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

Roulements — Butées — 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 document 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 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 4, *Rolling bearings - Vocabulary, boundary dimensions and geometrical product specifications*.

This fifth edition cancels and replaces the fourth edition (ISO 199:2014), which has been technically revised.

The main changes are as follows:

— symbols have been revised and the symbol list amended; in particular, the symbol for assembled bearing height has been revised;

— Annex A, B, C and D (in ISO 199:2014) have been deleted.

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) presented in matrix model of ISO 14638[6].

The fundamental rules of ISO GPS given in ISO 8015 apply to this document and the default decision rules given in ISO 14253-1[4] 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[5] be considered.

This document uses most of the existing symbols associated with rolling bearings because they are well established in the market. In some cases, new terms are derived from the full GPS definition. The definitions of the established terms and symbols are necessarily changed according to the GPS rules. These changes of terms, definitions and symbols for geometrical product specifications (GPS) to define characteristics and tolerances of rolling bearing components and assemblies are given in ISO 22872 and incorporated in this document.

The representation of symbols, tolerance values, limits of size, deviation limits and limit values derived from GPS indications according to, for example, ISO 1101 and ISO 14405-1, including indications in tables and graphical descriptions, have been revised and implemented in accordance with the principles of ISO 22872.

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

1 Scope

This document specifies dimensional characteristics, deviation limits from nominal values, and tolerance values to define the interface (except chamfers) of thrust rolling bearings. Nominal boundary dimensions are defined in ISO 104[1].

This document is not applicable to certain thrust bearings (e.g. thrust needle roller bearings) or for particular fields of application (e.g. special thrust precision bearings). Tolerances for such bearings are given in the relevant International Standards.

Chamfer dimension limits are given in ISO 582[3].

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 1101:2017, *Geometrical product specifications (GPS) — Geometrical tolerancing — Tolerances of form, orientation, location and run-out*

ISO 5593, *Rolling bearings — Vocabulary*

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

ISO 14405-1:2016, *Geometrical product specifications (GPS) — Dimensional tolerancing — Part 1: Linear sizes*

ISO/TS 17863:2013, *Geometrical product specification (GPS) — Tolerancing of moveable assemblies*

ISO 22872, *Rolling bearings — Geometrical product specifications (GPS) — Vocabulary and representation of symbols*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 1101, ISO 5593, ISO 14405-1, ISO/TS 17863 and ISO 22872 apply.

ISO and IEC maintain terminology 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/

4 Symbols

4.1 Symbols for physical quantities

Symbols in Table 1 represent physical quantities in the GPS environment and may sometimes be applied to more than one physical quantity.

In this document, the symbols for tolerance values, deviation limits and limit values are preceded by letter "t" in figures and tables.

EXAMPLE 1 t_{Se}, t_{Vdsp}.

In this document, the symbols for nominal dimensions and values of upper/lower limit of size are not preceded by the letter "t" because those values are usually interpreted as nominal dimensions.

EXAMPLE 2 D.

Table 1 — Symbols for dimensions and tolerance values

Symbol	Description	Figure
D	Nominal outside diameter	1, 2, 3, 4
d	Nominal bore diameter <cylindrical bore>	1, 2
d_2	Nominal bore diameter of central shaft washer	3, 4
T	Nominal assembled bearing height <single-direction thrust bearing>	1, 2
T_1	Nominal assembled bearing height <double-direction thrust bearing>	3, 4
t_{Se}	Tolerance value for range of housing washer raceway thickness <thrust ball bearing>	1, 3
t_{Se}	Tolerance value for range of housing washer raceway thickness <thrust cylindrical roller bearing>	2, 4
t_{Si}	Tolerance value for range of shaft washer raceway thickness <thrust ball bearing>	1
t_{Si}	Tolerance value for range of shaft washer raceway thickness <thrust cylindrical roller bearing>	2
t_{VDsp}	Tolerance value for range of outside diameter	1, 2, 3, 4
t_{Vdsp}	Tolerance value for range of bore diameter	1, 2
t_{Vd2sp}	Tolerance value for range of central shaft washer bore diameter	3, 4
$t_{\Delta Dmp}$	Upper and lower deviation limits of mid-range outside diameter	1, 2, 3, 4
$t_{\Delta dmp}$	Upper and lower deviation limits of mid-range bore diameter <cylindrical bore>	1, 2
$t_{\Delta d2mp}$	Upper and lower deviation limits of mid-range central shaft washer bore diameter	3, 4
$t_{\Delta Tg}$	Upper and lower deviation limits of actual assembled bearing height <single-direction thrust bearing>	1, 2
$t_{\Delta T1g}$	Upper and lower deviation limits of actual assembled bearing height <double-direction thrust bearing>	3, 4

4.2 Additional symbols

Symbols defined in standards other than ISO 22872 and used in this document are presented in Table 2 for information.

These include symbols for specification modifiers and complementary specification modifiers.

Table 2 — Additional symbols defined in other standards

Symbol	Description	Figure	Reference
ACS	Any cross-section	1, 2, 3, 4	ISO 14405-1:2016, 7.4
ALS	Any longitudinal section	1, 3	ISO 14405-1:2016, 7.4
Ⓖ	Minimum circumscribed size	1, 2, 3, 4	ISO 14405-1:2016, 3.7.1.3

Table 2 *(continued)*

Symbol	Description	Figure	Reference
(LS)	Spherical size	1,3	ISO 14405-1:2016, 3.6.4
(SD)	Mid-range size	1,2,3,4	ISO 14405-1:2016, 3.7.2.2.5
(SN)	Minimum size	1,3	ISO 14405-1:2016, 3.7.2.2.2
(SR)	Range of sizes	1,2,3,4	ISO 14405-1:2016, 3.7.2.2.6
⌯	Symmetry	1,3	ISO 1101:2017, 13.3
G	Gravity	1,2,3,4	ISO/TS 17863:2013, 6.3
⟨1⟩	Flag	1,2,3,4	ISO/TS 17863:2013, 6.8 and 6.9

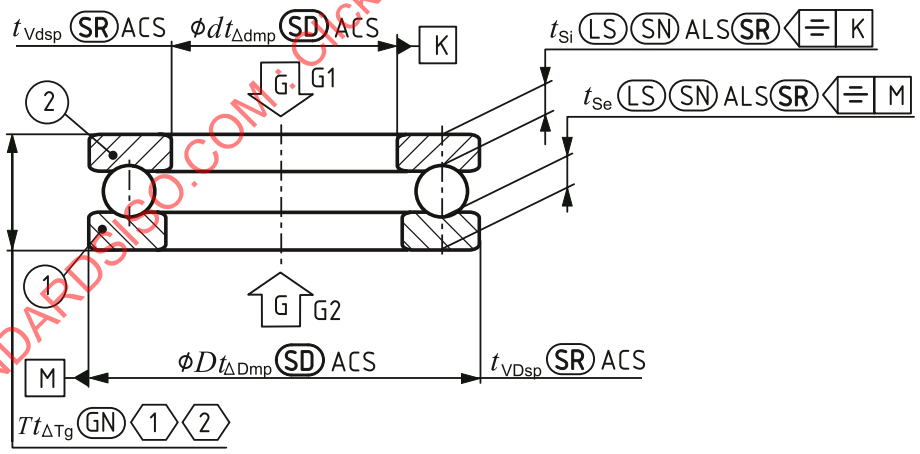
5 Graphical description

To express that the ISO GPS system in ISO 8015 is applied, the dimensional characteristics shall be included in the technical product documentation (e.g. on the drawing). The dimensional specifications associated to these characteristics are described in Figures 1 to 4.

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.

The indications in Figures 1 to 4 illustrate the correlation of interface dimensions and corresponding dimensional tolerance symbols.

NOTE Figures 1 to 4 are drawn schematically and do not necessarily show all design details.



Key

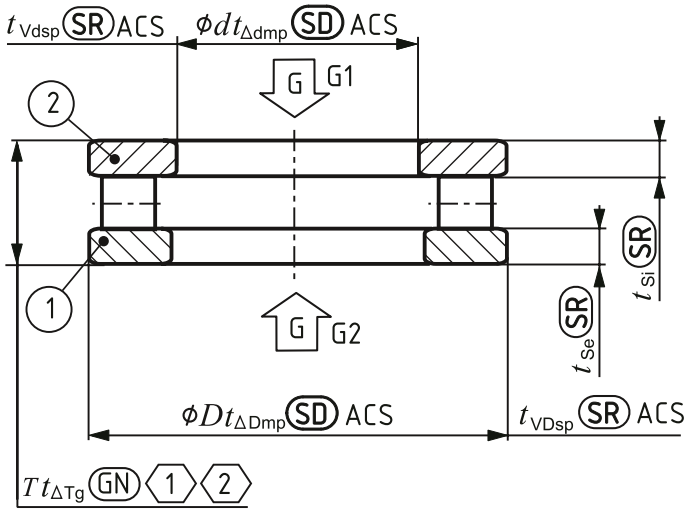
⟨1⟩ = G1 or G2

⟨2⟩ = the rolling elements shall be in correct functional contact with both shaft and housing washer raceways

1 housing washer

2 shaft washer

Figure 1 — Size specification for single-direction thrust bearing — Thrust ball bearing



Key

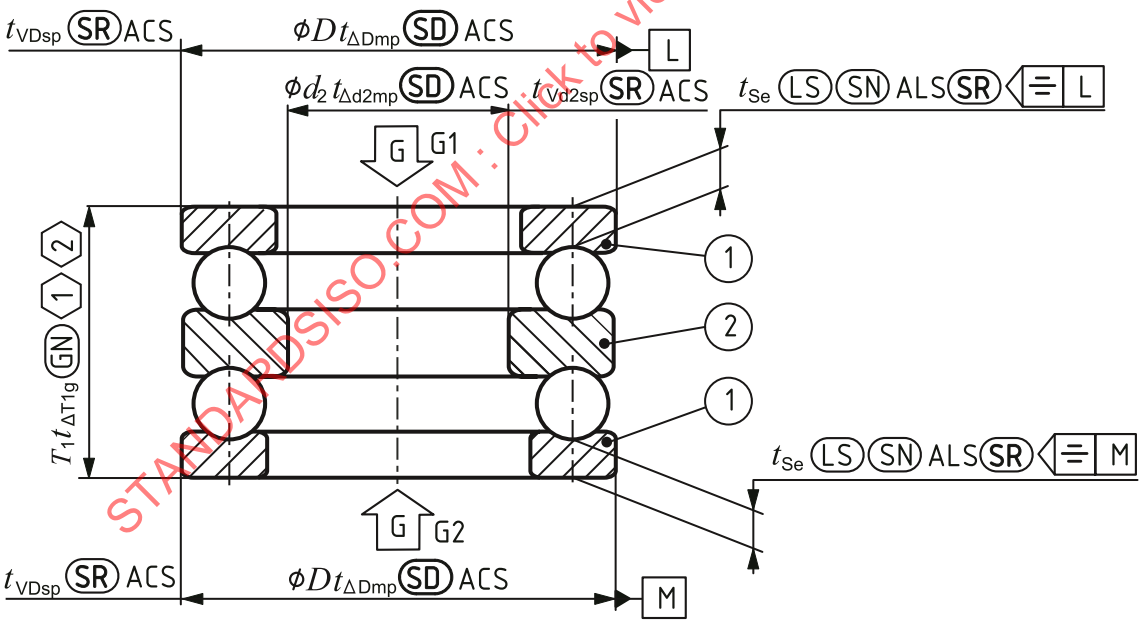
1 = G1 or G2

2 = the rolling elements shall be in correct functional contact with both shaft and housing washer raceways

1 housing washer

2 shaft washer

Figure 2 — Size specification for single-direction thrust bearing — Thrust cylindrical roller bearing



Key

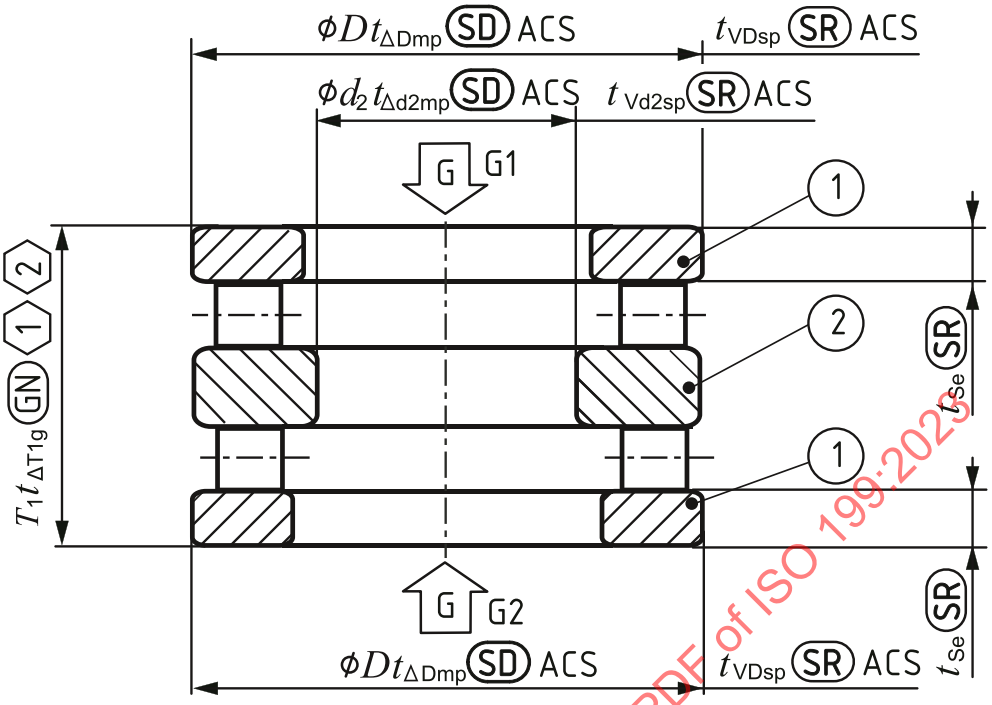
1 = G1 or G2

2 = the rolling elements shall be in correct functional contact with both central shaft and housing washer raceways

1 housing washer

2 central shaft washer

Figure 3 — Size specification for double-direction thrust bearing — Thrust ball bearing



Key

〈1〉 = G1 or G2

〈2〉 = the rolling elements shall be in correct functional contact with both central shaft and housing washer raceways

1 housing washer

2 central shaft washer

Figure 4 — Size specification for double-direction thrust bearing — Thrust cylindrical roller bearing

6 Deviation limits and tolerance values

6.1 General

Deviation limits and tolerance values for single-direction and double-direction thrust bearings are given in Tables 3 to 10.

In Tables 3 to 10, the symbols U and L are used as follows:

— U = upper deviation limit;

— L = lower deviation limit.

The symbol "—" in Tables 3 to 10 is used when no values have been established.

6.2 Tolerance class Normal

See Tables 3 and 4.

Table 3 — Shaft washer, central shaft washer, and bearing height — Tolerance class Normal

Deviation limits and tolerance values in micrometres

d, d_2 mm		$t_{\Delta dmp}$, $t_{\Delta d2mp}$		t_{Vdsp}, t_{Vd2sp}	t_{Si} [a] [b]	$t_{\Delta Tg}$		$t_{\Delta T1g}$	
>	≤	U	L			U	L	U	L
—	18	0	−8	6	10	+20	−250	+150	−400
18	30	0	−10	8	10	+20	−250	+150	−400
30	50	0	−12	9	10	+20	−250	+150	−400
50	80	0	−15	11	10	+20	−300	+150	−500
80	120	0	−20	15	15	+25	−300	+200	−500
120	180	0	−25	19	15	+25	−400	+200	−600
180	250	0	−30	23	20	+30	−400	+250	−600
250	315	0	−35	26	25	+40	−400	—	—
315	400	0	−40	30	30	+40	−500	—	—
400	500	0	−45	34	30	+50	−500	—	—
500	630	0	−50	38	35	+60	−600	—	—
630	800	0	−75	55	40	+70	−750	—	—
800	1 000	0	−100	75	45	+80	−1 000	—	—
1 000	1 250	0	−125	95	50	+100	−1 400	—	—
1 250	1 600	0	−160	120	60	+120	−1 600	—	—
1 600	2 000	0	−200	150	75	+140	−1 900	—	—
2 000	2 500	0	−250	190	90	+160	−2 300	—	—

NOTE For double-direction thrust bearings, the values apply only up to and including d_2 = 190 mm.

[a] Applies only to thrust ball bearings with 90° contact angle and thrust cylindrical roller bearings with 90° contact angle.

[b] Does not apply to central shaft washer.

Table 4 — Housing washer — Tolerance class Normal

Deviation limits and tolerance values in micrometres

D mm		$t_{\Delta Dmp}$		t_{VDsp}	t_{Se} [a]
>	≤	U	L		
10	18	0	−11	8	Identical to t_{Si} of shaft washer of the same bearing.
18	30	0	−13	10	
30	50	0	−16	12	
50	80	0	−19	14	
80	120	0	−22	17	
120	180	0	−25	19	
180	250	0	−30	23	
250	315	0	−35	26	
315	400	0	−40	30	
400	500	0	−45	34	
500	630	0	−50	38	
630	800	0	−75	55	
800	1 000	0	−100	75	
1 000	1 250	0	−125	95	
1 250	1 600	0	−160	120	
1 600	2 000	0	−200	150	
2 000	2 500	0	−250	190	
2 500	2 850	0	−300	225	

NOTE For double-direction thrust bearings, the values apply only up to and including D = 360 mm.

[a] Applies only to thrust ball bearings with 90° contact angle and thrust cylindrical roller bearings with 90° contact angle.

6.3 Tolerance class 6

See Tables 5 and 6.

Table 5 — Shaft washer, central shaft washer, and bearing height — Tolerance class 6

Deviation limits and tolerance values in micrometres

d, d_2 mm		$t_{\Delta dmp}$, $t_{\Delta d2mp}$		t_{Vdsp}, t_{Vd2sp}	t_{Si} [a b]	$t_{\Delta Tg}$		$t_{\Delta T1g}$	
>	≤	U	L			U	L	U	L
—	18	0	−8	6	5	+20	−250	+150	−400
18	30	0	−10	8	5	+20	−250	+150	−400
30	50	0	−12	9	6	+20	−250	+150	−400
50	80	0	−15	11	7	+20	−300	+150	−500
80	120	0	−20	15	8	+25	−300	+200	−500

NOTE For double-direction thrust bearings, the values apply only up to and including d_2 = 190 mm.

[a] Applies only to thrust ball bearings with 90° contact angle and thrust cylindrical roller bearings with 90° contact angle.

[b] Does not apply to central shaft washer.

Table 5 *(continued)*

d, d_2 mm		$t_{\Delta dmp}$, $t_{\Delta d2mp}$		t_{Vdsp}, t_{Vd2sp}	t_{Si} [a] [b]	$t_{\Delta Tg}$		$t_{\Delta T1g}$	
>	≤	U	L			U	L	U	L
120	180	0	−25	19	9	+25	−400	+200	−600
180	250	0	−30	23	10	+30	−400	+250	−600
250	315	0	−35	26	13	+40	−400	—	—
315	400	0	−40	30	15	+40	−500	—	—
400	500	0	−45	34	18	+50	−500	—	—
500	630	0	−50	38	21	+60	−600	—	—
630	800	0	−75	55	25	+70	−750	—	—
800	1 000	0	−100	75	30	+80	−1 000	—	—
1 000	1 250	0	−125	95	35	+100	−1 400	—	—
1 250	1 600	0	−160	120	40	+120	−1 600	—	—
1 600	2 000	0	−200	150	45	+140	−1 900	—	—
2 000	2 500	0	−250	190	50	+160	−2 300	—	—

NOTE For double-direction thrust bearings, the values apply only up to and including d_2 = 190 mm.

[a] Applies only to thrust ball bearings with 90° contact angle and thrust cylindrical roller bearings with 90° contact angle.

[b] Does not apply to central shaft washer.

Table 6 — Housing washer — Tolerance class 6

Deviation limits and tolerance values in micrometres

D mm		$t_{\Delta Dmp}$		t_{VDsp}	t_{Se} [a]
>	≤	U	L		
10	18	0	−11	8	Identical to t_{Si} of shaft washer of the same bearing.
18	30	0	−13	10	
30	50	0	−16	12	
50	80	0	−19	14	
80	120	0	−22	17	
120	180	0	−25	19	
180	250	0	−30	23	
250	315	0	−35	26	
315	400	0	−40	30	
400	500	0	−45	34	
500	630	0	−50	38	
630	800	0	−75	55	
800	1 000	0	−100	75	
1 000	1 250	0	−125	95	
1 250	1 600	0	−160	120	
1 600	2 000	0	−200	150	
2 000	2 500	0	−250	190	
2 500	2 850	0	−300	225	

NOTE For double-direction thrust bearings, the values apply only up to and including D = 360 mm.

[a] Applies only to thrust ball bearings with 90° contact angle and thrust cylindrical roller bearings with 90° contact angle.

6.4 Tolerance class 5

See Tables 7 and 8.

Table 7 — Shaft washer, central shaft washer, and bearing height — Tolerance class 5

Deviation limits and tolerance values in micrometres

d, d_2 mm		$t_{\Delta dmp}$, $t_{\Delta d2mp}$		t_{Vdsp}, t_{Vd2sp}	t_{Si} [a b]	$t_{\Delta Tg}$		$t_{\Delta T1g}$	
>	≤	U	L			U	L	U	L
—	18	0	−8	6	3	+20	−250	+150	−400
18	30	0	−10	8	3	+20	−250	+150	−400
30	50	0	−12	9	3	+20	−250	+150	−400
50	80	0	−15	11	4	+20	−300	+150	−500
80	120	0	−20	15	4	+25	−300	+200	−500

NOTE For double-direction thrust bearings, the values apply only up to and including d_2 = 190 mm.

[a] Applies only to thrust ball bearings with 90° contact angle and thrust cylindrical roller bearings with 90° contact angle.

[b] Does not apply to central shaft washer.

Table 7 *(continued)*

d, d_2 mm		$t_{\Delta dmp}$, $t_{\Delta d2mp}$		t_{Vdsp}, t_{Vd2sp}	t_{Si} [a] [b]	$t_{\Delta Tg}$		$t_{\Delta T1g}$	
>	≤	U	L			U	L	U	L
120	180	0	−25	19	5	+25	−400	+200	−600
180	250	0	−30	23	5	+30	−400	+250	−600
250	315	0	−35	26	7	+40	−400	—	—
315	400	0	−40	30	7	+40	−500	—	—
400	500	0	−45	34	9	+50	−500	—	—
500	630	0	−50	38	11	+60	−600	—	—
630	800	0	−75	55	13	+70	−750	—	—
800	1 000	0	−100	75	15	+80	−1 000	—	—
1 000	1 250	0	−125	95	18	+100	−1 400	—	—
1 250	1 600	0	−160	120	25	+120	−1 600	—	—
1 600	2 000	0	−200	150	30	+140	−1 900	—	—
2 000	2 500	0	−250	190	40	+160	−2 300	—	—

NOTE For double-direction thrust bearings, the values apply only up to and including d_2 = 190 mm.

[a] Applies only to thrust ball bearings with 90° contact angle and thrust cylindrical roller bearings with 90° contact angle.

[b] Does not apply to central shaft washer.