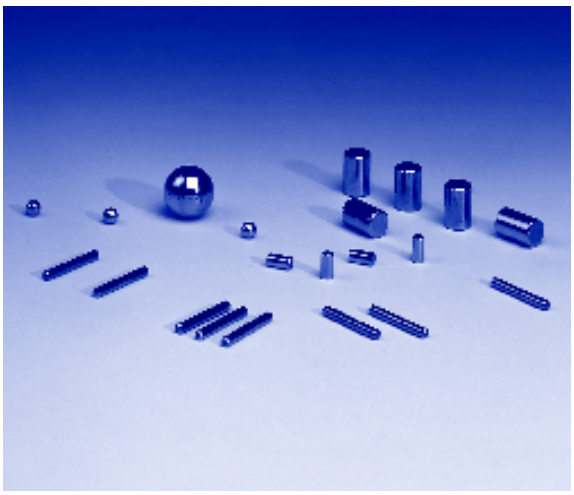
Rolling Elements



Balls

Balls as a rolling bearing component are made of the same material as bearing rings. The material hardness after processing (hardening) is 61 to 65 HRC.

Balls with diameter D_w = 3.175 to 17.462 mm are supplied within the tolerance classes 10, 16, 20, 28, 40, and 100. Balls with diameter D_w = 18.256 to 33.338 mm are supplied within the tolerance classes 16, 20, 28, 40 and 100 according to the international standard ISO 3290.

The delivery of balls in different tolerance class or made of a different material should be discussed in advance.

Within each tolerance class, balls of the same nominal diameter D_w are graded into grades according to mean grading deviation of the nominal ball diameter in the lot ΔD_{wm}.

Each grade is packed separately and is marked in documentation and package by the value of the nominal diameter mean deviation in the lot in μm, e.g.

Balls 6 - 40 + 4

This means that the ball has the nominal diameter 6 mm, tolerance class 40 and has the actual diameter within 6.003 to 6.005 mm.

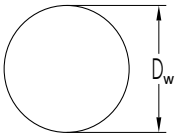
Limiting Deviation Diameter and Form. Limiting Surface Roughness.

Tolerance Class	D_w over	to	Δ_{Dwm}	V_{DWL} max	V_{Dws} max	Δ max	R_a max
	mm		μm				
3	0.25	12	±5	0.13	0.08	0.08	0.012
5	0.25	12	±5	0.25	0.13	0.13	0.020
10	0.25	25	±9	0.50	0.25	0.25	0.025
16	0.25	25	±10	0.80	0.40	0.40	0.032
20	0.25	38	±10	1.00	0.50	0.50	0.040
28	0.25	38	±12	1.40	0.70	0.70	0.050
40	0.25	50	±16	2.00	1.00	1.00	0.080
100	0.25	120	±40	5.00	2.50	2.50	0.125
200	0.25	150	±60	10.00	5.00	5.00	0.200

D_w - nominal ball diameter
Δ_{Dwm} - limiting deviation of mean ball diameter as individual component
V_{DwL} - ball diameter variation in a lot
V_{DwS} - individual ball diameter variation
Δ - deviation from roundness /out-of-roudness/
R_a - surface roughness

Balls

D_w = 1.000 to 33.338 mm



Nominal Diameter D_w		Weight 1000 pcs ~	Nominal Diameter D_w		Weight 1000 pcs ~
mm	inch	kg	mm	inch	kg
1.000		0.004	12.700	1/2	8.42
1.150		0.006	13.494	17/32	10.10
2.381	3/32	0.055			
2.450		0.060	14.288	9/16	12.00
3.175	1/8	0.132	15.081	19/32	14.10
3.969	5/32	0.257	15.875	5/8	16.40
4.762	3/16	0.444	16.669	21/32	19.10
5.000		0.514	17.462	11/16	21.90
5.556	7/32	0.705	18.256	23/32	25.00
5.953	15/64	0.867	19.050	3/4	28.40
6.000		0.887	19.844	25/32	32.10
6.350	1/4	1.050	20.638	13/16	36.20
6.747	17/64	1.260	21.431	27/31	40.00
7.144	9/32	1.500	22.225	7/8	45.10
7.938	5/16	2.060	23.019	29/32	50.20
8.500		2.520	23.812	15/16	55.50
8.731	11/32	2.730	24.606	31/32	61.20
9.525	3/8	3.550	25.400	1	67.30
10.000		3.110	26.988	1 1/16	80.80
10.319	13/32	4.510	28.575	1 1/8	96.00
10.500		4.723	30.162	1 3/16	113.00
11.112	7/16	5.640	31.750	1 1/4	132.00
11.450		6.160	33.338	1 5/16	152.00
11.906	15/32	6.930			

Cylindrical Rollers

Cylindricals rollers are produced with convex contour of the rolling surface or in design with straight line contour and end crowned towards both faces (ZB).

After being made of rolling bearing steel the cylindrical rollers have hardness 60 to 65 HRC.

Cylindrical rollers are usually delivered in the tolerance class III (DIN 5402). Delivery of rollers made of different dimensions or materials in than dimension tables of the catalogue should be discussed in advance.

Within each tolerance class, the cylindrical rollers of the same nominal diameter D_w and nominal length L_w are graded according to the mean grading deviation of the nominal cylindrical roller diameter and length.

Example of cylindrical roller designation is shown in documentation and packing.

Short cylindrical roller 8 x 12 ZB III + 2/-3

this means that the cylindrical roller has nominal diameter 8 mm and nominal length 12mm in ZB design, tolerance class III and has actual diameter 8.001 to 8.003 mm and actual length 11.994 to 12.000.

Limiting Coordinates of Cylindrical Roller Rounding

Nominal Diameter r	Limiting Dimensions of Rounding Coordinates $r_{s\,min}$	$r_{s\,max}$
mm	mm	
0.3	0.2	0.5
0.5	0.3	0.8
0.8	0.5	1.2
1.0	0.7	1.5
1.5	1.1	2.1
2.0	1.5	2.7

Limiting Deviations of Dimensions, Form and Position. Limiting Surface Roughness.

Tolerance Class	D_w over	to	Δ_{Dwmp}	V_{DWL} max	V_{Dwp}	Δ max	V_{Dwmp} max	Face Convexity max	R_a max
	mm		µm						
I.	-	18	+10.25/-16.25	0.5	0.25	0.3	0.3	2	0.08
	18	26	+10.25/-16.25	0.5	0.25	0.4	0.5	2	0.08
II.	-	18	+10.25/-16.25	1.0	0.5	0.5	0.5	2	0.16
	18	26	+10.25/-16.25	1.0	0.5	0.8	1.0	2	0.16
III.	-	18	+11/-17	2.0	1.0	1.0	1.0	2	0.16
	18	26	+11/-17	2.0	1.0	1.5	1.0	2	0.16
IV.	-	18	0/-45	3.0	2.0	2.0	2.0	3	0.32
	18	26	0/-45	3.0	2.0	3.0	2.0	3	0.32

D_w - short cylindrical roller nominal diameter
Δ_{Dwmp} - limiting deviation of cylindrical roller diameter as individual component
V_{DwL} - variations of cylindrical roller diameter in a lot
V_{Dwp} - variation of individual cylindrical roller diameter
Δ - roudness deviation
V_{Dwmp} - conicity
R_a - cylindrical surface roughness

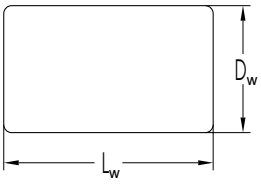
Dimension and shape Deviations, except Conicity and Convexity Are Valid in Central Section of Cylindrical Rollers.

Tolerance Class	L_w over	to	Δ_{Lws}	V_{LwL} max	S_w max	Face Convexity max	R_a max
	mm		µm				
I.	-	15	+2/-7	3	3	2	0.08
-	15	26	+2/-7	3	3	2	0.08
	26	40	+2.5/-7.5	5	5	3	0.08
II.	-	15	+3/-15	6	6	3	0.16
	15	40	+3/-15	6	6	5	0.16
III.	-	26	+10/-20	6	6	3	0.16
	26	40	+10/-20	6	6	5	0.32
IV.	-	10	0/-32	10	16	3	0.63
	10	18	0/-32	10	20	3	0.63
	18	30	0/-32	15	25	5	0.63
	30	40	0/-50	20	30	5	0.63

L_w - Short cylindrical roller nominal length
Δ_{Lws} - limiting length deviations of rollers as individual components
V_{LwL} - roller length variation in a lot
S_w - lateral run-out
R_a - face surface roughness

Cylindrical Rollers

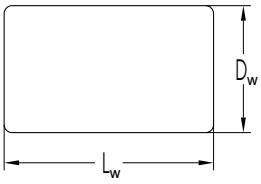
D_w = 3 to 22 mm



Dimensions D_w x L_w	r	Weight 100 pcs ~	Dimensions D_w x L_w	r	Weight 100 pcs ~	Dimensions D_w x L_w	r	Weight 100 pcs ~
mm		kg	mm		kg	mm		kg
3x5	0.3	0.027	8x8	0.5	0.308	15x17	0.8	2.340
3.175x4.400	0.3	0.027	8x10	0.5	0.391	15x22	0.8	3.000
3.5x5	0.3	0.037	8x12	0.5	0.465	15x24	0.8	3.300
			8x16	0.5	0.627	15x25	0.8	3.440
4x6	0.3	0.058				15x30	0.8	4.130
4x8	0.3	0.078	9x9	0.5	0.440	15x32	0.8	4.390
4.5x4.5	0.3	0.068	9x10	0.5	0.496			
			9x13	0.5	0.450	16x16	0.8	2.480
5x6	0.3	0.091	9x14	0.5	0.680	16x17	0.8	2.660
5x8	0.3	0.121				16x24	0.8	3.730
5x10	0.3	1.520	10x10	0.5	0.600	16x27	0.8	4.230
5.349x9.520	0.3	0.166	10x11	0.5	0.670	16x35	0.8	5.500
5.350x9.5	0.3	0.150	10x14	0.5	0.850	16x47	0.8	7.370
5.5x5.5	0.3	0.100	10x15	0.5	9.200	16.200x50	0.8	7.490
5.5x8	0.3	0.146	10x16	0.5	0.980			
			10x20	0.5	1.225	17x17	1.0	2.970
6x6	0.3	0.130	10x30	0.5	1.830	17x24	1.0	4.200
6x8	0.3	1.780				17x34	1.0	5.900
6x10	0.3	0.219	11x11	0.8	0.810			
6x12	0.3	0.261	11x12	0.8	0.890	18x18	1.0	3.570
6.350x6.350	0.4	0.158	11x15	0.8	1.100	18x19	1.0	3.770
6.350x12	0.5	0.296	11x16	0.8	1.180	18x26	0.8	5.100
6.5x6.5	0.5	0.166	11x18	0.8	1.330	18x30	1.0	5.960
6.5x9	0.5	0.230	11x22	0.8	1.620	18x36	1.0	7.150
6.5x11	0.5	0.258						
			12x12	0.8	1.040	19x19	1.0	4.160
7x7	0.5	0.206				19x20	1.0	4.440
7x10	0.5	0.296	13x13	0.8	1.330	19x28	1.0	6.100
7x14	0.5	0.417	13x20	0.8	2.040	19x32	1.0	7.030
7.350x14	0.5	0.463						
7.5x7.5	0.5	0.254	14x13.800	0.8	1.650	20x20	1.0	4.850
7.5x9	0.5	0.310	14x14	0.8	1.650	20x30	1.0	7.300
7.5x11	0.5	0.374	14x15	0.8	1.800	20x40	1.0	9.770
7.5x17	0.4	0.583	14x20	0.8	2.380			
7.5x19	0.4	0.652	14x22	0.8	2.640	21x21	1.0	5.600
7.5x22	0.4	0.757	14x26	0.8	3.100	21x22	1.0	9.940
7.5x25.5	0.5	0.884	14x28	0.8	3.340	21x42	1.0	11.200
7.937x6.350	0.5	0.241						
7.937x7.937	0.4	0.302	15x15	0.8	2.040	22x22	1.0	6.400
7.950x6.350	0.3	0.240	15x16	0.8	2.200	22x24	1.0	7.110

Cylindrical Rollers

D_w = 22 to 53 mm



Dimensions D_w x L_w	r	Weight 100 pcs ~	Dimensions D_w x L_w	r	Weight 100 pcs ~	Dimensions D_w x L_w	r	Weight 100 pcs ~
mm		kg	mm		kg	mm		kg
22x34	1.0	10.000	38x38	2.0	33.300			
22x44	1.0	12.900	38x62	2.0	55.000			
22x48	1.0	14.200						
			40x40	2.0	38.900			
23x23	1.0	7.400						
23x34	1.0	11.200	42x42	2.0	45.400			
24x24	1.0	8.400	45x45	2.0	55.800			
24x26	1.0	9.100						
24x36	1.0	12.600	48x48	2.0	67.700			
24x40	1.0	14.100	48x52	2.0	73.700			
24x52	1.0	18.100						
			53x53	2.0	91.000			
25x25	1.5	9.500						
25x36	1.5	13.700						
26x26	1.5	10.700						
26x40	1.5	16.400						
26x48	1.5	19.800						
26x55	1.5	22.600						
27x48	1.5	21.400						
28x28	1.5	13.300						
28x30	1.5	14.300						
28x32	1.5	15.300						
28x44	1.5	21.000						
28x56	1.5	26.900						
30x30	1.5	16.300						
30x33	1.5	18.000						
30x48	1.5	26.200						
30x63	1.5	34.600						
32x32	1.5	19.900						
32x52	1.5	32.400						
32x64	1.5	40.000						
34x34	2.0	23.900						
34x55	2.0	38.700						