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Rolling bearings — Radial bearings — Geometrical product specifications (GPS) and tolerance values

Roulements — Roulements radiaux — Spécification géométrique des produits (GPS) et valeurs de tolérance

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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).

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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 4, *Tolerances, tolerance definitions and symbols (including GPS)*.

This fifth edition cancels and replaces the fourth edition (ISO 492:2002), which has been technically revised.

This corrected version of ISO 492:2014 incorporates the correction of the title.

Introduction

This International Standard is a machine element geometry standard as defined in the geometrical product specification (GPS) system as presented in master plan of ISO/TR 14638.[12]

The fundamental rules of ISO/GPS given in ISO 8015[8] apply to this International Standard and the default decision rules given in ISO 14253-1[10] apply to the 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.[5] For measurement uncertainty it is intended that ISO 14253-2[11] should be considered.

Rolling bearings — Radial bearings — Geometrical product specifications (GPS) and tolerance values

1 Scope

This International Standard specifies dimensional and geometrical characteristics, limit deviations from nominal sizes, and tolerance values to define the interface (except chamfers) of radial rolling bearings. Nominal boundary dimensions are defined in ISO 15, ISO 355[2] and ISO 8443[9].

This International Standard does not apply to certain radial bearings of particular types (e.g. needle roller bearings) or for particular fields of application (e.g. airframe bearings and instrument precision bearings). Tolerances for such bearings are given in the relevant International Standards.

Chamfer dimension limits are given in ISO 582.

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 15, *Rolling bearings — Radial bearings — Boundary dimensions, general plan*

ISO 582, *Rolling bearings — Chamfer dimensions — Maximum values*

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

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 1101, ISO 5593, ISO 14405-1, and ISO/TS 17863 apply.

4 Symbols

To express that the ISO/GPS system, ISO 8015[8], 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 Table 1 and Figures 1 to 17.

Descriptions for symbols are in accordance with GPS terminology; relationships with traditional terms are described in Annex A.

A tolerance value associated to a characteristic is symbolised by t followed by the symbol for the characteristic, for example t_{VBs}.

In this International Standard, the ISO default specification operator for size is in accordance with ISO 14405-1, i.e. the two-point size is valid. Some specification modifiers are described in Annex D.

The detailed definitions for terms in ISO 1101 and ISO 14405-1 and traditional terms in ISO 1132-1[4] are not fully equal. For differences, see Annex C.

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

Symbol for nominal dimension (size and distance)[a]	Symbol for characteristic[a]	GPS symbol and specification modifier[bc]	Description[d]	See Figure
B			Nominal inner ring width	1; 2; 12
	VBs	LP SR	**Symmetrical rings**: range of two-point sizes of inner ring width	1; 12
		GN ALS SR [e]	**Asymmetrical rings**: range of minimum circumscribed sizes of inner ring width, between two opposite lines, obtained from any longitudinal section which includes the inner ring bore axis	2; 7
	ΔBs	LP	**Symmetrical rings**: deviation of a two-point size of inner ring width from its nominal size	1; 12
		GN ALS [e]	**Asymmetrical rings, upper limit**: deviation of a minimum circumscribed size of inner ring width, between two opposite lines, in any longitudinal section which includes the inner ring bore axis, from its nominal size	2; 7
		LP	**Asymmetrical rings, lower limit:** deviation of a two-point size of inner ring width from its nominal size	

Table 1 — *(continued)*

Symbol for nominal dimension (size and distance)[a]	Symbol for characteristic[a]	GPS symbol and specification modifier[bc]	Description[d]	See Figure
C			Nominal outer ring width	1; 7; 12
	VCs	(LP)(SR)	**Symmetrical rings**: range of two-point sizes of outer ring width	1; 7
		(GN) ALS (SR) ◁[≡|] [e]	**Asymmetrical rings**: range of minimum circumscribed sizes of outer ring width between two opposite lines, obtained from any longitudinal section which includes the outer ring outside surface axis	2; 12
	ΔCs	(LP)	**Symmetrical rings**: deviation of a two-point size of outer ring width from its nominal size	1; 7
		(GN) ALS ◁[≡|] [e]	**Asymmetrical rings, upper limit**: deviation of a minimum circumscribed size of outer ring width, between two opposite lines, in any longitudinal section which includes the outer ring outside surface axis, from its nominal size	2; 12
		(LP)	**Asymmetrical rings, lower limit**: deviation of a two-point size of outer ring width from its nominal size	
C_1			Nominal outer ring flange width	12
	VC1s	(LP)(SR)	Range of two-point sizes of outer ring flange width	12
	ΔC1s	(LP)	Deviation of a two-point size of outer ring flange width from its nominal size	12
d			Nominal bore diameter of a cylindrical bore or at the theoretical small end of a tapered bore	1 to 7; 12 to 16
	Vdmp	(LP)(SD) ACS (SR)	Range of mid-range sizes (out of two-point sizes) of bore diameter obtained from any cross-section of a cylindrical bore	1; 2; 12
	Δdmp	(LP)(SD) ACS	**Cylindrical bore**: deviation of a mid-range size (out of two-point sizes) of bore diameter in any cross-section from its nominal size	1; 2; 12
		(LP)(SD) SCS [f]	**Tapered bore:** deviation of a mid-range size (out of two-point sizes) of bore diameter at the theoretical small end from its nominal size	7
	Vdsp	(LP)(SR) ACS	Range of two-point sizes of bore diameter in any cross-section of a cylindrical or tapered bore	1; 2; 7; 12
	Δds	(LP)	Deviation of a two-point size of bore diameter of a cylindrical bore from its nominal size	1; 2; 12

Table 1 — *(continued)*

Symbol for nominal dimension (size and distance[a]	Symbol for characteristi[a]	GPS symbol and specification modifier[bc]	Description[d]	See Figure
d_1			Nominal diameter at the theoretical large end of a tapered bore	7
	Δd1mp	LP SD SCS [f]	Deviation of a mid-range size (out of two-point sizes) of bore diameter at the theoretical large end of a tapered bore from its nominal size	7
D			Nominal outside diameter	1 to 16
	VDmp	LP SD ACS SR	Range of mid-range sizes (out of two-point sizes) of outside diameter obtained from any cross-section	1; 2; 7; 12
	ΔDmp	LP SD ACS	Deviation of a mid-range size (out of two-point sizes) of outside diameter in any cross-section from its nominal size	1; 2; 7; 12
	VDsp	LP SR ACS	Range of two-point sizes of outside diameter in any cross-section	1; 2; 7; 12
	ΔDs	LP	Deviation of a two-point size of outside diameter from its nominal size	1; 2; 7; 12
D_1			Nominal outside diameter of outer ring flange	12
	ΔD1s	LP	Deviation of a two-point size of outside diameter of outer ring flange from its nominal size	12
	Kea	↗ [g]	Circular radial run-out of outer ring outside surface of assembled bearing with respect to datum, i.e. axis, established from the inner ring bore surface	4; 5; 6; 9; 10; 11; 14; 15; 16
	Kia	↗ [g]	Circular radial run-out of inner ring bore surface of assembled bearing with respect to datum, i.e. axis, established from the outer ring outside surface	4; 5; 6; 9; 10; 11; 14; 15; 16
	Sd	↗ [g]	Circular axial run-out of inner ring face with respect to datum, i.e. axis, established from the inner ring bore surface	3; 8; 13
	SD	⊥	Perpendicularity of outer ring outside surface axis with respect to datum established from the outer ring face	3; 8
	SD1	⊥	Perpendicularity of outer ring outside surface axis with respect to datum established from the outer ring flange back face	13

Table 1 — *(continued)*

Symbol for nominal dimension (size and distance)[a]	Symbol for characteristic[a]	GPS symbol and specification modifier[bc]	Description[d]	See Figure
	Sea	↗ [g]	Circular axial run-out of outer ring face of assembled bearing with respect to datum, i.e. axis, established from the inner ring bore surface	5; 6; 10; 11
	Sea1	↗ [g]	Circular axial run-out of outer ring flange back face of assembled bearing with respect to datum, i.e. axis, established from the inner ring bore surface	15; 16
	Sia	↗ [g]	Circular axial run-out of inner ring face of assembled bearing with respect to datum, i.e. axis, established from the outer ring outside surface	5; 6; 10; 11; 15; 16
SL [h]			Taper slope is the difference between nominal diameters at the theoretical large end and small end of a tapered bore ($d_1 - d$)	7
	ΔSL		Deviation of taper slope of a tapered inner ring bore from its nominal size [i]	7
T			Nominal assembled bearing width	17
	ΔTs	(GN) [g]	Deviation of minimum circumscribed size of assembled bearing width from its nominal size	17
T_1			Nominal effective width of inner subunit assembled with a master outer ring	17
	ΔT1s	(GN) [g]	Deviation of minimum circumscribed size of effective width (inner subunit assembled with a master outer ring) from its nominal size	17
T_2			Nominal effective width of outer ring assembled with a master inner subunit	17
	ΔT2s	(GN) [g]	Deviation of minimum circumscribed size of effective width (outer ring assembled with a master inner subunit) from its nominal size	17

Table 1 — *(continued)*

Symbol for nominal dimension (size and distance)[a]	Symbol for characteristic[a]	GPS symbol and specification modifier[bc]	Description[d]	See Figure
T_F			Nominal assembled flanged bearing width	17
	ΔTFs	GN [g]	Deviation of minimum circumscribed size of assembled flanged bearing width from its nominal size	17
T_{F2}			Nominal effective width of flanged outer ring assembled with a master inner subunit	17
	ΔTF2s	GN [g]	Deviation of minimum circumscribed size of effective width (flanged outer ring assembled with a master inner subunit) from its nominal size	17
α			Frustum angle of tapered inner ring bore [h]	7; 8; 9; 10; 11
a [k]			Distance from face to define the restricted area for SD or SD1	3; 8; 13

[a] Symbols as defined in ISO 15241[15] except for the format used.

[b] Symbols as defined in ISO 1101 and ISO 14405-1.

[c] Specification modifier LP shall not be indicated on a drawing, if the two-point size is applied for both specified limits.

[d] Description based on ISO 1101, ISO 5459[7] and ISO 14405-1.

[e] Specification modifier GN is not appropriate in cases where no opposite material is existing, e.g. tapered roller bearing outer ring with large back face chamfer and small front face. Solutions need to be developed within the framework of the GPS system and considered in future revisions of this International Standard.

[f] Specification modifier SCS can be omitted on the drawing.

[g] Symbols for direction of gravity G, fixed parts FP and movable parts MP, according to ISO/TS 17863; see Figures 4, 5, 6, 9, 10, 11, 14, 15, 16, and 17.

[h] *SL* is a distance.

[i] Description based on ISO 1119.[3]

[k] For $r_{s,min} \leq 0,6$: $a = r_{s,max,axial} + 0,5$; for $r_{s,min} > 0,6$: $a = 1,2 \times r_{s,max,axial}$; $r_{s,max,axial}$ see ISO 582. For definitions of $r_{s,min}$ and $r_{s,max,axial}$ see ISO 582.

The indications in Figures 1 to 17 illustrate the correlation of interface dimensions and corresponding dimensional and geometrical tolerance symbols.

The specifications for single components are illustrated in Figures 1, 2, 3, 7, 8, 12, and 13. The specifications for assembled components are illustrated in Figures 4, 5, 6, 9, 10, 11, 14, 15, 16, and 17.

NOTE Figures 1 to 17 are drawn schematically and do not necessarily show all design details.

Two examples of a real drawing indication are given in Annex B.

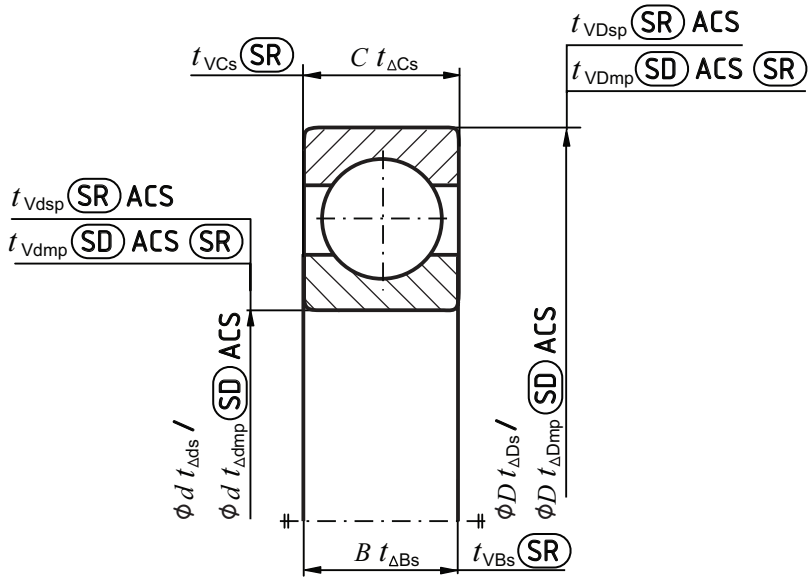
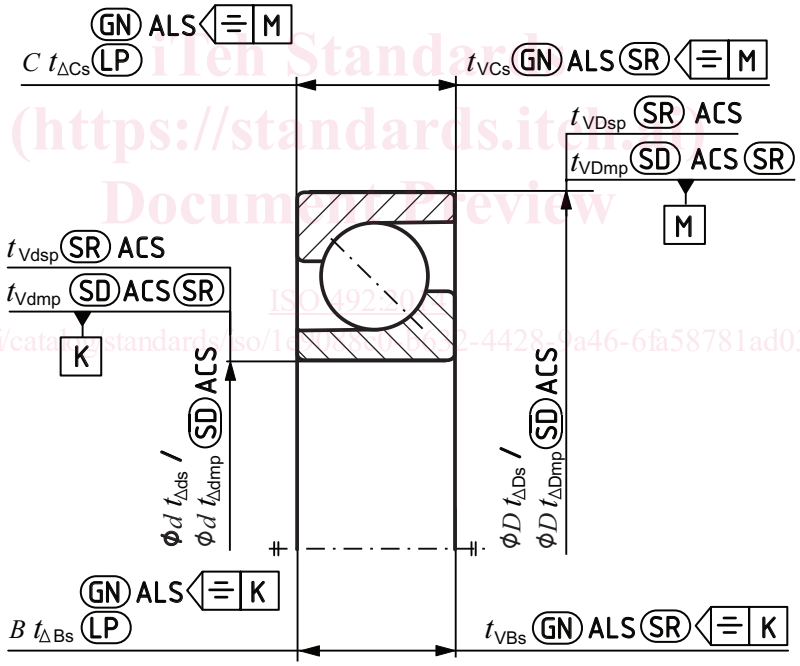


Figure 1 — Size specification for single components for bearing with cylindrical bore and symmetrical rings



NOTE t_{VBs} and t_{VCs} are not relevant for tapered roller bearings.

Figure 2 — Size specification for single components for bearing with cylindrical bore and asymmetrical rings

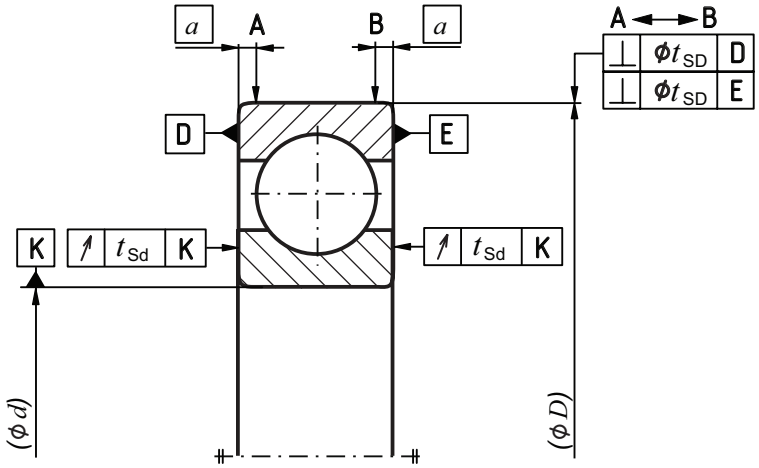
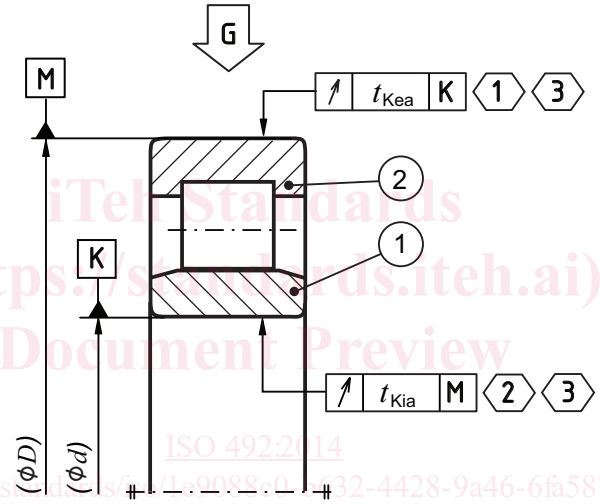


Figure 3 — Geometrical tolerances for single components for bearing with cylindrical bore



⟨1⟩ = FP(1) - MP(2), G

⟨2⟩ = FP(2) - MP(1), G

⟨3⟩ = the rolling elements shall be in contact with both the inner and outer ring raceways

Figure 4 — Geometrical tolerances for assembled bearing with cylindrical bore — Cylindrical roller bearing, spherical roller bearing, toroidal roller bearing and self-aligning ball bearing