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Rolling bearings — Steel cylindrical rollers — Dimensions and tolerances

Roulements — Rouleaux cylindriques en acier — Dimensions et tolérances

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Foreword

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ISO 12297 was prepared by Technical Committee ISO/TC 4, *Rolling bearings*, Subcommittee SC 5, *Needle, cylindrical and spherical roller bearings*.

Rolling bearings — Steel cylindrical rollers — Dimensions and tolerances

1 Scope

This International Standard specifies requirements for finished steel cylindrical rollers for rolling bearings. The maximum roller diameter is 40 mm.

2 Normative references

The following referenced documents are indispensable for the application 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 1132-1:2000, *Rolling bearings — Tolerances — Part 1: Terms and definitions*

ISO 5593:1997, *Rolling bearings — Vocabulary*

ISO 15241, *Rolling bearings — Symbols for quantities*

3 Terms and definitions

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

3.1
roller diameter
D_{w}
diameter value used for the general identification of roller diameter

[ISO 5593:1997, definition 05.05.01]

3.2
single roller diameter
D_{ws}
distance between two tangents to the actual surface of a roller parallel to each other and in a radial plane

NOTE Adapted from ISO 5593:1997, definition 05.05.02.

3.3
mean roller diameter in a single plane
D_{wmp}
arithmetical mean of the largest and the smallest of the single roller diameters in a single radial plane

[ISO 5593:1997, definition 05.05.03]

3.4
variation of mean roller diameter
$V_{D\mathrm{wmp}}$
difference between the largest and the smallest of the mean roller diameters measured in two radial planes in the cylindrical part of the roller arranged symmetrically to the middle of the roller

3.5
variation of roller diameter in a single plane
$V_{D\mathrm{wsp}}$
difference between the largest and the smallest of the single roller diameters in a single radial plane

[ISO 5593:1997, definition 05.05.04]

3.6
roller length
L_{w}
length value used for the general identification of roller length

NOTE Adapted from ISO 5593:1997, definition 05.05.05.

3.7
chamfer dimension
r
roller chamfer dimension value used for reference purposes

3.8
single chamfer dimension
r_{s}
⟨radial⟩ distance, in a single axial plane, between the imaginary sharp corner of a roller and the intersection of a chamfer surface and the roller end face

NOTE Adapted from ISO 1132-1:2000, definition 5.4.2.

3.9
single chamfer dimension
r_{s}
⟨axial⟩ distance, in a single axial plane, between the imaginary sharp corner of a roller and the intersection of a chamfer surface and the roller outside diameter surface

NOTE Adapted from ISO 1132-1:2000, definition 5.4.2.

3.10
smallest single chamfer dimension
$r_{\mathrm{s\ min}}$
⟨minimum limit⟩ smallest permissible radial and axial single chamfer dimensions of a roller

NOTE Adapted from ISO 1132-1:2000, definition 5.4.3.

3.11
largest single chamfer dimension
$r_{\mathrm{s\ max}}$
⟨maximum limit⟩ largest permissible radial and axial single chamfer dimensions of a roller

NOTE Adapted from ISO 1132-1:2000, definition 5.4.4.

3.12
axial runout of roller end face with respect to the roller axis
S_{Dw}
difference between the largest and the smallest of the axial distances of the end surface at a certain radial distance from the roller axis

3.13
deviation from circular form of roller outside diameter surface
$\Delta_{R\mathrm{w}}$
radial distance between the smallest circumscribed circle and the greatest inscribed circle, with their centres common to the least squares circle centre

3.14
surface roughness
surface irregularities with relatively small spacing, 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.

3.15
roller diameter gauge
amount by which the mean diameter of a roller diameter gauge lot should differ from the nominal roller diameter, this amount being one of an established series

NOTE 1 Each roller diameter gauge is a whole multiple of the roller diameter gauge interval established for the roller grade in question.

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

3.16
interval of roller diameter gauge
$I_{\mathrm{G}D\mathrm{w}}$
amount by which the permitted mean diameter of roller diameter gauge lot is divided

3.17
roller length gauge
amount by which the mean length of a roller length gauge lot should differ from the nominal roller length, this amount being one of an established series

NOTE Each roller length gauge is a whole multiple of the roller length gauge interval established for a certain nominal roller length.

3.18
interval of roller length gauge
$I_{\mathrm{G}L\mathrm{w}}$
amount by which the permitted mean length of roller length gauge lot is divided

3.19
roller diameter gauge lot
quantity of rollers of the same roller grade and nominal dimensions, all having the mean roller diameter in a single plane within the same roller diameter gauge

3.20
mean diameter of roller diameter gauge lot
D_{wmL}
arithmetical mean of the mean diameter of the largest roller and the smallest roller in a roller diameter gauge lot

3.21
roller length gauge lot
quantity of rollers, all having the mean roller length within the same roller length gauge

3.22
mean length of roller length gauge lot
L_{wmL}
arithmetical mean of the mean length of the longest roller and the shortest roller length in a roller length gauge lot

3.23
variation of roller diameter gauge lot diameter
$V_{D\mathrm{wL}}$
difference between the mean diameter in a single plane of the roller having the largest such diameter and that of the roller having the smallest such diameter in a roller diameter gauge lot

3.24
variation of roller length gauge lot length
$V_{L\mathrm{wL}}$
difference between the mean length of the roller having the largest such length and that of the roller having the smallest such length in a roller length gauge lot

3.25
roller grade
G
specific combination of dimensional, form, surface roughness and sorting tolerances for rollers

[ISO 5593:1997 definition 05.05.10]

3.26
hardness
measure of resistance to penetration as determined by a specific method, such as Rockwell hardness test

3.27
roller outside diameter surface
surface generated by the available roller length when rotating around the roller axis

NOTE The available roller length is given by $L_\mathrm{a} = L_\mathrm{w} - 2r$.

4 Symbols

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

The symbols (except those for tolerances) shown in Figure 1 and the values given in Table 1 denote nominal dimensions, unless specified otherwise.

D_w roller diameter

D_wmL mean diameter of roller diameter gauge lot

G roller grade

$I_{\mathrm{G}D\mathrm{w}}$ interval of roller diameter gauge

$I_{\mathrm{G}L\mathrm{w}}$ interval of roller length gauge

L_a available roller length, $L_\mathrm{a} = L_\mathrm{w} - 2r$

L_w roller length

L_wmL mean length of roller length gauge lot

r chamfer dimension

r_s single chamfer dimension

$r_\mathrm{s\,min}$ smallest single chamfer dimension

$r_\mathrm{s\,max}$ largest single chamfer dimension

S_Dw axial runout of roller end face with respect to the roller axis

$V_{D\mathrm{wL}}$ variation of roller diameter gauge lot diameter

$V_{D\mathrm{wmp}}$ variation of mean roller diameter

$V_{D\mathrm{wsp}}$ variation of roller diameter in a single plane

$V_{L\mathrm{wL}}$ variation of roller length gauge lot length

$\Delta_{R\mathrm{w}}$ deviation from circular form of roller outside diameter surface

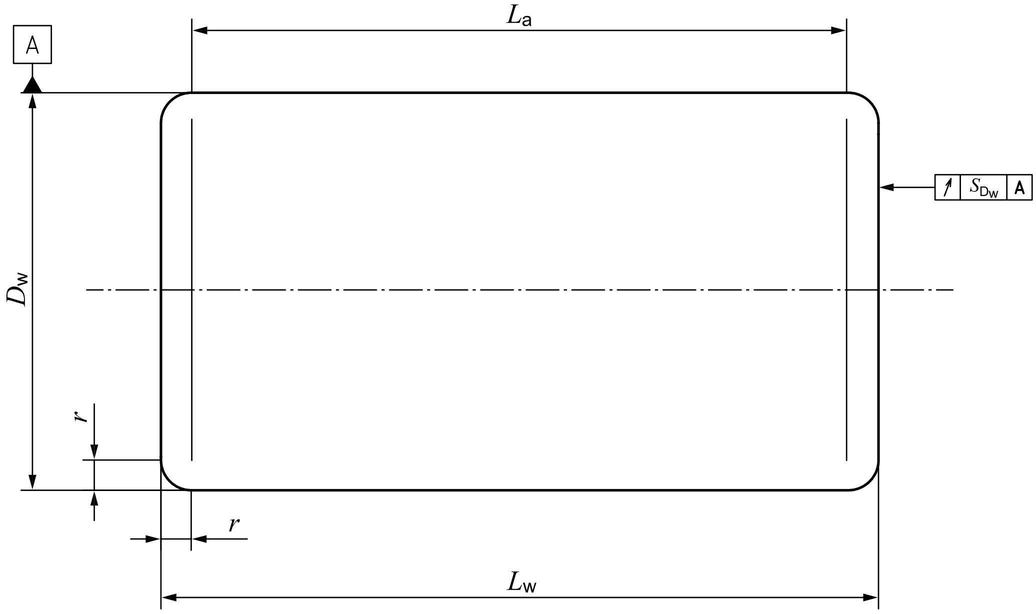


Figure 1 — Cylindrical roller

5 Dimensions

The dimensions of the cylindrical rollers are given in Table 1.

Table 1 — Dimensions for cylindrical rollers

Dimensions in millimetres

D_w	L_w	$r_{s\,min}$[a]	$r_{s\,max}$
3	3	0,1	0,7
3	4	0,1	0,7
3	5	0,1	0,7
3,5	5	0,1	0,7
4	4	0,2	0,7
4	6	0,2	0,7
4	8	0,2	0,7
4,5	4,5	0,2	0,7
4,5	6	0,2	0,7
5	5	0,2	0,7
5	8	0,2	0,7
5	10	0,2	0,7
5,5	5,5	0,2	0,7
5,5	8	0,2	0,7
6	6	0,2	0,7
6	8	0,2	0,7
6	9	0,2	0,7
6	10	0,2	0,7
6	12	0,2	0,7
6,5	6,5	0,2	0,8
6,5	8	0,2	0,8
6,5	9	0,2	0,8
7	7	0,2	0,8
7	10	0,2	0,8
7	14	0,2	0,8
7,5	7,5	0,2	0,8
7,5	9	0,2	0,8
7,5	10	0,2	0,8
7,5	11	0,2	0,8
8	8	0,3	0,8
8	10	0,3	0,8
8	12	0,3	0,8
8	14	0,3	0,8

Table 1 *(continued)*

D_W	L_W	$r_{s\ min}$[a]	$r_{s\ max}$
8	16	0,3	0,8
8	20	0,3	0,8
9	9	0,3	1,0
9	10	0,3	1,0
9	12	0,3	1,0
9	13	0,3	1,0
9	14	0,3	1,0
10	10	0,3	1,0
10	11	0,3	1,0
10	14	0,3	1,0
10	15	0,3	1,0
10	16	0,3	1,0
10	17	0,3	1,0
10	25	0,3	1,0
11	11	0,3	1,0
11	12	0,3	1,0
11	13	0,3	1,0
11	15	0,3	1,0
11	20	0,3	1,0
12	12	0,3	1,0
12	14	0,3	1,0
12	16	0,3	1,0
12	17	0,3	1,0
12	18	0,3	1,0
12	21	0,3	1,0
12	22	0,3	1,0
13	13	0,3	1,2
13	18	0,3	1,2
13	20	0,3	1,2
14	14	0,3	1,2
14	15	0,3	1,2
14	20	0,3	1,2
14	22	0,3	1,2
15	15	0,4	1,2
15	16	0,4	1,2
15	17	0,4	1,2
15	22	0,4	1,2

Table 1 *(continued)*

D_w	L_w	$r_{s\ min}$[a]	$r_{s\ max}$
15	24	0,4	1,2
16	16	0,4	1,2
16	17	0,4	1,2
16	18	0,4	1,2
16	24	0,4	1,2
16	27	0,4	1,2
17	17	0,4	1,2
17	24	0,4	1,2
18	18	0,4	1,2
18	19	0,4	1,2
18	26	0,4	1,2
18	30	0,4	1,2
19	19	0,4	1,5
19	20	0,4	1,5
19	21	0,4	1,5
19	28	0,4	1,5
19	32	0,4	1,5
20	20	0,4	1,5
20	30	0,4	1,5
21	21	0,5	1,5
21	22	0,5	1,5
21	30	0,5	1,5
21	32	0,5	1,5
22	22	0,5	1,5
22	24	0,5	1,5
22	34	0,5	1,5
23	23	0,5	1,5
23	34	0,5	1,5
24	24	0,5	1,5
24	26	0,5	1,5
24	36	0,5	1,5
24	38	0,5	1,5
25	25	0,5	1,7
25	27	0,5	1,7
25	33,5	0,5	1,7
25	36	0,5	1,7

Table 1 *(continued)*

D_w	L_w	$r_{s\ min}$[a]	$r_{s\ max}$
25	40	0,5	1,7
26	26	0,5	1,7
26	28	0,5	1,7
26	40	0,5	1,7
26	48	0,5	1,7
28	28	0,6	1,7
28	30	0,6	1,7
28	36	0,6	1,7
28	44	0,6	1,7
28	46	0,6	1,7
30	30	0,6	1,7
30	42	0,6	1,7
30	48	0,6	1,7
30	52	0,6	1,7
32	32	0,6	2,2
32	46	0,6	2,2
32	52	0,6	2,2
34	34	0,6	2,2
34	55	0,6	2,2
34	66	0,6	2,2
36	36	0,7	2,2
36	58	0,7	2,2
38	38	0,7	2,2
38	52	0,7	2,2
38	62	0,7	2,2
40	40	0,7	2,2
40	65	0,7	2,2

[a] No roller material is allowed to project beyond an imaginary circular arc, which has a radius $r_{s\ min}$ in an axial plane and is tangential to the roller face and to the outside surface of the roller.

6 Tolerances

Table 2 gives the tolerances for:

- deviation from circular form, Δ_{Rw}
- variation of roller gauge lot diameter, V_{DwL}
- variation of mean roller diameter, V_{Dwmp}
- surface roughness of the roller outside diameter surface, Ra
- axial runout with respect to the roller axis, S_{Dw}

Table 2 — Diameter tolerances, roller outside diameter surface roughness and axial runout

Tolerance values in micrometres

Grade	Δ_{Rw}[a] max.	V_{DwL}[a] max.	V_{Dwmp}[a b] max.	Surface roughness[a] Ra max.	S_{Dw} max.	l_{GDw} and roller diameter gauge
G1	0,5	1,5	0,8	0,1	6	The interval of roller diameter gauge and diameter gauge shall be defined subject to agreement between the customer and the supplier.
G1A	0,8	2	1,2	0,16	6	
G2	1	2	1,5	0,16	6	
G2A	1,3	3	2	0,2	6	
G3	1,5	3	3	0,3	10	
G5	2,5	5	4	0,4	15	

[a] The values apply to the cylindrical part of the roller outside diameter surface.

[b] The values apply to two single planes which are arranged symmetrically to the middle of the roller.

7 Hardness

The hardness of cylindrical rollers is given in Table 3.

Table 3 — Hardness for cylindrical roller

HRC	HV
58 to 67	(653 to 900)[a]

[a] Values in parentheses indicate the converted values for informative reference.

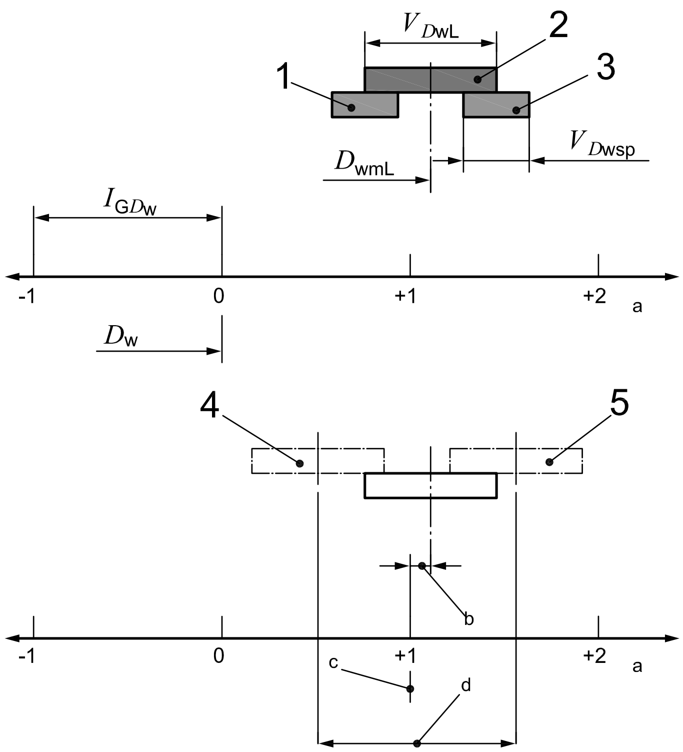
The hardness shall be the plane hardness.

Annex A
(informative)

Roller diameter gauges and sorting principles

Figure A.1 shows an example of the relationship between a roller diameter lot and its diameter gauge with a roller diameter gauge of +1 µm.

Dimensions in micrometres



Key

1 smallest roller in the roller diameter lot

2 roller diameter lot

3 largest roller in the roller diameter lot

4 roller diameter lot with smallest D_{wmL} to be related to roller diameter gauge

5 roller diameter lot with largest D_{wmL} to be related to roller diameter gauge

[a] Roller diameter gauge scale.

[b] Deviation of D_{wmL} from roller diameter gauge.

[c] Roller diameter gauge.

[d] Range of mean diameter of roller diameter gauge lot.

Figure A.1 — Roller diameter gauges and sorting principles

Annex B
(informative)

Roller length tolerances, gauges and sorting principles

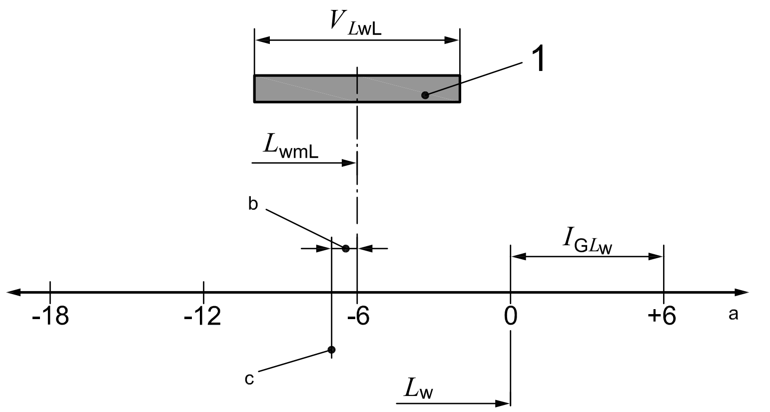
For some radial cylindrical roller bearings, specific application requirements may require the cylindrical rollers assembled in a bearing to be sorted in specific length gauges, as shown in Table B.1 and Figure B.1.

Table B.1 — Roller length tolerances and length gauges

D_w mm		L_w mm		V_{LwL} µm	I_{GLw} µm	**Roller length gauge** µm
>	≤	>	≤	max.		
—	40	—	48	8	6	– 18; – 12; – 6; 0; + 6
		48	—	12	10	– 40; – 30; – 20; – 10; 0; + 10

Figure B.1 shows an example of a roller length lot and its length gauges with a roller length gauge of −6 µm.

Dimensions in micrometres



Key

1 roller length lot

a Roller length gauge scale.

b Deviation of L_{wmL} from roller length gauge.

c Roller length gauge.

Figure B.1 — Roller length gauges and sorting principles

Annex C
(informative)

Method for assessment of deviation from circular form of roller outside diameter surface

The measurement of deviation from circular form of roller outside diameter surface may be carried out by measurement of roundness deviation in several radial planes.

The default evaluation method of roundness deviation in a single radial plane may be carried out by calculation from the least squares reference circle in accordance with ISO 12181-1.

The greatest roundness deviation in any of these radial planes is assumed to be the deviation from circular form of roller outside diameter surface.

For a detailed description of methods for the assessment of deviation from roundness, see ISO 4291.

If a different evaluation method is used, it should be agreed between the customer and the supplier.

Bibliography

[1] ISO 3096, *Rolling bearings — Needle rollers — Dimensions and tolerances*

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

[3] ISO 4291, *Methods for the assessment of departure from roundness — Measurement of variations in radius*

[4] ISO 12181-1, *Geometrical product specifications (GPS) — Roundness — Part 1: Vocabulary and parameters of roundness*

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