BS ISO 3245:2015

BSI Standards Publication

Rolling bearings — Needle roller bearings with drawn cup and without inner ring — Boundary dimensions, geometrical product specifications (GPS) and tolerance values

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National foreword

This British Standard is the UK implementation of ISO 3245:2015. It supersedes BS ISO 3245:2007 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee MCE/7, Rolling bearings.

A list of organizations represented on this committee can be obtained on request to its secretary.

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ISO 3245

Fourth edition
2015-12-01

Rolling bearings — Needle roller bearings with drawn cup and without inner ring — Boundary dimensions, geometrical product specifications (GPS) and tolerance values

Roulements — Douilles à aiguilles sans bague intérieure — Dimensions d'encombrement, spécification géométrique des produits (GPS) et valeurs de tolérance

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Foreword

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 4, *Rolling bearings*, Subcommittee SC 5, *Needle, cylindrical and spherical roller bearings*.

This fourth edition cancels and replaces the third edition (ISO 3245:2007), which has been technically revised with the following changes:

— implemented geometrical product specifications (GPS);

— included an informative annex on tolerances for shaft raceway and housing bore.

Introduction

This International Standard is a machine element geometry standard as defined in the geometrical product specification system (GPS system) as presented in matrix model of ISO 14638.[9]

The fundamental rules of ISO/GPS given in ISO 8015[6] apply to this International Standard and the default decision rules given in ISO 14253-1[7] apply to specifications made in accordance with this International Standard, unless otherwise indicated.

The connection between functional requirements, measuring technique and measuring uncertainty is always intended to be considered. The traditionally used measuring technique is described in ISO 1132-2.[4] For measurement uncertainty, it is intended that ISO 14253-2[8] be considered.

Rolling bearings — Needle roller bearings with drawn cup and without inner ring — Boundary dimensions, geometrical product specifications (GPS) and tolerance values

1 Scope

This International Standard specifies the boundary dimensions and preferred dimensions to be used for drawn cup needle roller bearings without inner ring as well as the minimum chamfer dimension limits. Also specified are the closed end thickness dimensions for bearings with one closed end.

In addition, dimensional tolerances for the needle roller complement bore diameter and tolerances for the drawn cup width are specified.

Informative values for the tolerances for shaft raceway and housing bore are given in Annex A.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

ISO 5593, *Rolling bearings — Vocabulary*

ISO 10579, *Geometrical product specifications (GPS) — Dimensioning and tolerancing — Non-rigid parts*

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

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

ISO/TS 17863, *Geometrical product specification (GPS) — Tolerancing of moveable assemblies*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 1132-1, ISO 5593, ISO 14405-1 and the following apply.

3.1
constraint diameter
$\boldsymbol{D_{1c}}$
diameter of the feature used in constraint condition to establish ΔFws characteristics

Note 1 to entry: It corresponds to the diameter of the ring gauge in ISO 1132-2.[4]

4 Symbols

For the purposes of this document, the symbols given in ISO 15241 and the following apply.

Descriptions for symbols are in accordance to GPS terminology. The dimensional specifications are described in Table 1 and Figure 1.

Figure 1 presents the dimensioning associated to a needle roller bearing, using the symbols introduced in Table 1.

Tolerance value associated to a characteristic is symbolized by *t* followed by the symbol of characteristic, for example, $t_{\Delta Cs}$.

In this International Standard, the ISO default specification operator for size is according to ISO 14405-1; i.e. the two-point size is valid.

Table 1 — Symbols for nominal dimensions, characteristics and specification modifiers

Symbol for nominal size and distance[a]	Symbol for characteristic	Specification modifier[b]	Description
C			nominal drawn cup width
	ΔCs	(GN)	deviation of minimum circumscribed size of drawn cup width from its nominal size
C_1			nominal end thickness of profiled end drawn cup
	C_{1s}	(GN)	single end thickness of profiled end drawn cup (minimum circumscribed distance)
C_2			nominal end thickness of flat end drawn cup
	C_{2s}	(GN)	single end thickness of flat end drawn cup (minimum circumscribed distance)
D			nominal drawn cup outside diameter
F_w			nominal bore diameter of needle roller complement
	ΔFws[c]	(GX) (SN)	deviation of the smallest[d] maximum inscribed sizes of bore diameter of needle roller complement from its nominal size
r			nominal chamfer[e] dimension
	r_s		single chamfer dimension

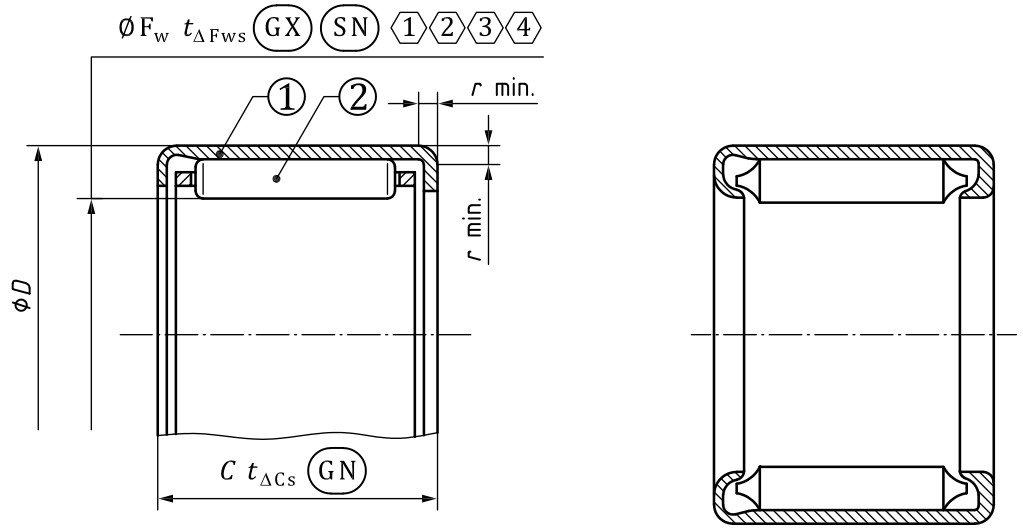
[a] Symbols as defined in ISO 15241 except for the format used.

[b] Symbols as defined in ISO 14405-1.

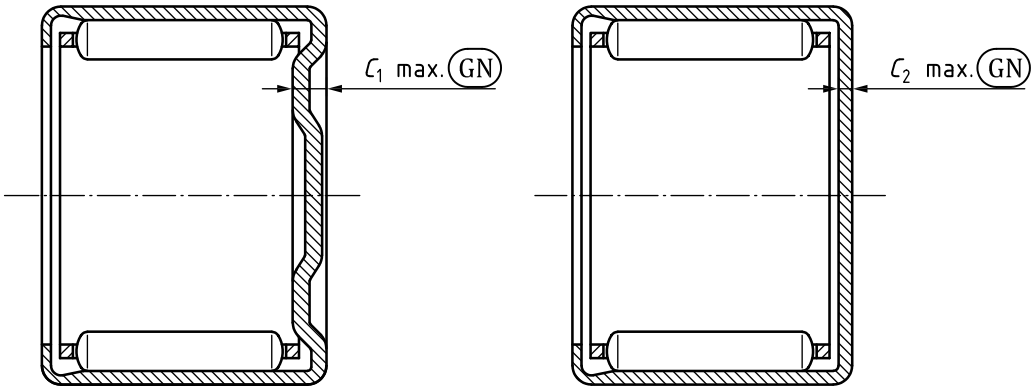
[c] Constraint condition and specification modifiers for fixed parts and movable parts, according to ISO/TS 17863; see Figure 1.

[d] Smallest value considering the influence of rotation of needle roller complement.

[e] The chamfer is considered in this International standard as a round corner.



a) Bearings with open ends



b) Bearings with one closed end

1 = valid in constraint condition by fitting ① into a ring gage having a bore diameter equal to D_{1c} according to Table 4 or Table 5

2 = FP ① – MP ②

3 = needle rollers shall be in contact with the raceway of the drawn cup

4 = in any rotation, in a coaxial direction

Key

① drawn cup

② needle roller complement

Figure 1 — Example of drawn cup needle roller bearing without inner ring design

5 Nominal boundary dimensions

The nominal boundary dimensions of drawn cup needle roller bearings, without inner ring, one closed end and open ends, of diameter series 1D are given in Table 2, those of diameter series 2D are given in Table 3.

Table 2 — Nominal boundary dimensions of needle roller bearings without inner ring, with open ends or one closed end — Diameter series 1D

Dimensions in millimetres

F_w	D	C								C_1[a]	C_2[a]	r[b]
		Dimension series										
		21D	31D	41D	51D	61D	71D	81D	91D			
4	8	7	8	9	—	—	—	—	—	1,9	1	0,3
5	9	7	8	9	—	—	—	—	—	1,9	1	0,4
6	10	7	8	9	10	—	—	—	—	1,9	1	0,4
7	11	7	8	9	10	12	—	—	—	1,9	1	0,4
8	12	7	8	9	10	12	—	—	—	1,9	1	0,4
9	13	7	8	9	10	12	14	—	—	1,9	1	0,4
10	14	7	8	9	10	12	14	—	—	1,9	1	0,4
12	16	7	8	9	10	12	14	—	—	1,9	1	0,4
14	20	10	12	14	16	18	20	—	—	2,8	1,3	0,4
15	21	10	12	14	16	18	20	—	—	2,8	1,3	0,4
16	22	10	12	14	16	18	20	—	—	2,8	1,3	0,4
17	23	10	12	14	16	18	20	—	—	2,8	1,3	0,4
18	24	10	12	14	16	18	20	—	—	2,8	1,3	0,4
20	26	10	12	14	16	18	20	—	—	2,8	1,3	0,4
22	28	10	12	14	16	18	20	—	—	2,8	1,3	0,4
25	32	12	14	16	18	20	24	28	32	2,8	1,3	0,8
28	35	12	14	16	18	20	24	28	32	2,8	1,3	0,8
30	37	12	14	16	18	20	24	28	32	2,8	1,3	0,8
32	39	12	14	16	18	20	24	28	32	2,8	1,3	0,8
35	42	12	14	16	18	20	24	28	32	2,8	1,3	0,8
38	45	12	14	16	18	20	24	28	32	2,8	1,3	0,8
40	47	12	14	16	18	20	24	28	32	2,8	1,3	0,8
42	49	12	14	16	18	20	24	28	32	2,8	1,3	0,8
45	52	12	14	16	18	20	24	28	32	2,8	1,3	0,8
50	58	14	16	18	20	24	28	32	36	2,8	1,6	0,8
55	63	14	16	18	20	24	28	32	36	2,8	1,6	0,8
60	68	14	16	18	20	24	28	32	36	2,8	1,6	0,8
65	73	14	16	18	20	24	28	32	36	2,8	1,6	0,8
70	78	14	16	18	20	24	28	32	36	2,8	1,6	0,8

NOTE Underlined values are the preferred dimensions.

[a] The upper specification limits of C_{1s} and C_{2s} are defined respectively as C_1 and C_2.

[b] The lower specification limit for chamfer dimension, r_s, is defined as r.

Table 3 — Nominal boundary dimensions of needle roller bearings without inner ring, with open ends or one closed end — Diameter series 2D

Dimensions in millimetres

F_w	D	C							C_1[a]	C_2[a]	r[b]
		Dimension series									
		22D	32D	42D	52D	62D	72D	82D			
8	14	10	12	14	—	—	—	—	2,8	1,3	0,4
9	15	10	12	14	16	—	—	—	2,8	1,3	0,4
10	16	10	12	14	16	—	—	—	2,8	1,3	0,4
12	18	10	12	14	16	18	—	—	2,8	1,3	0,4
14	22	12	14	16	18	20	24	—	2,8	1,3	0,4
15	23	12	14	16	18	20	24	—	2,8	1,3	0,4
16	24	12	14	16	18	20	24	—	2,8	1,3	0,8
17	25	12	14	16	18	20	24	—	2,8	1,3	0,8
18	26	12	14	16	18	20	24	—	2,8	1,3	0,8
20	28	12	14	16	18	20	24	—	2,8	1,3	0,8
22	30	12	14	16	18	20	24	—	2,8	1,3	0,8
25	35	14	16	18	20	24	28	32	3,4	1,6	0,8
28	38	14	16	18	20	24	28	32	3,4	1,6	0,8
30	40	14	16	18	20	24	28	32	3,4	1,6	0,8
32	42	14	16	18	20	24	28	32	3,4	1,6	0,8
35	45	14	16	18	20	24	28	32	3,4	1,6	0,8
38	48	14	16	18	20	24	28	32	3,4	1,6	0,8
40	50	14	16	18	20	24	28	32	3,4	1,6	0,8
42	52	14	16	18	20	24	28	32	3,4	1,6	0,8
45	55	14	16	18	20	24	28	32	3,4	1,6	0,8

[a] The upper specification limits of C_{1s} and C_{2s} are defined respectively as C_1 and C_2.

[b] The lower specification limit for chamfer dimension, r_s, is defined as r.

6 Tolerances

6.1 General

In Tables 4 to 6, the symbols U and L are used as follows:

U = upper limit deviation

L = lower limit deviation

6.2 Tolerance for the bore diameter

Drawn cup needle roller bearings are non-rigid parts according to the definition in ISO 10579 and require the outside diameter of the drawn cup to be restrained in a ring gauge for verification of the bore diameter of the needle roller complement.

The free state condition defined in ISO 10579 is valid for the tolerances applied to dimensions C, C_1, C_2 and r.

The tolerances for ΔFws, $t_{\Delta Fws}$, are given in Tables 4 and 5.

Table 4 — Tolerances for ΔFws — Diameter series 1D

Dimensions in millimetres

F_w	D[a]	**Constraint diameter**[b] D_{1c}	$t_{\Delta Fws}$	
			U	L
4	8	7,984	+0,028	+0,010
5	9	8,984		
6	10	9,984		
7	11	10,98	+0,031	+0,013
8	12	11,98		
9	13	12,98		
10	14	13,98		
12	16	15,98	+0,034	+0,016
14	20	19,976		
15	21	20,976		
16	22	21,976		
17	23	22,976		
18	24	23,976		
20	26	25,976	+0,041	+0,020
22	28	27,976		
25	32	31,972		
28	35	34,972		
30	37	36,972		
32	39	38,972	+0,050	+0,025
35	42	41,972		
38	45	44,972		
40	47	46,972		
42	49	48,972		
45	52	51,967		
50	58	57,967		
55	63	62,967	+0,060	+0,030
60	68	67,967		
65	73	72,967		
70	78	77,967		

[a] No deviations are specified for the outside diameter of drawn cup, *D*. The bearing manufacturer shall ensure a fit corresponding to the function.

[b] If the actual constraint diameter deviates from its specified value, $t_{\Delta Fws}$ should be corrected to compensate the deviation.

Table 5 — Tolerances for ΔFws — Diameter series 2D

Dimensions in millimetres

F_w	D[a]	Constraint diameter[b] D_{1c}	$t_{\Delta Fws}$	
			U	L
8	14	13,98	+0,031	+0,013
9	15	14,98		
10	16	15,98		
12	18	17,98	+0,034	+0,016
14	22	21,976		
15	23	22,976		
16	24	23,976		
17	25	24,976		
18	26	25,976		
20	28	27,976	+0,041	+0,020
22	30	29,976		
25	35	34,972		
28	38	37,972		
30	40	39,972		
32	42	41,972	+0,050	+0,025
35	45	44,972		
38	48	47,972		
40	50	49,972		
42	52	51,967		
45	55	54,967		

[a] No deviations are specified for the outside diameter of drawn cup, D. The bearing manufacturer shall ensure a fit corresponding to the function.

[b] If the actual constraint diameter deviates from its specified value, $t_{\Delta Fws}$ should be corrected to compensate the deviation.

6.3 Tolerance for the drawn cup

6.3.1 Drawn cup width, *C*

The tolerance for the drawn cup width, C, is given in Table 6.

Table 6 — Tolerances for drawn cup width

Dimensions in millimetres

C	$t_{\Delta Cs}$	
	U	L
all widths	0	-0,3

6.3.2 End thickness of profiled end and flat end drawn cup C_1 and C_2

The upper specification limits of C_{1s} and C_{2s} are defined respectively as C_1 and C_2 (see Tables 2 and 3). These values are given to enable the user to avoid contact between the end face of the shaft and the internal end face of the drawn cup.

The lower specification limits of C_{1s} and C_{2s} are not defined.

See GPS indications in Figure 1 b).

6.3.3 Chamfer dimension, *r*

The lower specification limit for chamfer dimension, r_s, is defined as r (see Tables 2 and 3).

The upper specification limit is not defined.

Annex A
(informative)

Tolerances for shaft raceway and housing bore

A.1 General

Proper function of drawn cup needle roller bearings depends on the shaft quality supplied by the user and a required press-fit into an adequate quality housing. The housing should be of sufficient strength to round and size the bearing.

This annex shows suggested tolerances and values for shaft raceway and housing bore.

Table values are informative only and may not be suitable for use in applications having certain operating conditions and features. If in doubt, consult the bearing manufacturer for specific advice.

A.2 Raceway hardness and case-hardened depth

The shaft raceway is hardened and finish ground. Surface hardness is minimum 670 HV (58 HRC). Case hardened depth of raceway is minimum of 0,3 mm to 0,8 mm, depending on bearing size, rolling element diameter, shaft heat treatment method and load condition. If in doubt, consult the bearing manufacturer for specific advice.

NOTE The definition of case-hardened depth is in accordance with ISO 2639:2002, 3.1.[5]

A.3 Symbols

For the purposes of this annex, the following symbols apply.

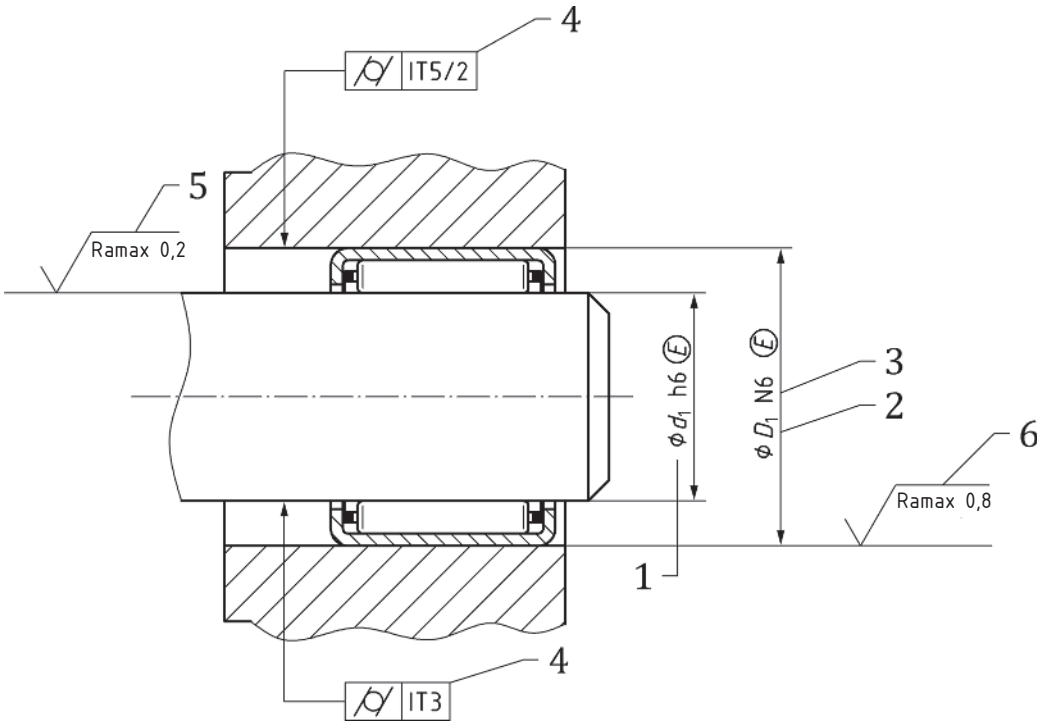
D_1 nominal housing bore diameter

d_1 nominal shaft diameter

A.4 Shaft raceway and housing bore designs

Figure A.1 shows suggested shaft raceway and housing bore design values.

Tolerances are valid for stationary housing and rotating shaft. For housing rotation, consult the bearing manufacturer for specific advice. The standard tolerance grade value (IT3 and IT5) and the limit deviations defined from a tolerance class (h6 or N6), as used in Figure A.1, are defined in ISO 286-1[1] in link with the related nominal diameter of the feature of size.



Key

1 nominal dimension of shaft diameter, d_1, is equal to F_w

2 nominal dimension of housing bore diameter, D_1, is equal to D

3 tolerance classes N6 for steel or cast iron housing and R6 for light metal housing apply (see NOTE 2)

4 cylindricity in accordance with ISO 1101[3]

5 or $\sqrt{Rz\max 1}$

6 or $\sqrt{Rz\max 4}$

NOTE 1 Suggested housing values apply to the mounting surface with the bearing. The shaft raceway specifications are applied to functional portion of the surface.

NOTE 2 Consult with manufacturer for specific advice on other material housing designs.

Figure A.1 — Shaft and housing designs

Bibliography

[1] ISO 286-1, *Geometrical product specifications (GPS) — ISO code system for tolerances on linear sizes — Part 1: Basis of tolerances, deviations and fits*

[2] ISO 286-2, *Geometrical product specifications (GPS) — ISO code system for tolerances on linear sizes — Part 2: Tables of standard tolerance classes and limit deviations for holes and shafts*

[3] ISO 1101, *Geometrical Product Specifications (GPS) — Geometrical tolerancing — Tolerances of form, orientation, location and run-out*

[4] ISO 1132-2, *Rolling bearings — Tolerances — Part 2: Measuring and gauging principles and methods*

[5] ISO 2639:2002, *Steels — Determination and verification of the depth of carburized and hardened cases*

[6] ISO 8015, *Geometrical product specifications (GPS) — Fundamentals — Concepts, principles and rules*

[7] ISO 14253-1, *Geometrical product specifications (GPS) — Inspection by measurement of workpieces and measuring equipment — Part 1: Decision rules for proving conformity or nonconformity with specifications*

[8] ISO 14253-2, *Geometrical product specifications (GPS) — Inspection by measurement of workpieces and measuring equipment — Part 2: Guidance for the estimation of uncertainty in GPS measurement, in calibration of measuring equipment and in product verification*

[9] ISO 14638, *Geometrical product specifications (GPS) — Matrix model*

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