Metrology, standardization and certification

Theme 5: Fits and tolerances for rolling bearing

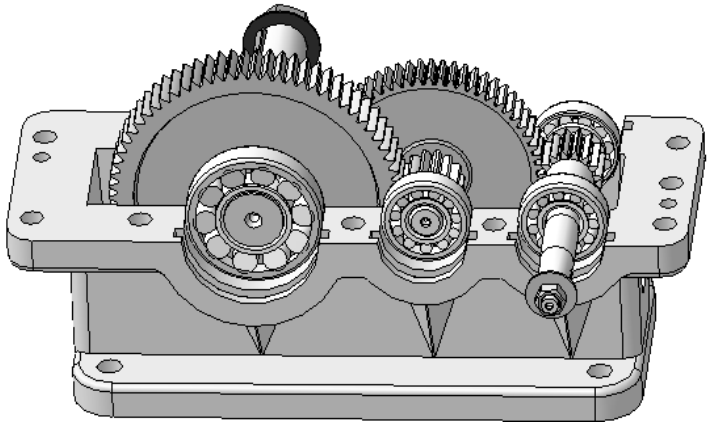
Lecture plan:

1. General information about rolling bearing.
2. Rationing of the accuracy for a rolling bearing.
3. Choice of fits for races.
4. Designation of the race fits in assembler drawing.

General information about rolling bearing

Rolling bearings are universal units in which set the parts. They intended for support of rotating elements and works under conditions of predominant of rolling friction.

For the first time in the world the production of frictionless bearings was organized in Germany at 1883. And at the same time in USA. In Russia the first workshop was created at 1916, but the first trade plant was build at 1932 in Moscow.

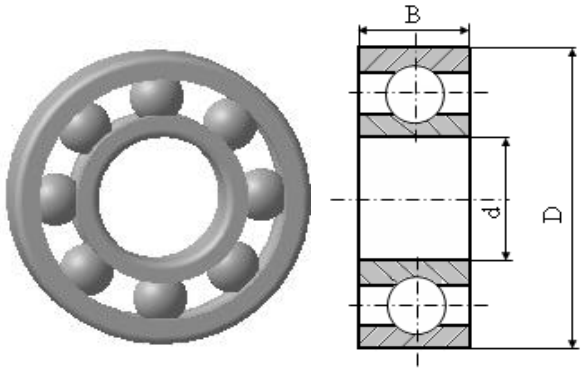


Shafts are inserted in the rolling bearings and placed in the body of reducer.

General information about rolling bearing

Operability of rolling bearings is highly dependent on the quality of the materials from which they are made, on the accuracy of their manufacture, of the type of their connection to mating parts and operating conditions.

Roll double-row bearing



Ball single-row bearing

1– outer race;

2– inner race;

3– cage;

4– element of rolling

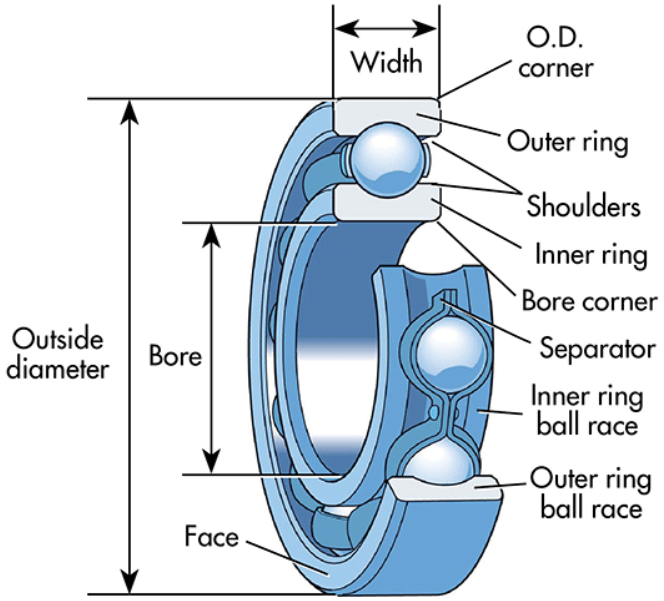
B – width of the bearing;

d – fit diameter of the inner race;

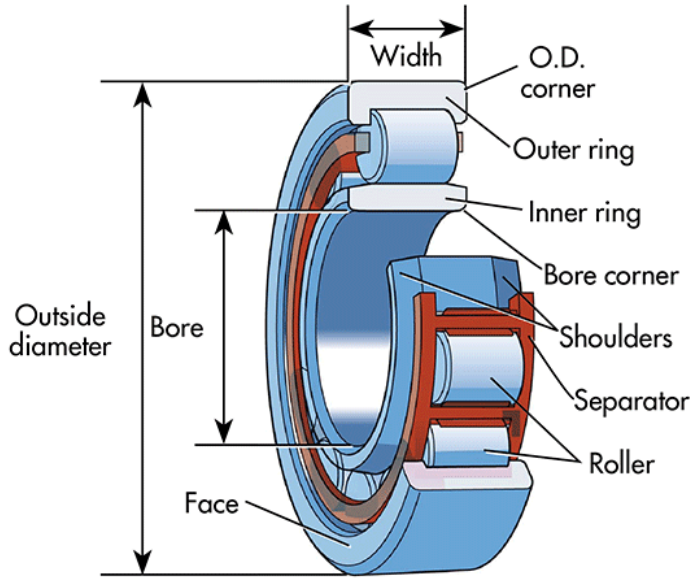
D – fit diameter of the outer race.

Rolling bearing must ensure the accuracy and uniformity of rotation of the moving parts of machines and devices, and also to have a high durability.

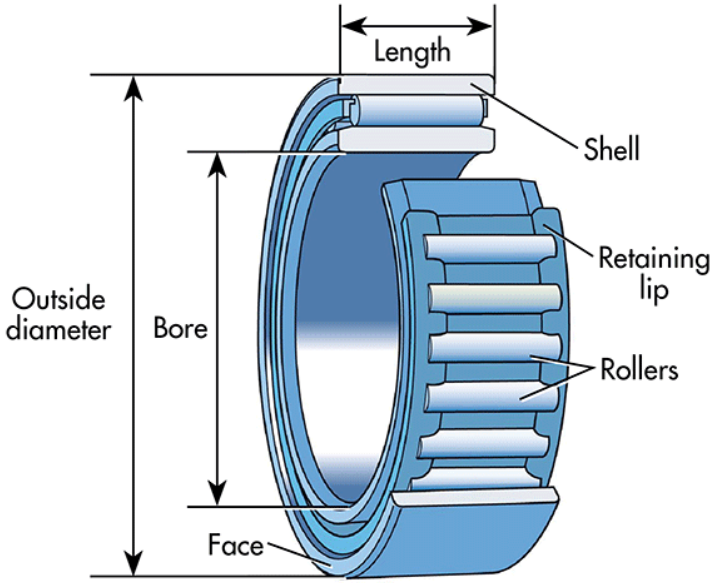
BALL BEARING



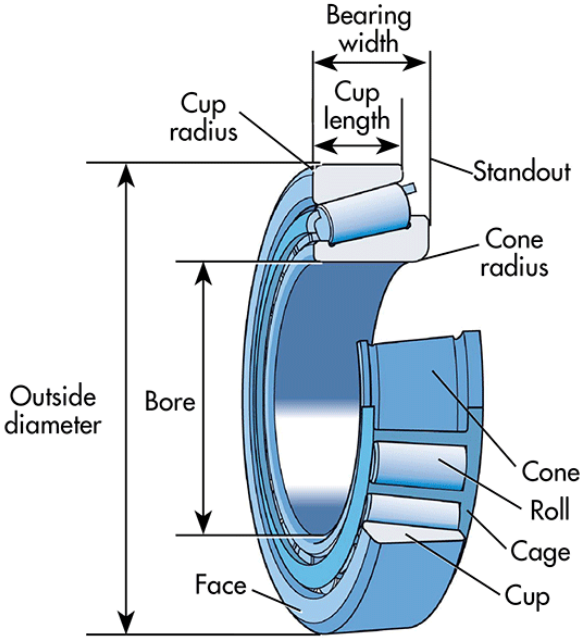
STRAIGHT ROLLER BEARING



NEEDLE ROLLER BEARING

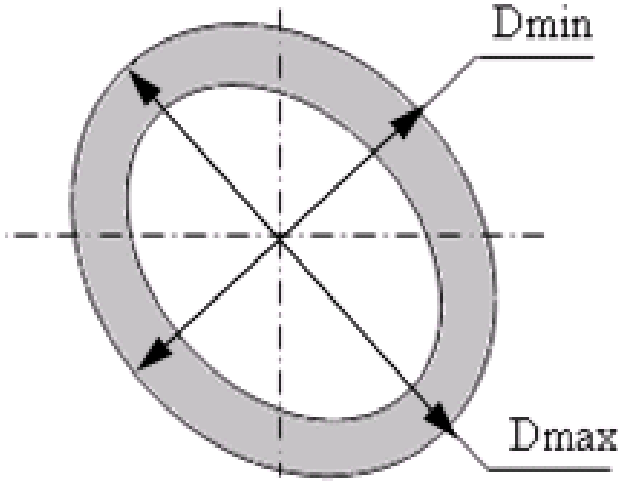


TAPERED ROLLER BEARING



General information about rolling bearing

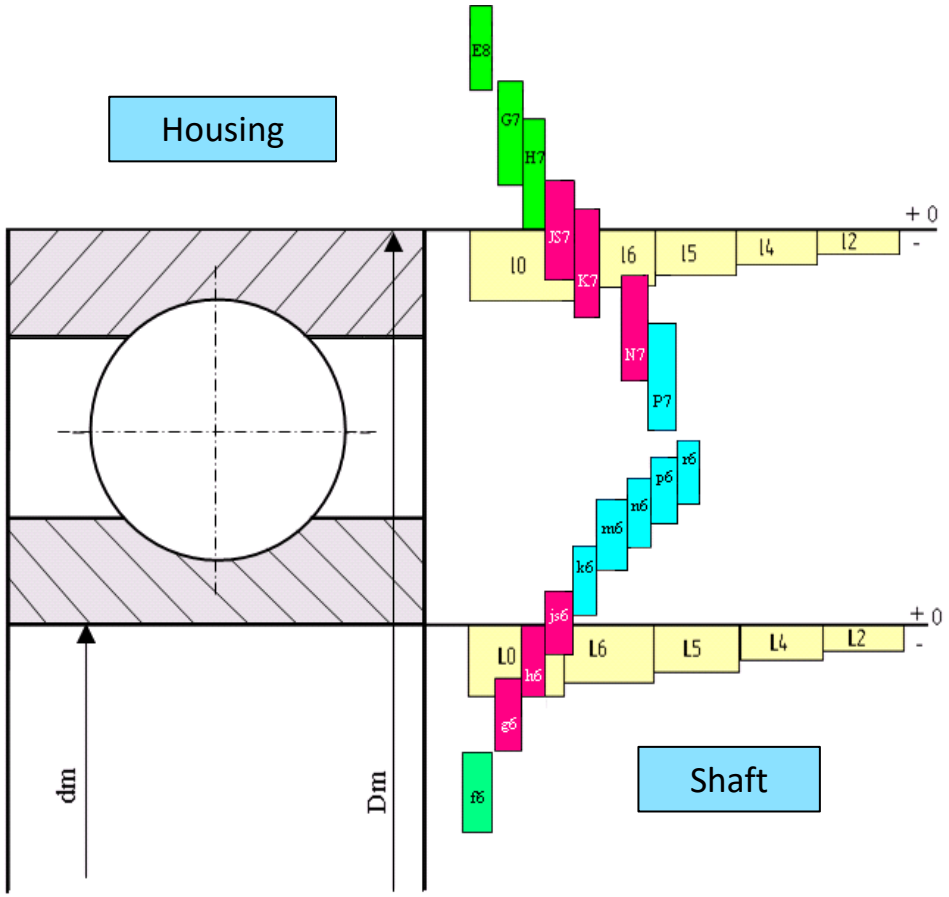
Rolling elements can be balls, cylindrical rollers, needle rollers, tapered rollers or barrel rollers. The rolling elements are generally guided by a cage that keeps them at a uniform distance from each other and prevents them coming into contact with each other. In needle roller bearings and rib less spherical roller bearings, the cage also ensures that the rolling element axis is positioned correctly. Where bearings can be dismantled, the cage holds the rolling elements together and gives easier fitting of the bearings. For particular applications, rolling bearings with a full complement of balls, cylindrical rollers or needle rollers may be used.



Outer race of rolling bearing

$$D_m = \frac{D_{\max} + D_{\min}}{2},$$

Rationing of the accuracy for a rolling bearing



The scheme of arrangement of the tolerance zones for rolling bearings (selectively)

Symbols for Boundary Dimensions and Running Accuracy

d	Brg bore dia., nominal
Δ_{ds}	Deviation of a single bore dia.
Δ_{dmp}	Single plane mean bore dia. deviation
V_{dp}	Bore dia. Variation in a single radial plane
V_{dmp}	Mean bore dia. Variation
B	Inner ring width, nominal
Δ_{Bs}	Deviation of a single inner ring width
V_{Bs}	Inner ring width variation
K_{ia}	Radial runout of assembles brg inner ring
S_d	inner ring reference face (backface, where applicable) runout with bore
S_{ia}	Assembled brg inner ring face (back face) runout with raceway
S_i, S_e	Raceway to backface thickness variation of thrust brg
T	Brg width, nominal
Δ_{Ts}	Deviation of the actual brg width
D	Brg outside dia., nominal
Δ_{Ds}	Deviation of a single outside dia.
Δ_{Dmp}	Single plane mean outside dia. Deviation
V_{Dp}	Outside dia. Variation in a single radial plane
V_{Dmp}	Mean outside dia. Variation
C	Outer ring width, nominal
Δ_{Cs}	Deviation of a single outer ring width
V_{Cs}	Outer ring width variation
K_{ea}	Radial runout of assembled brg outer ring
S_D	Variation of brg outside surface generatrix inclination with outer ring reference face (backface)
S_{ea}	Assembled brg outer ring face (backface) runout with raceway

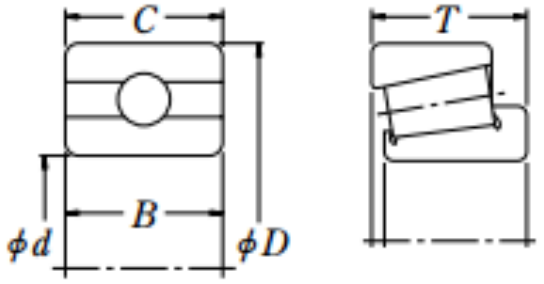


Table 8. 1 Bearing Types and Tolerance Classes

Bearing Types		Applicable Tolerance Classes					Applicable Tables	Reference Pages
Deep Groove Ball Bearings		Normal	Class 6	Class 5	Class 4	Class 2	Table 8.2	A60 to A63
Angular Contact Ball Bearings		Normal	Class 6	Class 5	Class 4	Class 2		
Self-Aligning Ball Bearings		Normal	Class 6 equivalent	Class 5 equivalent	—	—		
Cylindrical Roller Bearings		Normal	Class 6	Class 5	Class 4	Class 2		
Needle Roller Bearings (solid type)		Normal	Class 6	Class 5	Class 4	—		
Spherical Roller Bearings		Normal	Class 6	Class 5	—	—		
Tapered Roller Bearings	Metric Design	Normal Class 6X	—	Class 5	Class 4	—	Table 8.3	A64 to A67
	Inch Design	ANSI/ABMA CLASS 4	ANSI/ABMA CLASS 2	ANSI/ABMA CLASS 3	ANSI/ABMA CLASS 0	ANSI/ABMA CLASS 00	Table 8.4	A68 and A69
Magneto Bearings		Normal	Class 6	Class 5	—	—	Table 8.5	A70 and A71
Thrust Ball Bearings		Normal	Class 6	Class 5	Class 4	—	Table 8.4	A72 to A74
Spherical Thrust Roller Bearings		Normal	—	—	—	—	Table 8.7	A75
Equivalent standards (Reference) JIS(1)		Class 0	Class 6	Class 5	Class 4	Class 2	—	—
DIN(2)		P0	P6	P5	P4	P2	—	—
ANSI/ABMA(3)	Ball Bearings	ABEC 1	ABEC 3	ABEC 5 (CLASS 5P)	ABEC 7 (CLASS 7P)	ABEC 9 (CLASS 9P)	Table 8.2 [Table 8.8]	A60 to A63 (A76 and A77)
	Roller Bearings	RBEC 1	RBEC 3	RBEC 5	—	—		
	Tapered Roller Bearings	CLASS 4	CLASS 2	CLASS 3	CLASS 0	CLASS 00	[Table 8.4]	(A68 and A69)

Notes (1) JIS : Japanese Industrial Standards (2) DIN : Deutsch Industrie Norm
(3) ANSI/ABMA : The American Bearing Manufacturers Association

Remarks The permissible limit of chamfer dimensions shall conform to Table 8.9 (Page A78), and the tolerances and permissible tapered bore diameters shall conform to Table 8.10 (Page A80).

Tolerances for radial bearing

Nominal Bore Diameter d (mm)		Δ_{dmp} [2]										Δ_{ds} [2]			
		Normal		Class 6		Class 5		Class 4		Class 2		Class 4 Diameter Series 0, 1, 2, 3, 4		Class 2	
over	incl	high	low	high	low	high	low	high	low	high	low	high	low	high	low
0.6[1]	2.5	0	− 8	0	− 7	0	− 5	0	− 4	0	−2.5	0	− 4	0	−2.5
2.5	10	0	− 8	0	− 7	0	− 5	0	− 4	0	−2.5	0	− 4	0	−2.5
10	18	0	− 8	0	− 7	0	− 5	0	− 4	0	−2.5	0	− 4	0	−2.5
18	30	0	− 10	0	− 8	0	− 6	0	− 5	0	−2.5	0	− 5	0	−2.5
30	50	0	− 12	0	−10	0	− 8	0	− 6	0	−2.5	0	− 6	0	−2.5
50	80	0	− 15	0	−12	0	− 9	0	− 7	0	−4	0	− 7	0	−4
80	120	0	− 20	0	−15	0	−10	0	− 8	0	−5	0	− 8	0	−5
120	150	0	− 25	0	−18	0	−13	0	−10	0	−7	0	−10	0	−7
150	180	0	− 25	0	−18	0	−13	0	−10	0	−7	0	−10	0	−7
180	250	0	− 30	0	−22	0	−15	0	−12	0	−8	0	−12	0	−8
250	315	0	− 35	0	−25	0	−18	–	–	–	–	–	–	–	–
315	400	0	− 40	0	−30	0	−23	–	–	–	–	–	–	–	–
400	500	0	− 45	0	−35	–	–	–	–	–	–	–	–	–	–
500	630	0	− 50	0	−40	–	–	–	–	–	–	–	–	–	–
630	800	0	− 75	–	–	–	–	–	–	–	–	–	–	–	–
800	1 000	0	−100	–	–	–	–	–	–	–	–	–	–	–	–
1 000	1 250	0	−125	–	–	–	–	–	–	–	–	–	–	–	–
1 250	1 600	0	−160	–	–	–	–	–	–	–	–	–	–	–	–
1 600	2 000	0	−200	–	–	–	–	–	–	–	–	–	–	–	–

Tolerances for radial bearing

V_{dp} (2)											V_{dmp} (2)				
Normal			Class 6			Class 5		Class 4		Class 2	Normal	Class 6	Class 5	Class 4	Class 2
Diameter Series			Diameter Series			Diameter Series		Diameter Series		Diameter Series					
9	0, 1	2, 3, 4	9	0, 1	2, 3, 4	9	0,1,2,3,4	9	0,1,2,3,4	0,1,2,3,4					
max.			max.			max.		max.		max.	max.	max.	max.	max.	max.
10	8	6	9	7	5	5	4	4	3	2.5	6	5	3	2	1.5
10	8	6	9	7	5	5	4	4	3	2.5	6	5	3	2	1.5
10	8	6	9	7	5	5	4	4	3	2.5	6	5	3	2	1.5
13	10	8	10	8	6	6	5	5	4	2.5	8	6	3	2.5	1.5
15	12	9	13	10	8	8	6	6	5	2.5	9	8	4	3	1.5
19	19	11	15	15	9	9	7	7	5	4	11	9	5	3.5	2
25	25	15	19	19	11	10	8	8	6	5	15	11	5	4	2.5
31	31	19	23	23	14	13	10	10	8	7	19	14	7	5	3.5
31	31	19	23	23	14	13	10	10	8	7	19	14	7	5	3.5
38	38	23	28	28	17	15	12	12	9	8	23	17	8	6	4
44	44	26	31	31	19	18	14	–	–	–	26	19	9	–	–
50	50	30	38	38	23	23	18	–	–	–	30	23	12	–	–
56	56	34	44	44	26	–	–	–	–	–	34	26	–	–	–
63	63	38	50	50	30	–	–	–	–	–	38	30	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

Tolerances for radial bearing

Δ_{Bs} (or Δ_{Cs})(3)												V_{Bs} (or V_{Cs})				
Single Bearing						Combined Bearings (4)						Inner Ring (or Outer Ring) (5)	Inner Ring			
Normal Class 6		Class 5 Class 4		Class 2		Normal Class 6		Class 5 Class 4		Class 2		Normal	Class 6	Class 5	Class 4	Class 2
high	low	high	low	high	low	high	low	high	low	high	low	max.	max.	max.	max.	max.
0	− 40	0	− 40	0	− 40	—	—	0	−250	0	−250	12	12	5	2.5	1.5
0	− 120	0	− 40	0	− 40	0	−250	0	−250	0	−250	15	15	5	2.5	1.5
0	− 120	0	− 80	0	− 80	0	−250	0	−250	0	−250	20	20	5	2.5	1.5
0	− 120	0	−120	0	−120	0	−250	0	−250	0	−250	20	20	5	2.5	1.5
0	− 120	0	−120	0	−120	0	−250	0	−250	0	−250	20	20	5	3	1.5
0	− 150	0	−150	0	−150	0	−380	0	−250	0	−250	25	25	6	4	1.5
0	− 200	0	−200	0	−200	0	−380	0	−380	0	−380	25	25	7	4	2.5
0	− 250	0	−250	0	−250	0	−500	0	−380	0	−380	30	30	8	5	2.5
0	− 250	0	−250	0	−250	0	−500	0	−380	0	−380	30	30	8	5	4
0	− 300	0	−300	0	−300	0	−500	0	−500	0	−500	30	30	10	6	5
0	− 350	0	−350	—	—	0	−500	0	−500	—	—	35	35	13	—	—
0	− 400	0	−400	—	—	0	−630	0	−630	—	—	40	40	15	—	—
0	− 450	—	—	—	—	—	—	—	—	—	—	50	45	—	—	—
0	− 500	—	—	—	—	—	—	—	—	—	—	60	50	—	—	—
0	− 750	—	—	—	—	—	—	—	—	—	—	70	—	—	—	—
0	−1 000	—	—	—	—	—	—	—	—	—	—	80	—	—	—	—
0	−1 250	—	—	—	—	—	—	—	—	—	—	100	—	—	—	—
0	−1 600	—	—	—	—	—	—	—	—	—	—	120	—	—	—	—
0	−2 000	—	—	—	—	—	—	—	—	—	—	140	—	—	—	—

Notes (1) 0.6mm is included in the group.
(2) Applicable to bearings with cylindrical bores.
(3) Tolerance for width deviation and tolerance limits for the width variation of the outer ring should be the same bearing. Tolerances for the width variation of the outer ring of Class 5, 4, and 2 are shown in Table 8.2.2.
(4) Applicable to individual rings manufactured for combined bearings.
(5) Applicable to ball bearings such as deep groove ball bearings, angular contact ball bearings, etc.

Tolerances for radial bearing

Units : μm

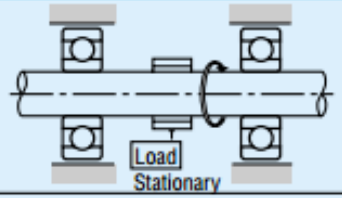
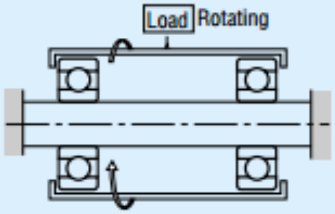
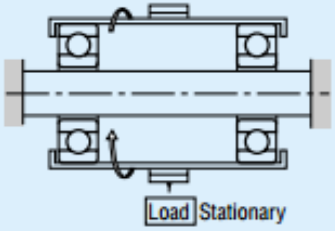
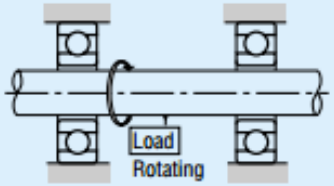
K_{ia}					S_d			S_{ia} (5)			Nominal Bore Diameter d (mm)	
Normal	Class 6	Class 5	Class 4	Class 2	Class 5	Class 4	Class 2	Class 5	Class 4	Class 2		
max.	max.	max.	max.	max.	max.	max.	max.	max.	max.	max.	over	incl
10	5	4	2.5	1.5	7	3	1.5	7	3	1.5	**0.6**(1)	**2.5**
10	6	4	2.5	1.5	7	3	1.5	7	3	1.5	**2.5**	**10**
10	7	4	2.5	1.5	7	3	1.5	7	3	1.5	**10**	**18**
13	8	4	3	2.5	8	4	1.5	8	4	2.5	**18**	**30**
15	10	5	4	2.5	8	4	1.5	8	4	2.5	**30**	**50**
20	10	5	4	2.5	8	5	1.5	8	5	2.5	**50**	**80**
25	13	6	5	2.5	9	5	2.5	9	5	2.5	**80**	**120**
30	18	8	6	2.5	10	6	2.5	10	7	2.5	**120**	**150**
30	18	8	6	5	10	6	4	10	7	5	**150**	**180**
40	20	10	8	5	11	7	5	13	8	5	**180**	**250**
50	25	13	–	–	13	–	–	15	–	–	**250**	**315**
60	30	15	–	–	15	–	–	20	–	–	**315**	**400**
65	35	–	–	–	–	–	–	–	–	–	**400**	**500**
70	40	–	–	–	–	–	–	–	–	–	**500**	**630**
80	–	–	–	–	–	–	–	–	–	–	**630**	**800**
90	–	–	–	–	–	–	–	–	–	–	**800**	**1 000**
100	–	–	–	–	–	–	–	–	–	–	**1 000**	**1 250**
120	–	–	–	–	–	–	–	–	–	–	**1 250**	**1 600**
140	–	–	–	–	–	–	–	–	–	–	**1 600**	**2 000**

Remarks 1. The cylindrical bore diameter "no-go side" tolerance limit (high) specified in this table does not necessarily apply within a distance of 1.2 times the chamfer dimension r (max.) from the ring face.

2. ABMA Std 20-1996: ABEC1·RBEC1, ABEC3·RBEC3, ABEC5·RBEC5, ABEC7·RBEC7, and ABEC9·RBEC9 are equivalent to Classes Normal, 6, 5, 4, and 2 respectively.

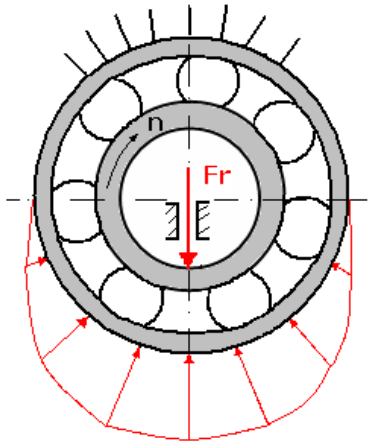
Choice of fits for races

Table 9.1 Loading Conditions and Fits

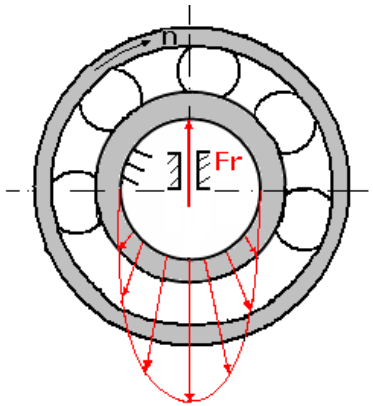
Load Application	Bearing Operation		Load Conditions	Fitting	
	Inner Ring	Outer Ring		Inner Ring	Outer Ring
	Rotating	Stationary	Rotating Inner Ring Load Stationary Outer Ring Load	Tight Fit	Loose Fit
	Stationary	Rotating			
	Stationary	Rotating	Rotating Outer Ring Load Stationary Inner Ring Load	Loose Fit	Tight Fit
	Rotating	Stationary			
Direction of load indeterminate due to variation of direction or unbalanced load	Rotating or Stationary	Rotating or Stationary	Direction of Load Indeterminate	Tight Fit	Tight Fit

Choice of fits for races

1. *Stationary loading*
2. *Rotation loading*
3. *Fluctuation loading*



Stationary loading of outer race and rotation loading of the inner race



Stationary loading of the inner race and rotation loading of the outer race

Table 9.2 Fits of Radial Bearings with Shafts

Load Conditions		Examples	Shaft Diameter (mm)			Tolerance of Shaft	Remarks
			Ball Brgs	Cylindrical Roller Brgs, Tapered Roller Brgs	Spherical Roller Brgs		
Radial Bearings with Cylindrical Bores							
Rotating Outer Ring Load	Easy axial displacement of inner ring on shaft desirable.	Wheels on Stationary Axles	All Shaft Diameters			g6	Use g5 and h5 where accuracy is required. In case of large bearings, f6 can be used to allow easy axial movement.
	Easy axial displacement of inner ring on shaft unnecessary	Tension Pulleys Rope Sheaves				h6	
Rotating Inner Ring Load or Direction of Load Indeterminate	Light Loads or Variable Loads ($<0.06C_r$[1])	Electrical Home Appliances Pumps, Blowers, Transport Vehicles, Precision Machinery, Machine Tools	<18	—	—	js5	
			18 to 100	<40	—	js6 (j6)	
			100 to 200	40 to 140	—	k6	
			—	140 to 200	—	m6	
	Normal Loads (0.06 to $0.13C_r$[1])	General Bearing Applications, Medium and Large Motors, Turbines, Pumps, Engine Main Bearings, Gears, Woodworking Machines	<18	—	—	js5 or js6 (j5 or j6)	k6 and m6 can be used for single-row tapered roller bearings and single-row angular contact ball bearings instead of k5 and m5.
			18 to 100	<40	<40	k5 or k6	
			100 to 140	40 to 100	40 to 65	m5 or m6	
			140 to 200	100 to 140	65 to 100	m6	
			200 to 280	140 to 200	100 to 140	n6	
			—	200 to 400	140 to 280	p6	
			—	—	280 to 500	r6	
			—	—	over 500	r7	
	Heavy Loads or Shock Loads ($>0.13C_r$[1])	Railway Axleboxes, Industrial Vehicles, Traction Motors, Construction Equipment, Crushers	—	50 to 140	50 to 100	n6	More than CN bearing internal clearance is necessary.
			—	140 to 200	100 to 140	p6	
			—	over 200	140 to 200	r6	
			—	—	200 to 500	r7	
Axial Loads Only			All Shaft Diameters			js6 (j6)	—
Radial Bearings with Tapered Bores and Sleeves							
All Types of Loading		General bearing Applications, Railway Axleboxes	All Shaft Diameters			h9/IT5	IT5 and IT7 mean that the deviation of the shaft from its true geometric form, e. g. roundness and cylindricity should be within the tolerances of IT5 and IT7 respectively.
		Transmission Shafts, Woodworking Spindles				h10/IT7	

Note (1) C_r represents the basic load rating of the bearing.
Remarks This table is applicable only to solid steel shafts.

Table 9.4 Fits of Radial Bearings with Housings

Load Conditions			Examples	Tolerances for Housing Bores	Axial Displacement of Outer Ring	Remarks
Solid Housings	Rotating Outer Ring Load	Heavy Loads on Bearing in Thin-Walled Housing or Heavy Shock Loads	Automotive Wheel Hubs (Roller Bearings) Crane Travelling Wheels	P7	Impossible	—
		Normal or Heavy Loads	Automotive Wheel Hubs (Ball Bearings) Vibrating Screens	N7		
		Light or Variable Loads	Conveyor Rollers Rope Sheaves Tension Pulleys	M7		
	Direction of Load Indeterminate	Heavy Shock Loads	Traction Motors			
		Normal or Heavy Loads	Pumps Crankshaft Main Bearings Medium and Large Motors	K7	Generally Impossible	If axial displacement of the outer ring is not required.
		Normal or Light Loads		JS7 (J7)	Possible	Axial displacement of outer ring is necessary.
Solid or Split Housings	Rotating Inner Ring Load	Loads of All kinds	General Bearing Applications, Railway Axleboxes	H7	Easily possible	—
		Normal or Light Loads	Plummer Blocks	H8		
		High Temperature Rise of Inner Ring Through Shaft	Paper Dryers	G7		
Solid Housing	Direction of Load Indeterminate	Accurate Running Desirable under Normal or Light Loads	Grinding Spindle Rear Ball Bearings High Speed Centrifugal Compressor Free Bearings	JS6 (J6)	Possible	—
			Grinding Spindle Front Ball Bearings High Speed Centrifugal Compressor Fixed Bearings	K6	Generally Impossible	For heavy loads, interference fit tighter than K is used. When high accuracy is required, very strict tolerances should be used for fitting.
	Rotating Inner Ring Load	Accurate Running and High Rigidity Desirable under Variable Loads	Cylindrical Roller Bearings for Machine Tool Main Spindle	M6 or N6	Impossible	
		Minimum noise is required.	Electrical Home Appliances	H6	Easily Possible	—

Remarks This table is applicable to cast iron and steel housings. For housings made of light alloys, the interference should be tighter than those in this table.

9.2 Bearing Internal Clearances

9.2.1 Internal Clearances and Their Standards

The internal clearance in rolling bearings in operation greatly influences bearing performance including fatigue life, vibration, noise, heart-generation, etc. Consequently, the selection of the proper internal clearance is one of the most important tasks when choosing a bearing after the type and size have been determined.

This bearing internal clearance is the combined clearances between the inner/outer rings and rolling elements. The radial and axial clearances are defined as the total amount that one ring can be displaced relative to the other in the radial and axial directions respectively (Fig. 9.1).

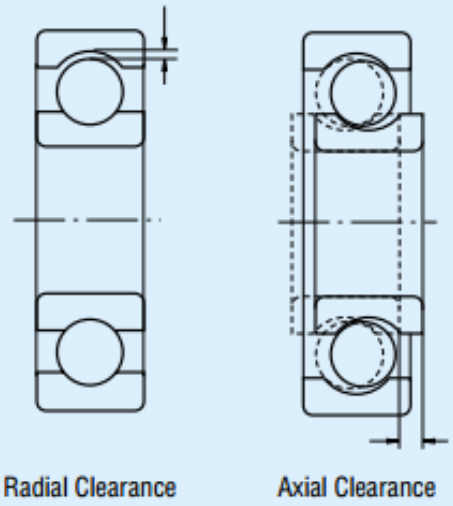


Table 9.8 Bearing Internal Clearance

Table 9.9 Radial Internal Clearances in Deep Groove Ball Bearings

Units : μm

Nominal Bore Diameter d (mm)		Clearance									
		C2		CN		C3		C4		C5	
over	incl	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.
10 only		0	7	2	13	8	23	14	29	20	37
10	**18**	0	9	3	18	11	25	18	33	25	45
18	**24**	0	10	5	20	13	28	20	36	28	48
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	510
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	110	90	230	210	360	340	520	490	690
630	**710**	20	130	110	260	240	400	380	570	540	760
710	**800**	20	140	120	290	270	450	430	630	600	840

Remarks To obtain the measured values, use the clearance correction for radial clearance increase caused by the measuring load in the table below.
For the C2 clearance class, the smaller value should be used for bearings with minimum clearance and the larger value for bearings near the maximum clearance range.

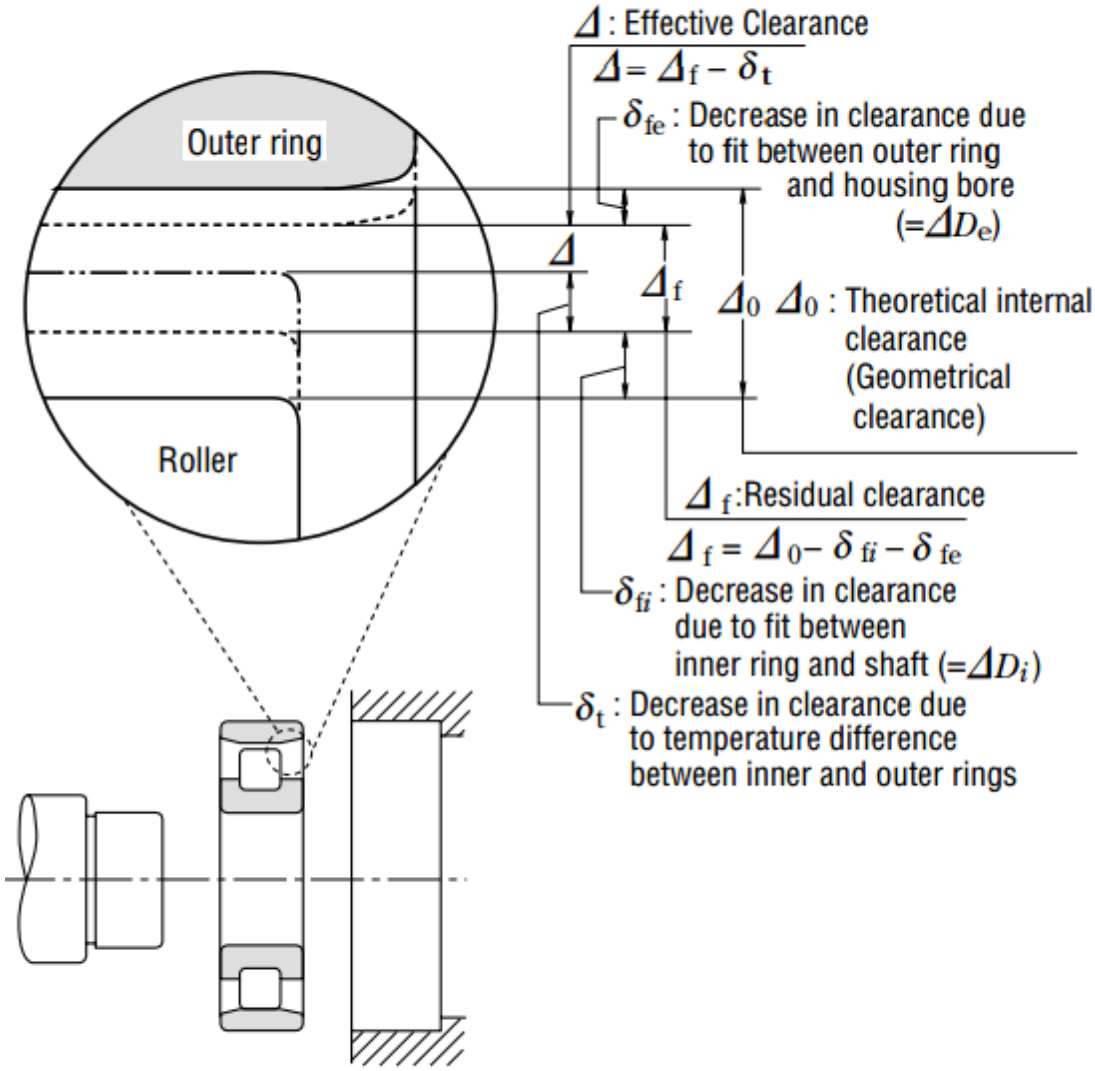
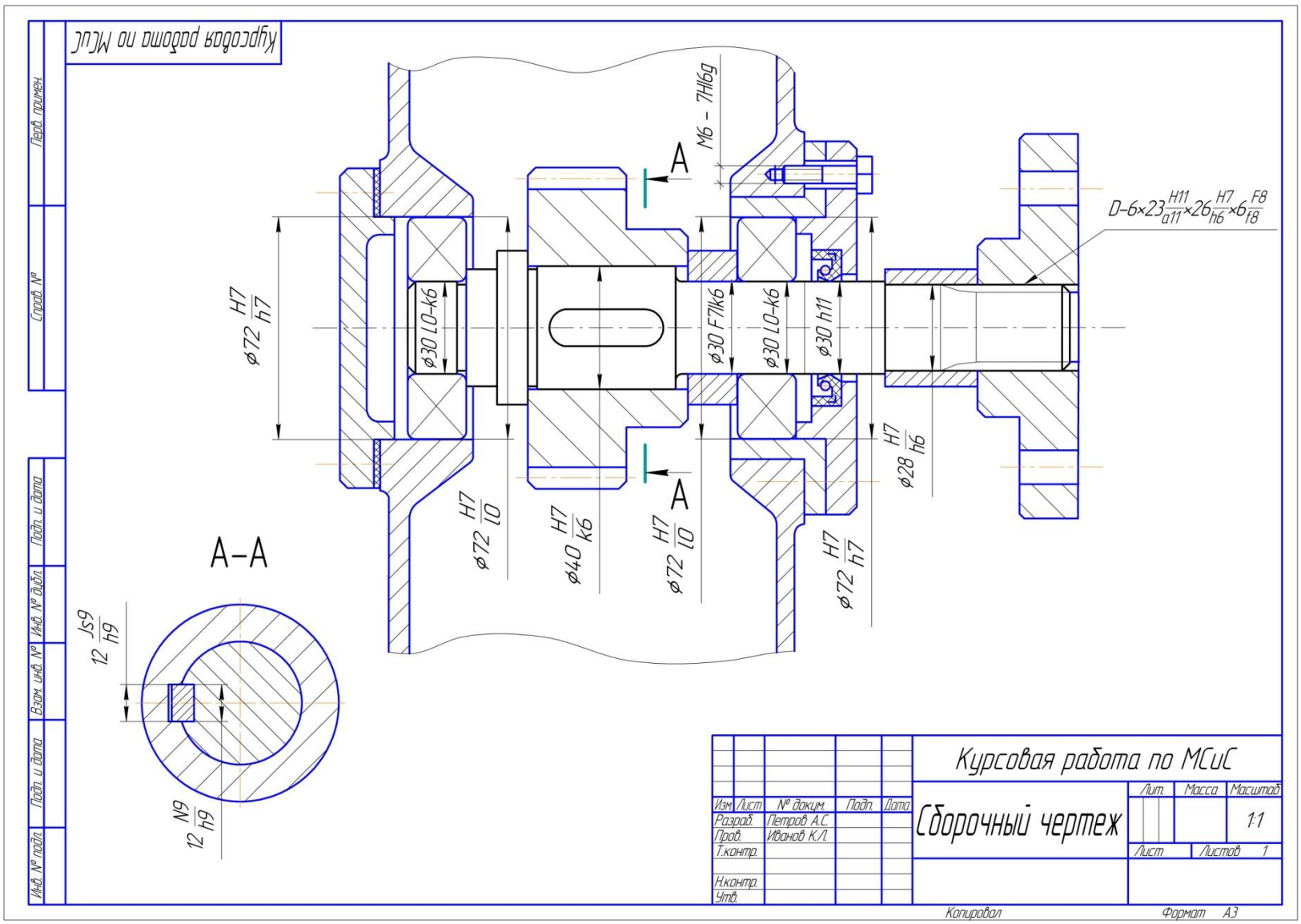


Fig. 9.2 Changes in Radial Internal Clearance of Bearings

Table 9. 19 Examples of Clearances for Specific Applications

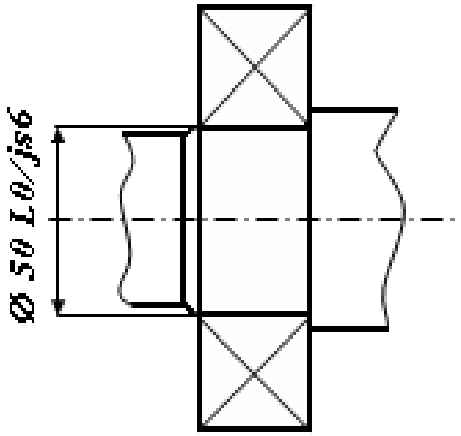
Operating Conditions	Examples	Internal Clearance
When shaft deflection is large.	Semi-floating rear wheels of automobiles	C5 or equivalent
When steam passes through hollow shafts or roller shafts are heated.	Dryers in paper making machines	C3, C4
	Table rollers for rolling mills	C3
When impact loads and vibration are severe or when both the inner and outer rings are tight-fitted.	Traction motors for railways	C4
	Vibrating screens	C3, C4
	Fluid couplings	C4
	Final reduction gears for tractors	C4
When both the inner and outer rings are loose-fitted	Rolling mill roll necks	C2 or equivalent
When noise and vibration restrictions are severe	Small motors with special specifications	C1, C2, CM
When clearance is adjusted after mounting to prevent shaft deflection, etc.	Main shafts of lathes	CC9, CC1


Курсовая работа по МСиС
Сборочный чертеж
Петров А.С.
Иванов К.Л.
Масштаб 1:1
Лист 1
Листов 1
Копировал
Формат А3
A–A
M6 – 7H/6g
D–6×23 H11/a11 ×26 H7/h6 ×6 F8/f8
ø72 H7/h7
ø30 L0–k6
ø30 F7/k6
ø30 L0–k6
ø30 h11
ø28 H7/h6
ø72 H7/l0
ø40 H7/k6
ø72 H7/l0
ø72 H7/h7
12 Js9/h9
12 N9/h9

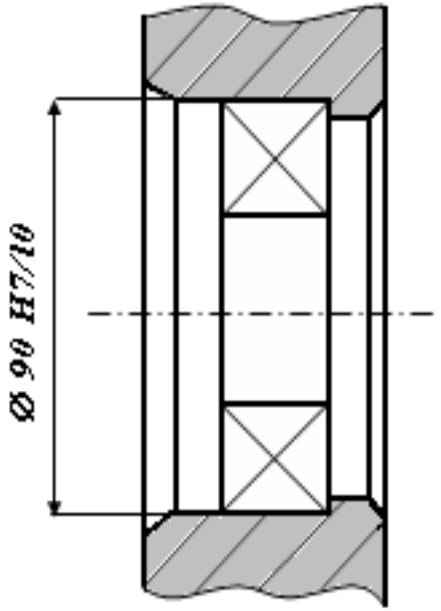
Designation of the race fits in assembler drawing

Ø50 L0/js6 or Ø50 L0 – js6.

Ø90 H7//0 or Ø90 H7 – /0.



Designation of the fit for the inner race with the shaft in assembly drawing



Designation of the fit for outer race with the housing in assembly drawing

Thank you for attention