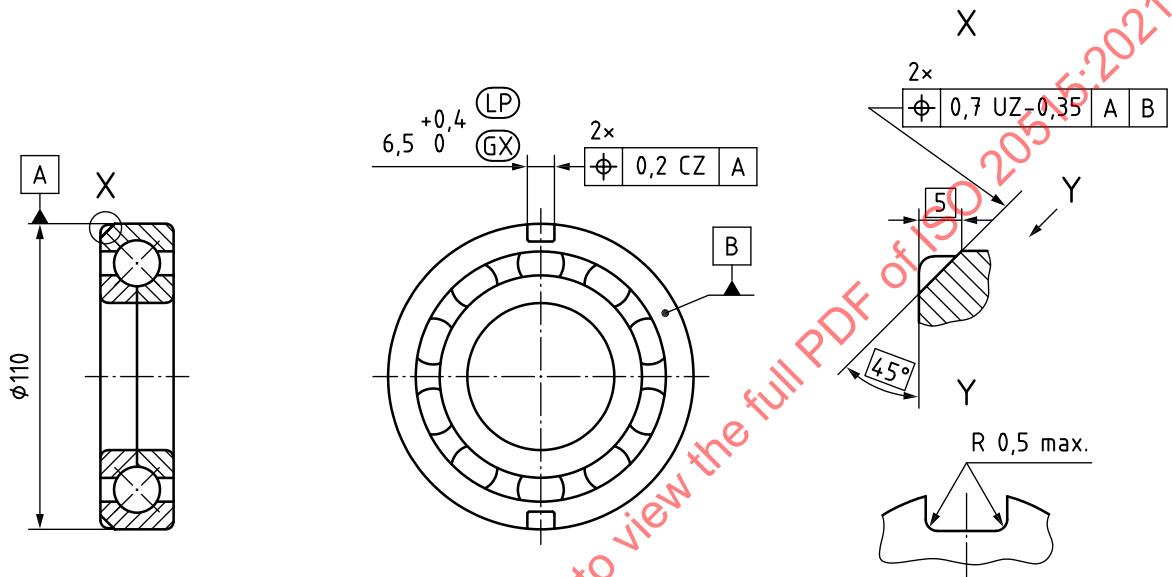
Dimensions and tolerance values in millimetres

D		t_{PS2}
>	≤	
—	290	0,2
290	—	0,4

Annex A
(informative)

Example of drawing indications of characteristics with specification for retaining slot

Figure A.1 gives an example of drawing indications of the characteristics given in this document.

NOTE   The dimensions (not to scale) and tolerance values correspond to a four-point-contact ball bearing of diameter series 2 and outside diameter 110 mm.

Figure A.1 — Example of drawing