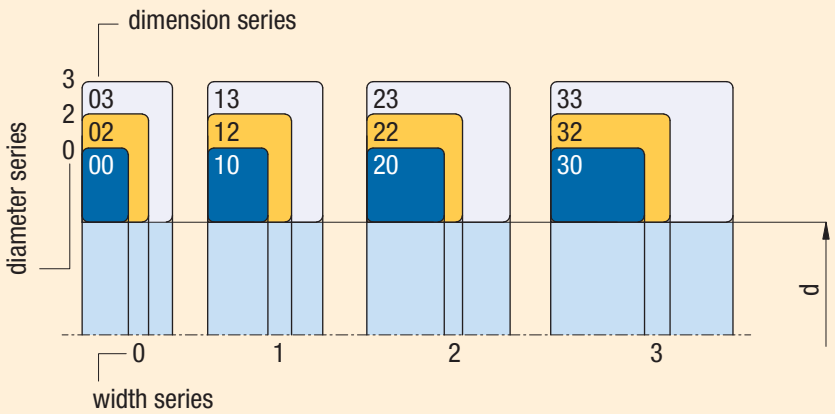
2.1 Boundary dimensions

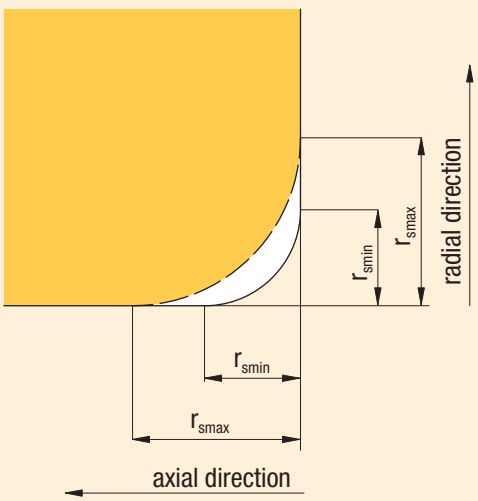
Bearings introduced in this publication are made in dimensions that are in accordance with the international standards ISO 15, ISO 355 and ISO 104. In the dimensional plan each bearing bore diameter d corresponds to several outer diameters D and various widths are added to them - B or T for radial and H for thrust bearings. Bearings having the same bore diameter and outer diameter belong to one diameter series which is designated according to the ascending outer diameter by figures 7, 8, 9, 0, 1, 2, 3, 4. Within each diameter series there are bearings of various width series according to the ascending width: 8, 0, 1, 2, 3, 4, 5, 6 for radial bearings and 7, 9, 1, 2 for thrust bearings. Diameter and width series form dimension series which are designated by a two digit number, where the first digit indicates the width series and the second the diameter one, as shown in Figure 7.

Figure 7



Dimensional plan also includes the bearing ring chamfer dimensions, so called mounting chamfer, see Figure 8.

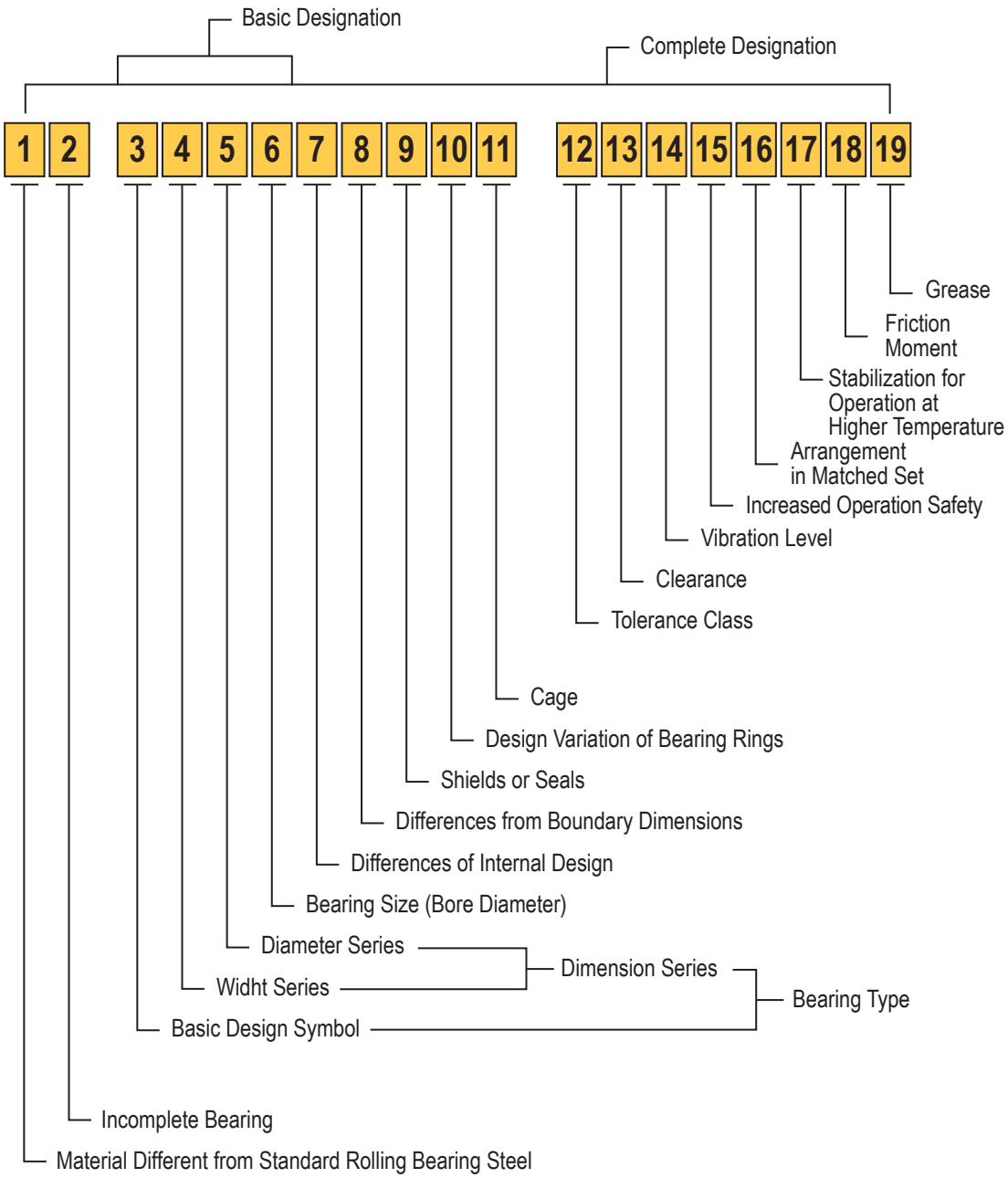
Figure 8



Overview of chamfer limiting values according to international standard ISO 582 is given in Table 9.

Limiting Dimensions of Mounting Chamfer									Table 9
Radial Bearings except Tapered Roller Bearings					Tapered Roller Bearings				Thrust Bearings
$r_{s\ min}$	d or D		$r_{s\ max}$		d or D		$r_{s\ max}$		$r_{s\ max}$
	Over	Incl.	In Radial Direction	In Axial Direction	Over	Incl.	In Radial Direction	In Axial Direction	In Radial And Axial Direction
mm									
0,15	-	-	0,3	0,6	-	-	-	-	0,3
0,2	-	-	0,5	0,8	-	-	-	-	0,5
0,3	-	40	0,6	1	-	40	0,7	1,4	0,8
	40	-	0,8	1	40	-	0,9	1,6	0,8
0,6	-	40	1	2	-	40	1,1	1,7	1,5
	40	-	1,3	2	40	-	1,3	2	1,5
1	-	50	1,5	3	-	50	1,6	2,5	2,2
	50	-	1,9	3	50	-	1,9	3	2,2
1,1	-	120	2	3,5	-	-	-	-	2,7
	120	-	2,5	4	-	-	-	-	2,7
1,5	-	120	2,3	4	-	120	2,3	3	3,5
	120	-	3	5	120	250	2,8	3,5	3,5
	-	-	-	-	250	-	3,5	4	3,5
2	-	80	3	4,5	-	120	2,8	4	4
	80	220	3,5	5	120	250	3,5	4,5	4
	220	-	3,8	6	250	-	4	5	4
2,1	-	280	4	6,5	-	-	-	-	4,5
	280	-	4,5	7	-	-	-	-	4,5
2,5	-	100	3,8	6	-	120	3,5	5	-
	100	280	4,5	6	120	250	4	5,5	-
	280	-	5	7	250	-	4,5	6	-
3	-	280	5	8	-	120	4	5,5	5,5
	280	-	5,5	8	120	250	4,5	6,5	5,5
	-	-	-	-	250	400	5	7	5,5
	-	-	-	-	400	-	5,5	7,5	5,5
4	-	-	6,5	9	-	120	5	7	6,5
	-	-	-	-	120	250	5,5	7,5	6,5
	-	-	-	-	250	400	6	8	6,5
	-	-	-	-	400	-	6,5	8,5	6,5
5	-	-	8	10	-	180	6,5	8	8
	-	-	-	-	180	-	7,5	9	8
6	-	-	10	13	-	180	7,5	10	10
	-	-	-	-	180	-	9	11	10
7,5	-	-	12,5	17	-	-	-	-	12,5
9,5	-	-	15	19	-	-	-	-	15
12	-	-	18	24	-	-	-	-	18
15	-	-	21	30	-	-	-	-	21

2.2 Designation



Bearing designation is created by numerical and letter symbols indicating the type, size and design of the bearing, see the scheme.
In the basic design the bearings are designated by a basic designation which consists of bearing type and size designation. The type designation is usually created by the symbol indicating the bearing design (see position 3 in the scheme) and the symbol for dimension series or diameter series (positions 4 and 5 in the scheme), e.g. bearing type 223, 302, NJ22, 511, 62, 12, etc. Bearing size designation is created by symbols for the nominal bore diameter d (see position 6 in the scheme).

Bearings with bore diameter d < 10 mm:
Digit separated by a slash, or the last digit indicates directly the bore dimension in mm, e.g. 619/2, 624.

Bearings with bore diameter d = 10 to 17 mm:

double digit number	00 indicates bore	d = 10 mm, e.g. 6200
	01	d = 12 mm, e.g. 51101
	02	d = 15 mm, e.g. 3202
	03	d = 17 mm, e.g. 6303

An exception to the designation are separable single row ball bearings - types E and BO, where the double digit number indicates directly the bore diameter in mm, e.g. E17.

Bearings with bore diameter d = 20 mm to 480 mm
Bore diameter is fivefold of the last double digit number, e.g. bearing 1320 has the bore diameter
d = 20 x 5 = 100 mm.

An exception create bearings with bore d = 22, 28, and 32 mm, where the double digit number separated by a slash indicates directly the bore diameter in mm, e.g. 320/32AX, further separable single row ball bearings - type E and single row cylindrical roller bearings - type NG, where the double digit number, or number indicates directly the bore diameter in mm, e.g.: E20, NG160 C4SO.

Bearings with bore diameter d = 500 mm:
The last three or four digit number separated by a slash indicates directly the bore diameter in mm, e.g. 230/530M, NU29/1060.

Bearings produced in different design than standard are designated by so called complete designation, see the scheme. It consists of the basic designation and prefixes and suffixes indicating the difference from the basic design.

Meaning of Prefixes and Suffixes
In compliance with complete designation a survey and meaning of used prefixes and suffixes is given in the following part. (Number in brackets at individual groups corresponds to the position number in the scheme).

Prefixes

Material Different from Standard Bearing Steel (1)

X - corrosion resisiting steel, e.g. X 623
T - case hardened steel, e.g. T 32240

Incomplete Bearing (2)

L - removable ring of separable bearing, e.g. L NU206,
for thrust ball bearings without shaft washer, e.g. L 51215
R - separable bearing without removable ring, e.g. R NU206 or R N310

E - single shaft washer of thrust roller bearing, e.g. E 51314
W - single housing washer of thrust ball bearing, e.g. W 51411
K - cage with rolling elements, e.g. K NU320

Suffixes

Difference of Internal Design (7)

A - single row angular contact ball bearing, contact angle α = 25°, e.g. B7205ATB P5
- single row tapered roller bearing with higher load rating and higher limiting speed, e.g. 30206A
- thrust ball bearing with higher limiting speed, e.g. 51105A

AA - single row angular contact ball bearing with contact angle α = 26°, e.g. B7210AATB P5

B - single row angular contact ball bearing with contact angle α = 40°, e.g. 7304B
- single row tapered roller bearing with contact angle α > 17° e.g. 32315B

BE - single row angular contact ball bearing with contact angle α = 40°, in new design, e.g. 7310BETNG

C - single row angular contact ball bearing with contact angle α = 15°, e.g. 7220CTB P4
- double row spherical roller bearing in new design, e.g. 22216C

CA - single row angular contact ball bearing with contact angle α = 12°, e.g. B7202CATB P5

CB - single row angular contact ball bearing with contact angle α = 10°, napr. B7206CBTB P4

D - single row ball bearing - type 160 with higher load rating, e.g. 16004D

E - single row cylindrical roller bearing with higher load rating, e.g. NU209E
- double row spherical roller bearing with higher load rating, e.g. 22215E
- spherical roller thrust bearing with higher load rating, e.g. 29416EJ

Difference of Boundary Dimensions (8)

X - change of boundary dimensions, introduced by new international standards, e.g. 32028AX

Shields or Seals (9)

RS - seal on one side, e.g. 6304RS

-2RS - seals on both sides, e.g. 6204-2RS

RSN - seal on one side and snap ring groove in outer ring opposite to seal side, e.g. 6306RSN

RSNB - seal on one side and snap ring groove in outer ring on the same side as seal, e.g. 6210RSNB

-2RSN - seals on both sides and snap ring groove in outer ring, e.g. 6310-2RSN

RSR - seal on one side adhering to flat surface of inner ring, e.g. 624RSR

-2RSR - seals on both sides adhering to flat surface of inner ring, e.g. 608-2RSR

Z - metal shield on one side, e.g. 6206Z

-2Z - metal shields on both sides, e.g. 6304-2Z

ZN - metal shield on one side and snap ring groove in outer ring opposite to metal shield, e.g. 6208ZN

ZNB - metal shield on one side and snap ring groove in outer ring on the same side as shield, e.g. 6306ZNB
-2ZN - metal shields on both sides and snap ring groove in outer ring, e.g. 6208-2ZN
ZR - metal shield on one side adhering to flat surface of iner ring, e.g. 608ZR
-2ZR - metal shields on both sides adhering to flat surface of inner ring, e.g. 608-2ZR

Bearing Ring Design Variation (10)

K - tapered bore, taper 1:12, e.g. 1207K
K30 - tapered bore, taper 1:30, e.g. 24064K30M
N - snap ring groove in outer ring, e.g. 6308N
NR - snap ring groove in outer ring and inserted snap ring, e.g. 6310NR
NX - snap ring groove in outer ring whose boundary dimensions do not correspond to STN 02 4605, e.g. 6210NX
D - split inner ring, e.g. 3309D
W33 - groove and lubrication holes in bearing outer ring surface, e.g. 23148W33M
O - lubrication grooves in bearing outer ring, e.g. NU1014O

Cages (11)

Cage material for bearings in basic design is not usually indicated.

J - pressed steel cage, rolling element centred, e.g. 6034J
J2 - pressed steel cage, rolling element centred, new design for single row tapered roller bearings, e.g. 30206AJ2
Y - pressed brass cage, rolling elements centred, e.g. 6001Y
F - machined steel cage, rolling elements centred, e.g.6418F
L - machined light metal cage, rolling elemnents centred, e.g. NG180L C3S0
M - machined brass or bronze cage, rolling elements centred, e.g. NU330M
T - machined cage made of textite, rolling elements centred, e.g. 6005T P5
TN - machined cage made of polyamide or similar plastic, rolling elements centred, e.g. 6207TN
TNG - machined cage made of polyamide or similar plastic with glass fibres, rolling elements centred, e.g. 2305TNG

Cage design (introduced symbols are always used in connection with cage material symbols).

A - cage centred on outer ring, e.g. NU226MA
B - cage centred on inner ring, e.g. B7204CATBP5
P - machined window-type cage, e.g. NU1060MAP
H - one-piece open-type cage, e.g. 629TNH
S - cage with lubrication grooves, e.g. NJ418MAS
R - silver plated cage, e.g. 6210MAR
V - bearing without cage, full rolling element number, e.g. NU209V

Tolerance Class (12)

P0 - standard tolerance class (not indicated), e.g. 6204
P6 - higher tolerance class than standard, e.g. 6322 P6
P5 - higher tolerance class than P6, e.g. 6201 P5
P5A - in some parameters higher tolerance class than P5, e.g. 6006TB P5A

P4 - higher tolerance class than P5, e.g. B7204CBTB P4
P4A - in some parameters higher tolerance class than P4, e.g. B7205CATB P4A
P2 - higher tolerance class than P4, e.g. B7205CATB P2
P6E - higher tolerance class for rotating electric machines, e.g. 6204 P6E
P6X - higher tolerance class for single row tapered roller bearings, e.g. 30210A P6X
SP - higher tolerance class for cylindrical roller bearings with tapered bore, e.g. NN3022K SPC2NA
UP - higher tolerance class than SP for cylindrical roller bearings with tapered bore, e.g. N1016 UPC1NA

Clearances (13)

C2 - clearance less than normal, e.g. 608 C2
normal clearance (not indicated), e.g. 6204
C3 - clearance greater than normal, e.g. 6310 C3
C4 - clearance greater than C3, e.g. NU320M C4
C5 - clearance greater than C4, e.g. 22330M C5
NA - radial clearance for bearings with non-interchangable rings (always after radial clearance symbol), e.g. NU215 P63NA
R... - radial clearance in non-standardized range (range in µm), e.g. 6210A R10-20
A... - axial clearance in non-standardized range (range in µm), e.g. 3210 A20-30

Vibration Level (14)

C6 - reduced vibration level lower than normal (not indicated) e.g. 6304 C6
C06 - reduced vibration level lower than C6, e.g. 6205 C06
C66 - reduced vibration level lower than C06, e.g. 6205 C66

Concrete C06 and C66 values are determined after negotiaitions between customer and supplier.

Note: Bearings in tolerance class P5 and higher have vibration level C6.

Increased Operation Safety (15)

C7, C8, C9 - bearings with increased operation safety determined primarily for aircraft industry, e.g. 6008MB P68

Symbol Combination (12-15)

Symbols for tolerance class, bearing internal clearances, vibration levels and increased operation safety are combined, when symbol C is omitted from the second and following special bearing characteristics, e.g.:

P6 + C3 = P63	e.g. 6211 P63
P6 + C8 = P68	e.g. 16002 P68
C3 + C6 = C36	e.g. 6303-2RS C36
P5 + C3 + C9 = P539	e.g. 6205MA P539
P6 + C2NA + C6 = P626NA	e.g. NU1038 P626NA

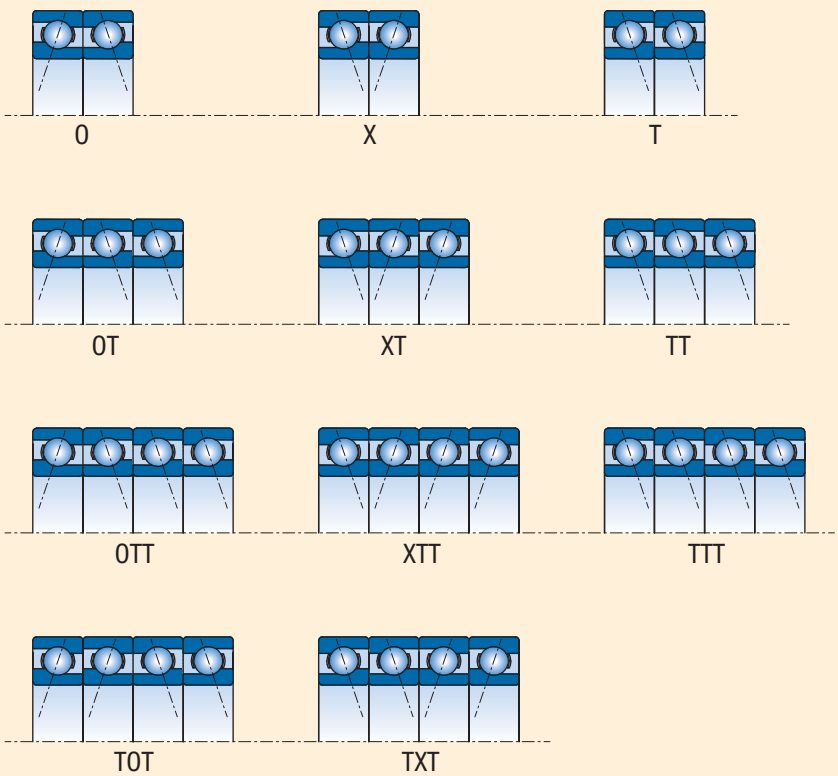
Bearing Arrangement in Matched Set (16)

Designation of the arrangement in matched sets of two, three or four bearings consists of symbols indicating the bearing arrangement and symbols determining internal clearance, or preload of matched bearings. Besides symbols shown in the table also U symbol is used and it indicates that respective bearings can be universally matched, e. g. B7003CTA P4UL.

Internal Clearance or Preload

Introduced symbols are always used in combination with matching symbols.

A	- bearing matching with clearance,	e.g. 7305OA
O	- bearing matching without clearance,	e.g. 7305 P6XO
L	- bearing matching with light preload,	e.g. B7205CATB P4UL
M	- bearing matching with medium preload,	e.g. B7204CATB P5XM
S	- bearing matching with great preload,	e.g. B7304AATB P4OS



Stabilization for Operation at Higher Temperature (17)

Both rings have stabilized dimensions for operation at higher temperature.

S0 for operating temperature	up to 150° C
S1	up to 200°C
S2	up to 250°C
S3	up to 300°C
S4	up to 350°C
S5	up to 400°C

Designation example - 6305 C4S2

Friction Moment (18)

JU	- reduced friction moment, e.g. 619/2 JU
JUA	- bearings with determined friction moment for starting up, e.g. 623 JUA
JUB	- bearings with determined friction moment for running out, e.g. 623 JUB

Grease (19)

For designation of bearings with shields or seals on both sides, filled with grease different from the standard one, symbol combinations are used for designation. The first two symbols determine the operating temperature range and the third (a letter) the name or type of lubricant, according to producer's specifications, or another symbol (a digit) determines the grease volume, which the sealed or shielded inner bearing's space is filled with.

TL - grease for low operating temperatures from -60°C to +100°C, designation example 6302-2RS TL

TM - grease for medium operating temperatures from -35°C to +140°C, designation example 6204-2ZR TM

TH - grease for high operating temperatures from -30°C to +200°C, designation example 6202-2Z TH

TW - grease for both low and high operating temperatures from -40°C to +150°C, designation example 6310-2Z C4TW

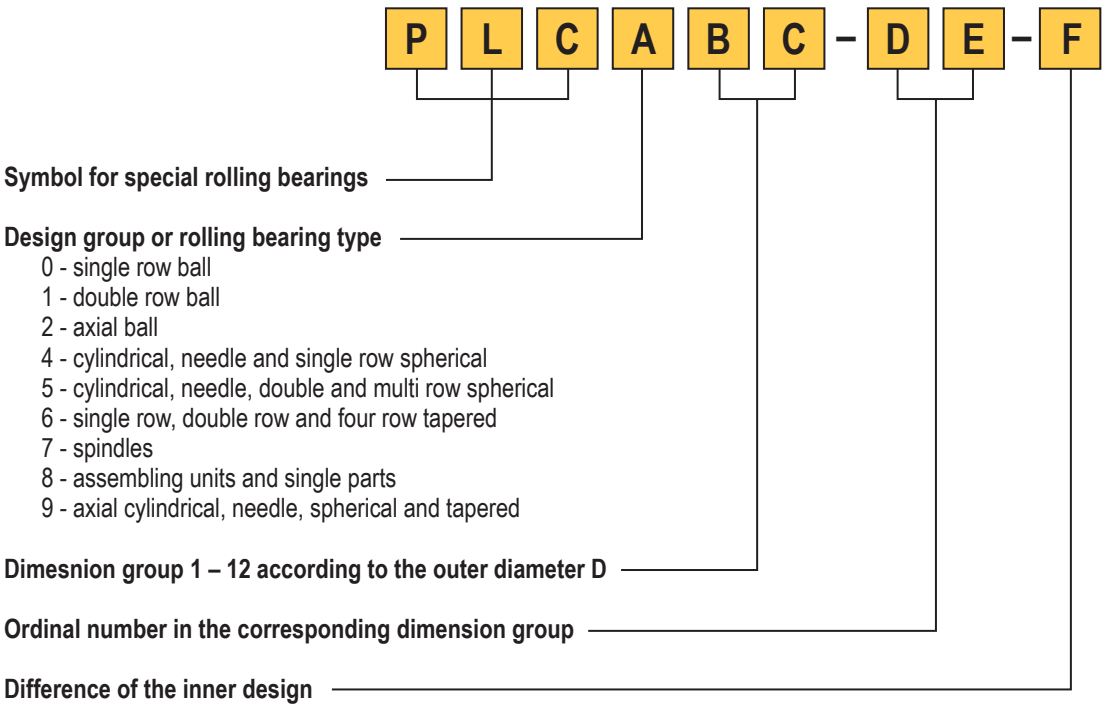
Note: Symbol TM needs not be marked on bearings and packages.

Bearings processed according to the special technology conditions

TP - bearings processed according to the special technology conditions approved by the customer, for instance 6205MA P66 bearing according to the technology conditions TP 324-Y-69/03, which is characterized by: 6205MA P66 TP69

Bearings according to the special PLC drawing documentation

Designation scheme of non-standardized bearings:



2.3 Tolerance

Under bearing tolerance, dimension and operation accuracy is understood. Bearings are manufactured in tolerance classes P0, P6, P5A, P4, P4A, P2, SP and UP. Tolerance class P0 is the basic one and a decreasing number in designation means a higher bearing tolerance class. Limiting values for dimension and operation acuracy shown in tables 20 to 30 are in accordance with the standard ISO 492 and ISO 199 (STN 02 4612). Designation P5A and P4A are used for bearings manufactured in corresponding tolerance class (P5, P4), or selected parameters are in higher tolerance class than P5 and P4.

Tolerance Symbols and Their Meaning

d - nominal bore diameter
d_1 - nominal diameter of larger theoretical tapered bore diameter
d_2 - nominal diameter of the shaft washer of double direction thrust bearings
Δ_{ds} - deviation of single bore diameter from nominal
Δ_{dmp} - mean cylindrical bore diameter deviation in single radial plane (for tapered bore Δ_{dmp} is valid for theoretical bore diameter)
Δ_{d1mp} - deviation of mean larger theoretical diameter of tapered bore
Δ_{d2mp} - mean shaft washer bore diameter deviation of double direction thrust bearings in single radial plane
V_{dp} - single bore diameter variation in single radial plane
V_{dmp} - mean cylindrical bore diameter variation
V_{d2p} - shaft washer bore diameter variation of double direction thrust bearings in single radial plane
D - nominal outside diameter
Δ_{Ds} - deviation of single outside diameter from the nominal dimension
Δ_{Dmp} - mean outside cylindrical surface diameter deviation in single plane
V_{Dp} - single outside cylindrical surface diameter variation in single radial plane
V_{Dmp} - mean outside cylindrical surface diameter variation
B - inner ring nominal width
T - total nominal width of tapered roller bearings
T_1 - nominal effective width of cup sub-unit
T_2 - nominal effective width of cone sub-unit
H - rated width of unidirectional axial bearing
H_1 - rated height of unidirectional ball axial bearing including the body ring
H_2 - rated height of bidirectional axial bearing
H_3 - rated height of bidirectional axial ball bearing including body rings
H_4 - rated height of spherical-roller bearing
Δ_{Bs} - inner ring single width deviation
Δ_{Cs} - outer ring single width deviation
Δ_{Ts} - bearing single width deviation (total)
Δ_{T1s} - cone sub-unit effective width deviation
Δ_{T2s} - cup sub-unit effective width deviation
Δ_{Hs} - deviation of unidirectional axial bearing height from the rated value
Δ_{H1s} - height deviation of unidirectional ball axial bearing including the body ring from the rated value
Δ_{H2s} - deviation of bidirectional axial bearing height from the rated value
Δ_{H1s} - height deviation of unidirectional ball axial bearing including the body rings from the rated value
Δ_{H4s} - height deviation of axial spherical-roller bearing from the rated value
C - outer ring nominal width
V_{Bs} - inner ring single width variation
V_{Cs} - outer ring single width variation
K_{ia} - radial runout of assembled bearing inner ring
K_{ea} - radial runout of assembled bearing outer ring
S_i - shaft washer raceway axial runout
S_e - housing washer raceway axial runout
S_{ia} - inner ring flat seat face axial runout of assembled bearing
S_{ea} - outer ring flat seat face axial runout of assembled bearing
S_d - flat seat face axial runout
S_D - runout of outside cylindrical surface towards outer ring face
S_s - runout of supporting face towards seat face for single row tapered roller bearings

Dimension and Running Accuracy of Radial Bearings (except Tapered Roller Bearings)												Tab. 10				
Tolerance Class P0																
Inner Ring																
d		Cylindrical Bore										Tapered Bore				
		Δ_{dmp}		V_{dp} Diameter Series			V_{dmp}	K_{ia}	Δ_{Bs}		V_{Bs}	Δ_{dmp}		$\Delta_{d1mp} - \Delta_{dmp}$		V_{dp} [1]
				7,8,9	0,1	2,3,4										
over	incl.	max	min	max	max	max	max	max	max	min	max	max	min	max	min	max
mm		μm														
2,5	10	0	-8	10	8	6	6	10	0	-120	15	-	-	-	-	-
10	18	0	-8	10	8	6	6	10	0	-120	20	-	-	-	-	-
18	30	0	-10	13	10	8	8	13	0	-120	20	+ 21	0	+ 21	0	13
30	50	0	-12	15	12	9	9	15	0	-120	20	+ 25	0	+ 25	0	15
50	80	0	-15	19	19	11	11	20	0	-150	25	+30	0	+30	0	19
80	120	0	-20	25	25	15	15	25	0	-200	25	+35	0	+35	0	25
120	180	0	-25	31	31	19	19	30	0	-250	30	+40	0	+40	0	31
180	250	0	-30	38	38	23	23	40	0	-300	30	+46	0	+46	0	38
250	315	0	-35	44	44	26	26	50	0	-350	35	+ 52	0	+ 52	0	44
315	400	0	-40	50	50	30	30	60	0	-400	40	+ 57	0	+ 57	0	50
400	500	0	-45	56	56	34	34	65	0	-450	50	+ 63	0	+ 63	0	56
500	630	0	-50	63	63	38	38	70	0	-500	60	-	-	-	-	-
630	800	0	-75	-	-	-	-	80	0	-750	70	-	-	-	-	-
800	1000	0	-100	-	-	-	-	90	0	-1000	80	-	-	-	-	-
1000	1250	0	-125	-	-	-	-	100	0	-1250	100	-	-	-	-	-

Outer Ring										
D		Δ_{Dmp}		V_{DP} Diameter Series				V_{Dmp}	K_{ea}	Δ_{CS}, V_{CS}
				7,8,9	0,1	2,3,4	bearings [2] with seals			
over	incl.	max	min	max	max	max	max	max	max	
mm		μm								
6	18	0	-8	10	8	6	10	6	15	Corresponds to Δ_{Bs}, V_{Bs} of the same bearing inner ring
18	30	0	-9	12	9	7	12	7	15	
30	50	0	-11	14	11	8	16	8	20	
50	80	0	-13	16	13	10	20	10	25	
80	120	0	-15	19	19	11	26	11	35	
120	150	0	-18	23	23	14	30	14	40	
150	180	0	-25	31	31	19	38	19	45	
180	250	0	-30	38	38	23	-	23	50	
250	315	0	-35	44	44	26	-	26	60	
315	400	0	-40	50	50	30	-	30	70	
400	500	0	-45	56	56	34	-	34	80	
500	630	0	-50	63	63	38	-	38	100	
630	800	0	-75	94	94	55	-	55	120	
800	1000	0	-100	125	125	75	-	75	140	
1000	1250	0	-125	-	-		-	-	160	
1250	1600	0	-160	-	-		-	-	190	

1) Valid in any bore radial plane
2) Valid only for bearings in diameter series 2, 3 and 4

Dimension and Running Accuracy of Radial Bearings (except Tapered Roller Bearings)																Tab. 11a
Tolerance Class P6																
Inner Ring																
d		Cylindrical Bore										Tapered Bore				
		Δ_{dmp}		V_{dp} Diameter Series			V_{dmp}	K_{ia}	Δ_{Bs}		V_{Bs}	Δ_{dmp}		$\Delta_{d1mp} - \Delta_{dmp}$		V_{dp} [1]
				7,8,9	0,1	2,3,4										
over	incl.	max	min	max	max	max	max	max	max	min	max	max	min	max	min	max
mm		µm														
2,5	10	0	-7	9	7	5	5	6	0	-120	15	-	-	-	-	-
10	18	0	-7	9	7	5	5	7	0	-120	20	-	-	-	-	-
18	30	0	-8	10	8	6	6	8	0	-120	20	+ 21	0	+ 21	0	13
30	50	0	-10	13	10	8	8	10	0	-120	20	+ 25	0	+ 25	0	15
50	80	0	-12	15	15	9	9	10	0	-150	25	+ 30	0	+ 30	0	19
80	120	0	-15	19	19	11	11	13	0	-200	25	+ 35	0	+ 35	0	25
120	180	0	-18	23	23	14	14	18	0	-250	30	+ 40	0	+ 40	0	31
180	250	0	-22	28	28	17	17	20	0	-300	30	+ 46	0	+ 46	0	38
250	315	0	-25	31	31	19	19	25	0	-350	35	+ 52	0	+ 52	0	44
315	400	0	-30	38	38	23	23	30	0	-400	40	+ 57	0	+ 57	0	50
400	500	0	-35	44	44	26	26	35	0	-450	45	+ 63	0	+ 63	0	56
500	630	0	-40	50	50	30	30	40	0	-500	50	+ 70	0	+ 70	0	70

Dimension and Running Accuracy of Radial Bearings (except Tapered Roller Bearings)																	Tab. 12a
Tolerance Class P5																	
Inner Ring																	
d		Cylindrical Bore											Tapered Bore				
		Δ_{dmp}		V_{dp} Diameter Series		V_{dmp}	K_{ia}	S_d	S_{ia} [1]	Δ_{Bs}		V_{Bs}	Δ_{dmp}		$\Delta_{d1mp} - \Delta_{dmp}$		V_{dp} [1]
				7,8,9	0,1,2,3,4												
over	incl.	max	min	max	max	max	max	max	max	max	min	max	max	min	max	min	max
mm		µm															
2,5	10	0	-5	5	4	3	4	7	7	0	-40	5	-	-	-	-	-
10	18	0	-5	5	4	3	4	7	7	0	-80	5	-	-	-	-	-
18	30	0	-6	6	5	3	4	8	8	0	-120	5	+ 13	0	+ 13	0	13
30	50	0	-8	8	6	4	5	8	8	0	-120	5	+ 16	0	+ 16	0	15
50	80	0	-9	9	7	5	5	8	8	0	-150	6	+ 19	0	+ 19	0	19
80	120	0	-10	10	8	5	6	9	9	0	-200	7	+ 22	0	+ 22	0	22
120	180	0	-13	13	10	7	8	10	10	0	-250	8	+ 25	0	+ 25	0	25
180	250	0	-15	15	12	8	10	11	13	0	-300	10	+ 29	0	+ 29	0	29
250	315	0	-18	18	14	9	13	13	15	0	-350	13	+ 32	0	+ 32	0	32
315	400	0	-23	23	18	12	15	15	20	0	-400	15	+ 36	0	+ 36	0	36

Outer Ring										Tab. 11b
D		Δ_{Dmp}		V_{Dp}			bearings[2] with seals	V_{dmp}	K_{ea}	Δ_{Cs}, V_{Cs}
				Diameter Series						
				7, 8, 9	0, 1	2, 3, 4				
over	incl.	max	min	max	max	max	max	max	max	
mm		µm								
6	18	0	-7	9	7	5	9	5	8	Corresponds to Δ_{Bs}, V_{Bs} of the same bearing inner ring
18	30	0	-8	10	8	6	10	6	9	
30	50	0	-9	11	9	7	13	7	10	
50	80	0	-11	14	11	8	16	8	13	
80	120	0	-13	16	16	10	20	10	18	
120	150	0	-15	19	19	11	25	11	20	
150	180	0	-18	23	23	14	30	14	23	
180	250	0	-20	25	25	15	-	15	25	
250	315	0	-25	31	31	19	-	19	30	
315	400	0	-28	35	35	21	-	21	35	
400	500	0	-33	41	41	25	-	25	40	
500	630	0	-38	48	48	29	-	29	50	
630	800	0	-45	56	56	34	-	34	60	
800	1000	0	-50	75	75	45	-	45	75	

1) Valid in any bore radial plane
2) Valid only for bearings in diameter series 2, 3 and 4

Outer Ring											Tab. 12b
D		Δ_{Dmp}		V_{Dp}		V_{Dmp}	K_{ea}	S_D	S_{ea}[2]	Δ_{cs}	V_{Cs}
				Diameter Series[3]							
				7, 8, 9	0, 1, 2, 3, 4						
over	incl.	max	min	max	max	max	max	max	max		max
mm		µm									
6	18	0	-5	5	4	3	5	8	8	Corresponds to Δ_{Bs} of the same bearing inner ring	5
18	30	0	-6	6	5	3	6	8	8		5
30	50	0	-7	7	5	4	7	8	8		5
50	80	0	-9	9	8	5	8	8	10		6
80	120	0	-10	10	8	5	10	9	11		8
120	150	0	-11	11	8	6	11	10	13		8
150	180	0	-13	13	10	7	13	10	14		8
180	250	0	-15	15	11	8	15	11	15		10
250	315	0	-18	18	14	9	18	13	18		11
315	400	0	-20	20	15	10	20	13	20		13
400	500	0	-23	23	17	12	23	15	23		15
500	630	0	-28	28	21	14	25	18	25		18
630	800	0	-35	35	26	18	30	20	30		20

1) Valid only for ball bearings
2) Not valid for shielded or sealed bearings
3) Not valid for shielded or sealed bearings

Dimension and Running Accuracy of Radial Bearings (except Tapered Roller Bearings)														Tab. 13a
Tolerance Class P4														
Inner Ring														
d		Δ_{dmp}		Δ_{ds} [1]		V_{dp} Diameter Series		V_{dmp}	K_{ia}	S_d	S_{ia} [2]	Δ_{Bs}		V_{Bs}
						7, 8, 9	0, 1, 2, 3, 4							
over	incl.	max	min	max	min	max	max	max	max	max	max	max	min	max
mm		µm												
2,5	10	0	-4	0	-4	4	3	2	2,5	3	3	0	-40	2,5
10	18	0	-4	0	-4	4	3	2	2,5	3	3	0	-80	2,5
18	30	0	-5	0	-5	5	4	2,5	3	4	4	0	-120	2,5
30	50	0	-6	0	-6	6	5	3	4	4	4	0	-120	3
50	80	0	-7	0	-7	7	5	3,5	4	5	5	0	-150	4
80	120	0	-8	0	-8	8	6	4	5	5	5	0	-200	4
120	180	0	-10	0	-10	10	8	5	6	6	7	0	-250	5
180	250	0	-12	0	-12	12	9	6	8	7	8	0	-300	6

Dimension and Running Accuracy of Cylindrical Roller Bearings with Tapered Bore											Tab. 14a
Tolerance Class SP											
Inner Ring											
d		Δ_{dmp}		$\Delta_{d1mp} - \Delta_{dmp}$		V_{dp}	K_{ia}	S_d	Δ_{Bs}		V_{Bs}
over	incl.	max	min	max	min	max	max	max	max	min	max
mm		µm									
18	30	+ 10	0	+4	0	3	3	8	0	-100	5
30	50	+ 12	0	+4	0	4	4	8	0	-120	5
50	80	+ 15	0	+ 5	0	5	4	8	0	-150	6
80	120	+ 20	0	+ 6	0	5	5	9	0	-200	7
120	180	+ 25	0	+ 8	0	7	6	10	0	-250	8
180	250	+30	0	+ 10	0	8	8	11	0	-300	10
250	315	+35	0	+ 12	0	9	10	13	0	-350	13
315	400	+40	0	+ 13	0	12	12	15	0	-400	15
400	500	+45	0	+ 15	0	14	12	18	0	-450	25

Outer Ring													Tab. 13b
D		Δ_{Dmp}		Δ_{Ds} [1]		V_{Dp} Diameter Series [3]		V_{Dmp}	K_{ea}	S_D	S_{ea} [2]	Δ_{Cs}	V_{Cs}
						7, 8, 9	0, 1, 2, 3, 4						
over	incl.	max	min	max	min	max	max	max	max	max	max		max
mm		μm											
6	18	0	-4	0	-4	4	3	2	3	4	5	Corresponds to Δ_{Bs} of the same bearing inner ring	2,5
18	30	0	-5	0	-5	5	4	2,5	4	4	5		2,5
30	50	0	-6	0	-6	6	5	3	5	4	5		2,5
50	80	0	-7	0	-7	7	5	3,5	5	4	5		3
80	120	0	-8	0	-8	8	6	4	6	5	6		4
120	150	0	-9	0	-9	9	7	5	7	5	7		5
150	180	0	-10	0	-10	10	8	5	8	5	8		5
180	250	0	-11	0	-11	11	8	6	10	7	10		7
250	315	0	-13	0	-13	13	10	7	11	8	10		7
315	400	0	-15	0	-15	15	11	8	13	10	13		8

1) Valid only for bearings with diameter series 0, 1, 2, 3 and 4
2) Valid only for ball bearings
3) Not valid for shielded or sealed bearings

Outer Ring							Tab. 14b
D		Δ_{Dmp}		V_{Dp}	K_{ea}	S_D	Δ_{Cs}, V_{Cs}
over	incl.	max	min	max	max	max	
mm		μm					
50	80	0	-9	5	5	8	Corresponds to Δ_{Bs} and V_{Bs} of the same bearing inner ring
80	120	0	-10	5	6	9	
120	150	0	-11	6	7	10	
150	180	0	-13	7	8	10	
180	250	0	-15	8	10	11	
250	315	0	-18	9	11	13	
315	400	0	-20	10	13	13	
400	500	0	-23	12	15	15	
500	630	0	-28	14	17	18	
630	800	0	-35	18	20	20	

Dimension and Running Accuracy of Cylindrical Roller Bearings with Tapered Bore											Tab. 15a
Tolerance Class UP											
Inner Ring											
d		Δ_{dmp}		$\Delta_{d1mp} - \Delta_{dmp}$		V_{dp}	K_{ia}	S_d	Δ_{Bs}		V_{Bs}
over	incl.	max	min	max	min	max	max	max	max	min	max
mm		µm									
18	30	+ 6	0	+ 2	0	3	1,5	3	0	-25	1,5
30	50	+ 7	0	+3	0	3	2	3	0	-30	2
50	80	+ 8	0	+3	0	4	2	4	0	-40	3
80	120	+ 10	0	+4	0	4	3	4	0	-50	3
120	180	+ 12	0	+ 5	0	5	3	5	0	-60	4
180	250	+ 14	0	+ 6	0	6	4	6	0	-75	5
250	315	+ 17	0	+ 8	0	8	5	6	0	-90	6

Dimension and Running Accuracy of Tapered Roller Bearings														Tab. 16a
Tolerance Class P0														
Cone and Overall Bearing Width														
d		Δ_{dmp}		V_{dp}	V_{dmp}	K_{ia}	Δ_{Bs}		Δ_{Ts}		Δ_{T1s}		Δ_{T2s}	
over	incl.	max	min	max	max	max	max	min	max	min	max	min	max	min
mm		µm												
10	18	0	-12	12	9	15	0	-120	+ 200	0	+ 100	0	+ 100	0
18	30	0	-12	12	9	18	0	-120	+ 200	0	+ 100	0	+ 100	0
30	50	0	-12	12	9	20	0	-120	+ 200	0	+ 100	0	+ 100	0
50	80	0	-15	15	11	25	0	-150	+ 200	0	+ 100	0	+ 100	0
80	120	0	-20	20	15	30	0	-200	+ 200	-200	+ 100	-100	+ 100	-100
120	180	0	-25	25	19	35	0	-250	+350	-250	+ 150	-150	+ 200	-100
180	250	0	-30	30	23	50	0	-300	+350	-250	+ 150	-150	+ 200	-100

Dimension and Running Accuracy of Tapered Roller Bearings														Tab. 17a
Tolerance Class P6X														
Cone and Overall Bearing Width														
d		Δ_{dmp}		V_{dp}	V_{dmp}	K_{ia}	Δ_{Bs}		Δ_{Ts}		Δ_{T1s}		Δ_{T2s}	
over	incl.	max	min	max	max	max	max	min	max	min	max	min	max	min
mm		µm												
10	18	0	-12	12	9	15	0	-50	+ 100	0	+ 50	0	+ 50	0
18	30	0	-12	12	9	18	0	-50	+ 100	0	+ 50	0	+ 50	0
30	50	0	-12	12	9	20	0	-50	+ 100	0	+ 50	0	+ 50	0
50	80	0	-15	15	11	25	0	-50	+ 100	0	+ 50	0	+ 50	0
80	120	0	-20	20	15	30	0	-50	+ 100	0	+ 50	0	+ 50	0
120	180	0	-25	25	19	35	0	-50	+ 150	0	+ 50	0	+ 100	0

Outer Ring							Tab. 15b
D		Δ_{Dmp}		V_{Dp}	K_{ea}	S_D	Δ_{Cs}, V_{Cs}
over	incl.	max	min	max	max	max	
mm		μm					
50	80	0	-6	3	3	2	Corresponds to Δ_{Bs} and V_{Bs} of the same bearing cone
80	120	0	-7	4	3	3	
120	150	0	-8	4	4	3	
150	180	0	-9	5	4	3	
180	250	0	-10	5	5	4	
250	315	0	-12	6	6	4	
315	400	0	-14	7	7	5	

Outer Ring								Tab. 16b
D		Δ_{Dmp}		V_{Dp}	V_{Dmp}	K_{ea}	Δ_{Cs}	
over	incl.	max	min	max	max	max	max	min
mm		μm						
18	30	0	-12	12	9	18	0	-120
30	50	0	-14	14	11	20	0	-120
50	80	0	-16	16	12	25	0	-150
80	120	0	-18	18	14	35	0	-200
120	150	0	-20	20	15	40	0	-250
150	180	0	-25	25	19	45	0	-250
180	250	0	-30	30	23	50	0	-300
250	315	0	-35	35	26	60	0	-350
315	400	0	-40	40	30	70	0	-400

Outer Ring								Tab. 17b
D		Δ_{Dmp}		V_{Dp}	V_{Dmp}	K_{ea}	Δ_{Cs}	
over	incl.	max	min	max	max	max	max	min
mm		μm						
18	30	0	-12	12	9	18	0	-100
30	50	0	-14	14	11	20	0	-100
50	80	0	-16	16	12	25	0	-100
80	120	0	-18	18	14	35	0	-100
120	150	0	-20	20	15	40	0	-100
150	180	0	-25	25	19	45	0	-100
180	250	0	-30	30	23	50	0	-100
250	315	0	-35	35	26	60	0	-100

Dimension and Running Accuracy of Tapered Roller Bearings								Tab. 18a
Tolerance Class P6								
Cone and Overall Bearing Width								
d		Δ_{dmp}		K_{ia}	Δ_{Bs}		Δ_{Ts}	
over	incl.	max	min	max	max	min	max	min
mm		µm						
10	18	0	-7	7	0	-200	+ 200	0
18	30	0	-8	8	0	-200	+ 200	0
30	50	0	-10	10	0	-240	+ 200	0
50	80	0	-12	10	0	-300	+ 200	0
80	120	0	-15	13	0	-400	+ 200	-200
120	180	0	-18	18	0	-500	+350	-250

Dimension and Running Accuracy of Tapered Roller Bearings											Tab. 19a
Tolerance Class P5											
Cone and Overall Bearing Width											
d		Δ_{dmp}		V_{dp}	V_{dmp}	K_{ia}	S_d	Δ_{Bs}		Δ_{Ts}	
over	incl.	max	min	max	max	max	max	max	min	max	min
mm		µm									
10	18	0	-7	5	5	5	7	0	-200	+ 200	-200
18	30	0	-8	6	5	5	8	0	-200	+ 200	-200
30	50	0	-10	8	5	5	8	0	-240	+ 200	-200
50	80	0	-12	9	6	7	8	0	-300	+ 200	-200
80	120	0	-15	11	8	8	9	0	-400	+ 200	-200
120	180	0	-18	14	9	11	10	0	-500	+350	-250

Dimension and Running Accuracy of Thrust Bearings							Tab. 20a
Tolerance Class P0, P6 a P5							
Shaft Washer							
d		Δ_{dmp} Δ_{d2mp}		V_{dp} V_{d2p}	S_i [1]		
					P0	P6	P5
over	incl.	max	min	max	max	max	max
mm		µm					
-	18	0	-8	6	10	5	3
18	30	0	-10	8	10	5	3
30	50	0	-12	9	10	6	3
50	80	0	-15	11	10	7	4
80	120	0	-20	15	15	8	4
120	180	0	-25	19	15	9	5
180	250	0	-30	23	20	10	5
250	315	0	-35	26	25	13	7
315	400	0	-40	30	30	15	7
400	500	0	-45	34	30	18	9
500	630	0	-50	38	35	21	11
630	800	0	-75	-	40	25	13
800	1000	0	-100	-	45	30	15

Outer Ring					Tab. 18b
D		Δ_{Dmp}		K_{ea}	Δ_{Cs}
over	incl.	max	min	max	
mm		µm			
18	30	0	-8	9	Corresponds to Δ_{Bs} of the same bearing cone
30	50	0	-9	10	
50	80	0	-11	13	
80	120	0	-13	18	
120	150	0	-15	20	
150	180	0	-18	23	
180	250	0	-20	25	
250	315	0	-25	30	

Outer Ring								Tab. 19b
D		Δ_{Dmp}		V_{Dp}	V_D	K_{ea}	S_D	Δ_{Cs}
over	incl.	max	min	max	max	max	max	
mm		µm						
18	30	0	-8	6	5	6	8	Corresponds to Δ_{Bs} of the same bearing cone
30	50	0	-9	7	5	7	8	
50	80	0	-11	8	6	8	8	
80	120	0	-13	10	7	10	9	
120	150	0	-15	11	8	11	10	
150	180	0	-18	14	9	13	10	
180	250	0	-20	15	10	15	11	
250	315	0	-25	19	13	18	13	

Housing Washer					Tab. 20b
D		Δ_{Dmp}		V_{Dp}	$Se^{1)}$
over	incl.	max	min	max	
mm		µm			
18	30	0	-13	10	Corresponds to S_i of shaft washer of the same bearing
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	1000	0	-100	75	
1000	1250	0	-125	-	
1250	1600	0	-160	-	

1) Not valid for thrust spherical roller bearings

Dimension and Running Accuracy of Thrust Bearings					Tab. 20c
Nominal bearing opening diameter from - to	Tolerance Class P0 ... P4				
	Δ_{Hs}	Δ_{H1s}	Δ_{H2s}	Δ_{H3s}	Δ_{H4s}
mm	μm				
0 - 30	+20	+100	+150	+300	+20
	-250	-250	-400	-400	-300
30 - 50	+20	+100	+150	+300	+20
	-250	-250	-400	-400	-300
50 - 80	+20	+100	+150	+300	+20
	-300	-300	-500	-500	-400
80 -120	+25	+150	+200	+400	+25
	-300	-300	-500	-500	-400
120 - 180	+25	+150	+200	+400	+25
	-400	-400	-600	-600	-500
180 - 250	+30	+150	+250	+500	+30
	-400	-400	-600	-600	-500
250 - 315	+40	+200	+350	+600	+40
	-400	-400	-700	-700	-700
315 - 400	+40	+200	+350	+600	+40
	-500	-500	-700	-700	-700
400 - 500	+50	+300	+400	+750	+50
	-500	-500	-900	-900	-900
500 - 630	+60	+350	+500	+900	+60
	-600	-600	-1100	-1100	-1200
630 - 800	+70	+400	+600	+1100	+70
	-750	-750	-1300	-1300	-1400
800 - 1000	+80	+450	+700	+1300	+80
	-1000	-1000	-1500	-1500	-1800
1000 - 1250	+100	+500	+900	+1800	+100
	-1400	-1400	-1800	-1800	-2400

2.4 Internal clearance

Bearing clearance is the value of one bearing displacement length of assembled bearing with respect to the other ring from one end position to the other one. The displacement can be in radial direction (radial clearance) or axial (axial clearance). In a mounted bearing smaller radial clearance can be found than the same bearing had before mounting.

Radial clearance reduction is caused by interference of the bearing rings on the shaft and in housing bore and thus it is dependent on selected tolerance of bearing seating surface diameters. Another change of radial clearance, mainly its reduction, arises during operation from temperatures evoked by its own operation and surrounding sources, but also by elastic deformations caused by load.
Clearance for standard designed bearings is determined so that one of the bearing rings can be fixed, what is sufficient for most operation conditions in the arrangement. For special arrangements with different requirement on the radial clearance bearings with various radial clearance designated C_1 up to C_5 are produced. Values for various internal clearances according to the standard ISO 5753 are shown for individual bearing types in tables 21 up to 27 and these values are valid for non-mounted bearings by zero measuring load.

For double row angular contact ball bearings instead of radial clearance the axial clearance measured at axial load 100 N is introduced.
Single row angular contact ball bearings and single row tapered roller bearings are usually mounted in pairs and the radial or axial clearence is adjusted during mounting.

Radial Clearance of Single Row Ball Bearings — Tab. 21

Bore Diameter d		Radial Clearance										Single Row Separable Ball Bearings Type E and BO	Radial Clearance	
		C2		normal		C3		C4		C5				
over	to	min	max	min	max	min	max	min	max	min	max		min	max
mm		µm										µm		
2,5	6	0	7	2	13	8	23	-	-	-	-	E10, E12	15	30
6	10	0	7	2	13	8	23	14	29	20	37	E15	15	30
10	18	0	9	3	18	11	25	18	33	25	45	B017, E17	25	45
18	24	0	10	5	20	13	28	20	36	28	48	E20	20	40
24	30	1	11	5	20	13	28	23	41	30	53			
30	40	1	11	6	20	15	33	28	46	40	64			
40	50	1	11	6	23	18	36	30	51	45	73			
50	65	1	15	8	28	23	43	38	61	55	90			
65	80	1	15	10	30	25	51	46	71	65	105			
80	100	1	18	12	36	30	58	53	84	75	120			
100	120	2	20	15	41	36	66	61	97	90	140			
120	140	2	23	18	48	41	81	71	114	105	160			
140	160	2	23	18	53	46	91	81	130	120	180			
160	180	2	25	20	61	53	102	91	147	135	200			
180	200	2	30	25	71	63	117	107	163	150	230			
200	225	2	35	25	85	75	140	125	195	175	265			
225	250	2	40	30	95	85	160	145	225	205	300			
250	280	2	45	35	105	90	170	155	245	225	340			
280	315	2	55	40	115	100	190	175	270	245	370			
315	355	3	60	45	125	110	210	195	300	275	410			
355	400	3	70	55	145	130	240	225	340	315	460			
400	450	3	80	60	170	150	270	250	380	350	520			
450	500	3	90	70	190	170	300	280	420	390	570			
500	560	10	100	80	210	190	330	310	470	440	630			
560	630	10	100	90	230	210	360	340	520	490	700			
630	710	20	130	110	260	240	400	380	570	540	780			
710	800	20	140	120	290	270	450	430	630	600	860			
800	900	20	160	140	320	300	500	480	700	670	960			
900	1000	20	170	150	350	330	550	530	700	740	1040			
1000	1120	20	180	160	380	360	600	580	850	820	1150			
1120	1250	20	190	170	410	390	650	630	920	890	1260			
1250	1400	30	200	190	440	420	700	680	1000	-	-			
1400	1600	30	210	210	470	450	750	730	1060	-	-			

Axial Clearance of Double Row Angular Contact Ball Bearings										Tab. 22
Bore Diameter		Axial Clearance								
d		C2		normal		C3		C4		
over	to	min	max	min	max	min	max	min	max	
mm		µm								
6	10	1	11	5	21	12	28	25	45	
10	18	1	12	6	23	13	31	27	47	
18	24	2	14	7	25	16	34	28	48	
24	30	2	15	8	27	18	37	30	50	
30	40	2	16	9	29	21	40	33	54	
40	50	2	19	11	33	23	44	36	58	
50	65	3	22	13	36	26	48	40	63	
65	80	3	24	15	40	30	54	46	71	

Radial Clearance of Double Row Self-Aligning Ball Bearings												Tab. 23									
Bore Diameter		Cylindrical Bore										Tapered Bore									
		Radial Clearance										Radial Clearance									
d		C2		normal		C3		C4		C5		C2		normal		C3		C4		C5	
over	to	min	max	min	max	min	max	min	max	min	max	min	max	min	max	min	max	min	max	min	max
mm		µm										µm									
2,5	6	1	8	5	15	10	20	15	25	21	33	-	-	-	-	-	-	-	-	-	-
6	10	2	9	6	17	12	25	19	33	27	42	-	-	-	-	-	-	-	-	-	-
10	14	2	10	6	19	13	26	21	35	30	48	-	-	-	-	-	-	-	-	-	-
14	18	3	12	8	21	15	28	23	37	32	50	-	-	-	-	-	-	-	-	-	-
18	24	4	14	10	23	18	30	25	39	34	52	7	17	13	26	20	33	28	42	37	55
24	30	5	16	11	24	19	35	29	46	40	58	9	20	15	28	23	39	33	50	44	62
30	40	6	18	13	29	23	40	34	53	46	66	12	24	19	35	29	46	40	59	52	72
40	50	6	19	14	31	25	44	37	57	50	71	14	27	22	39	33	52	45	65	58	79
50	65	7	21	16	36	30	50	45	69	62	88	18	32	27	47	41	61	56	80	73	99
65	80	8	24	18	40	35	60	54	83	76	108	23	39	35	57	50	75	69	98	91	123
80	100	9	27	22	48	42	70	64	96	89	124	29	47	42	68	62	90	84	116	109	144
100	120	10	31	25	56	50	83	75	114	105	145	35	56	50	81	75	108	100	139	130	170
120	140	10	38	30	68	60	100	90	135	125	175	-	-	-	-	-	-	-	-	-	-
140	160	15	44	35	80	70	120	110	161	150	210	-	-	-	-	-	-	-	-	-	-

Radial Clearance of Single Row Cylindrical Roller Bearings											Tab. 24
Bore Diameter		Radial Clearance									
d		C2		normal		C3		C4		C5	
over	incl.	min	max	min	max	min	max	min	max	min	max
mm		µm									
10	24	0	25	20	45	35	60	50	75	65	90
24	30	0	25	20	45	35	60	50	75	70	95
30	40	5	30	25	50	45	70	60	85	80	105
40	50	5	35	30	60	50	80	70	100	95	125
50	65	10	40	40	70	60	90	80	110	110	140
65	80	10	45	40	75	65	100	90	125	130	165
80	100	15	50	50	85	75	110	105	140	155	190
100	120	15	55	50	90	85	125	125	165	180	220
120	140	15	60	60	105	100	145	145	190	200	245
140	160	20	70	70	120	115	165	165	215	225	275
160	180	25	75	75	125	120	170	170	220	250	300
180	200	35	90	90	145	140	195	195	250	275	330
200	225	45	105	105	165	160	220	220	280	305	365
225	250	45	110	110	175	170	235	235	300	330	395
250	280	55	125	125	195	190	260	260	330	370	440
280	315	55	130	130	205	200	275	275	350	410	485
315	355	65	145	145	225	225	305	305	385	455	535
355	400	100	190	190	280	280	370	370	460	510	600
400	450	110	210	210	310	310	410	410	510	565	665
450	500	110	220	220	330	330	440	440	550	625	735
500	560	120	240	240	360	360	480	480	600	695	815
560	630	140	260	260	380	380	500	500	620	780	900
630	710	145	285	285	425	425	565	565	705	870	1010
710	800	150	310	310	470	470	630	630	790	980	1140
800	900	180	350	350	520	520	690	690	860	1100	1270
900	1000	200	390	390	580	580	770	770	960	1220	1410
1000	1120	220	430	430	640	640	850	850	1060	1360	1570
1120	1250	230	470	470	710	710	950	950	1190	1520	1760

Radial Clearance of Double Row Cylindrical Roller Bearings with Tapered Bore												Tab. 25
Bearing with Non-Interchangable Rings Determined for Machine Tool Spindles												
Bore Diameter		Radial Clearance				Bore Diameter		Radial Clearance				
d		C1NA		C2NA		d		C1NA		C2NA		
over	incl.	min	max	min	max	over	incl.	min	max	min	max	
mm		µm				mm		µm				
24	30	15	25	25	35	160	180	55	85	75	110	
30	40	15	25	25	40	180	200	60	90	80	120	
40	50	17	30	30	45	200	225	60	95	90	135	
50	65	20	35	35	50	225	250	65	100	100	150	
65	80	25	40	40	60	250	280	75	110	110	165	
80	100	35	55	45	70	280	315	80	120	120	180	
100	120	40	60	50	80	315	355	90	135	135	200	
120	140	45	70	60	90	355	400	100	150	150	225	
140	160	50	75	65	100	400	450	110	170	170	255	

Radial Clerance of Single Row Needle Roller Bearings with Interchangeable Rings					Tab. 26
Bore Diameter		Radial Clearance			
d		normal		C3	
over	incl.	min	max	min	max
mm		μm			
10	14	10	50	25	70
14	18	15	55	35	75
18	24	25	65	40	80
24	30	30	65	50	80
30	40	40	75	60	95
40	50	40	85	65	100
50	65	45	90	70	120
65	80	50	110	75	135
80	100	60	115	95	150
100	120	70	125	115	70
120	140	80	155	130	205
140	160	80	160	140	210

Radial Clearance of Double Row Spherical Roller Bearings											Tab. 27
Bore Diameter		Cylindrical Bore									
		Radial Clearance									
d		C2		normal		C3		C4		C5	
over	incl.	min	max	min	max	min	max	min	max	min	max
mm		μm									
30	40	15	30	35	45	45	60	60	80	80	100
40	50	20	35	35	55	55	75	75	100	100	125
50	65	20	40	40	65	65	90	90	120	120	150
65	80	30	50	50	80	80	110	110	145	145	180
80	100	35	60	60	100	100	135	135	180	180	225
100	120	40	75	75	120	120	160	160	210	210	260
120	140	50	95	95	145	145	190	190	240	240	300
140	160	60	110	110	170	170	220	220	280	280	350
160	180	65	120	120	180	180	240	240	310	310	390
180	200	70	130	130	200	200	260	260	340	340	430
200	225	80	140	140	220	220	290	290	380	380	470
225	250	90	150	150	240	240	320	320	420	420	520
250	280	100	170	170	260	260	350	350	460	460	570
280	315	110	190	190	280	280	370	370	500	500	630
315	355	120	200	200	310	310	410	410	550	550	690
355	400	130	220	220	340	340	450	450	600	600	760
400	450	140	240	240	370	370	500	500	660	660	820
450	500	140	260	260	410	410	550	550	720	720	900
500	560	150	280	280	440	440	600	600	780	780	1000
560	630	170	310	310	480	480	650	650	850	850	1100
630	710	190	350	350	530	530	700	700	920	920	1190
710	800	210	390	390	580	580	770	770	1010	1010	1300
800	900	230	430	430	650	650	860	860	1120	1120	1440

Radial Clearance of Double Row Spherical Roller Bearings											Tab. 27b
Bore Diameter		Tapered Bore									
		Radial Clearance									
d		C2		normal		C3		C4		C5	
over	incl.	min	max	min	max	min	max	min	max	min	max
mm		μm									
30	40	25	35	35	50	50	65	65	85	85	105
40	50	30	45	45	60	60	80	80	100	100	130
50	65	40	55	55	75	75	95	95	120	120	160
65	80	50	70	70	95	95	120	120	150	150	200
80	100	55	80	80	110	110	140	140	180	180	230
100	120	65	100	100	135	135	170	170	220	220	280
120	140	80	120	120	160	160	200	200	260	260	330
140	160	90	130	130	180	180	230	230	300	300	380
160	180	100	140	140	200	200	260	260	340	340	430
180	200	110	160	160	220	220	290	290	370	370	470
200	225‘	120	180	180	250	250	320	320	410	410	520
225	250	140	200	200	270	270	350	350	450	450	570
250	280	150	220	220	300	300	390	390	490	490	620
280	315	170	240	240	330	330	430	430	540	540	680
315	355	190	270	270	360	360	470	470	590	590	740
355	400	210	300	300	400	400	520	520	650	650	820
400	450	230	330	330	440	440	570	570	720	720	910
450	500	260	370	370	490	490	630	630	790	790	1000
500	560	290	410	410	540	540	680	680	870	870	1100
560	630	320	460	460	600	600	760	760	980	980	1230
630	710	350	510	510	670	670	850	850	1090	1090	1360
710	800	390	570	570	750	750	960	960	1220	1220	1500
800	900	440	640	640	840	840	1070	1070	1370	1370	1690

2.5 Cages

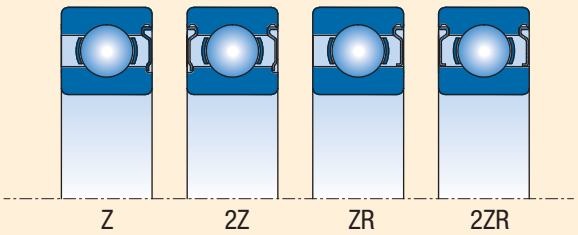
Cage in the rolling bearing fulfills the following roles:
- separates rolling elements evenly around the periphery
- prevents contact of rolling elements and their sliding
- prevents falling out of the rolling elements from separable or self-aligning bearings when mounting.

From the point of view of design and material the cages are divided into pressed and machined. Pressed cages are made of steel or brass sheet and are mostly used in dimensionally smaller and medium bearings. Their advantage in comparison with the solid cages is the smaller weight. Machined cages are made of steel, brass, bronze, light metals or plastic in various designs. Cages made of metals are used when there are higher demands on the cage rigidity and the bearing is determined for higher operational temperatures. Cages are radially centered on the rolling elements in bearings, this is the most usual way, or they are centered on the rib of either of the bearing rings. Bearings without cages, i.e. with full complement of rolling elements, are only rarely used, namely only for some bearing types, e.g. single row needle roller bearings.

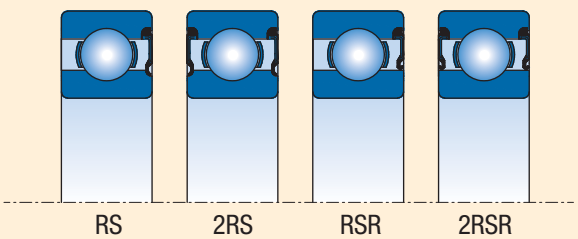
In the texts about individual bearing types the survey of cages in standard design and delivery possibilities of bearings with cages of non-standard design are given in the section Cages.

2.6 Shields and seals

Bearings with sealing on one or both sides are manufactured with shields (Z, 2Z, ZR, 2ZR) or seals (RS, 2RS, RSR, 2RSR).
Shields form a non-contact sealing. In design Z and 2Z the fitting for the shield is in the inner ring, in design ZR and 2ZR the shield adheres on the smooth rib of the bearing inner ring.



Sealing is created by sealing rings made of rubber vulcanized on sheet steel reinforcement, which create an effective contact sealing with a chamfered fitting on the inner ring (RS, 2RS) as well as in design with contact on the smooth rib of the inner ring (RSR, 2RSR). Seals and sealing rings are fastened in the grooves of the outer ring and are unseparable. Sealing RS, 2RS, RSR, 2RSR can be used for temperature range -30°C to +110°C, sealing RS2, -2RS2, RSR2, -2RSR2 for temperature range -30°C to +180°C.



Bearings with covers on both sides in basic processing are filled with high performance plastic lubrication with temperature interval from -30°C up to +120°C, properties of which provide the lubrication for whole lifetime of bearings at normal operation conditions. Bearings in this construction type cannot be additionally lubricated. The use of covers as well as plastic lubrication material for temperature interval other than -30°C +120°C is recommended to be consulted with the supplier.