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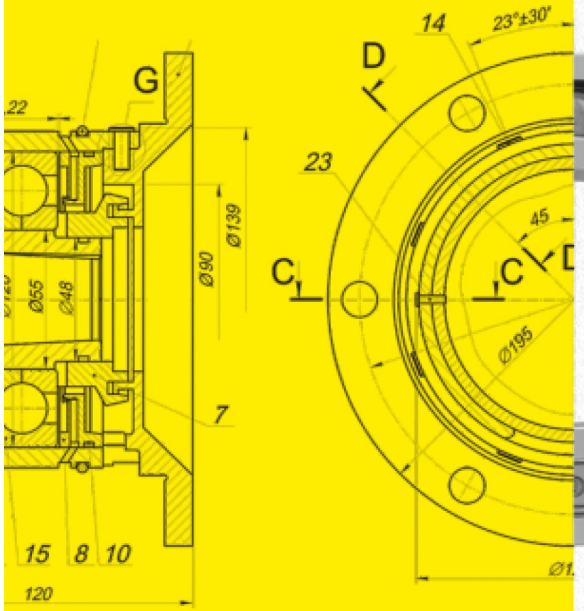

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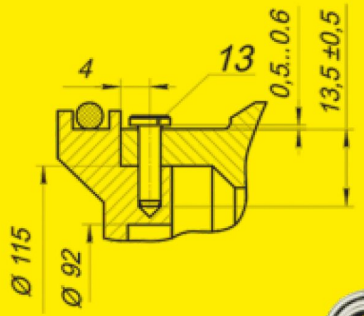

ROLLING BEARINGS

Fits

2 WHEELERS | 3 WHEELERS | 4 WHEELERS | TRACTORS | LCV, HCV | INDUSTRIES | RAILWAYS | AEROSPACE

WINNER DEMING GRAND PRIZE

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CATALOGUE/TC-106, 01/2024

This version supersedes all previously published versions. All the bearing mentioned in this catalogue are manufactured with normal tolerance class. We can, however, supply other class bearing against specific requirement.

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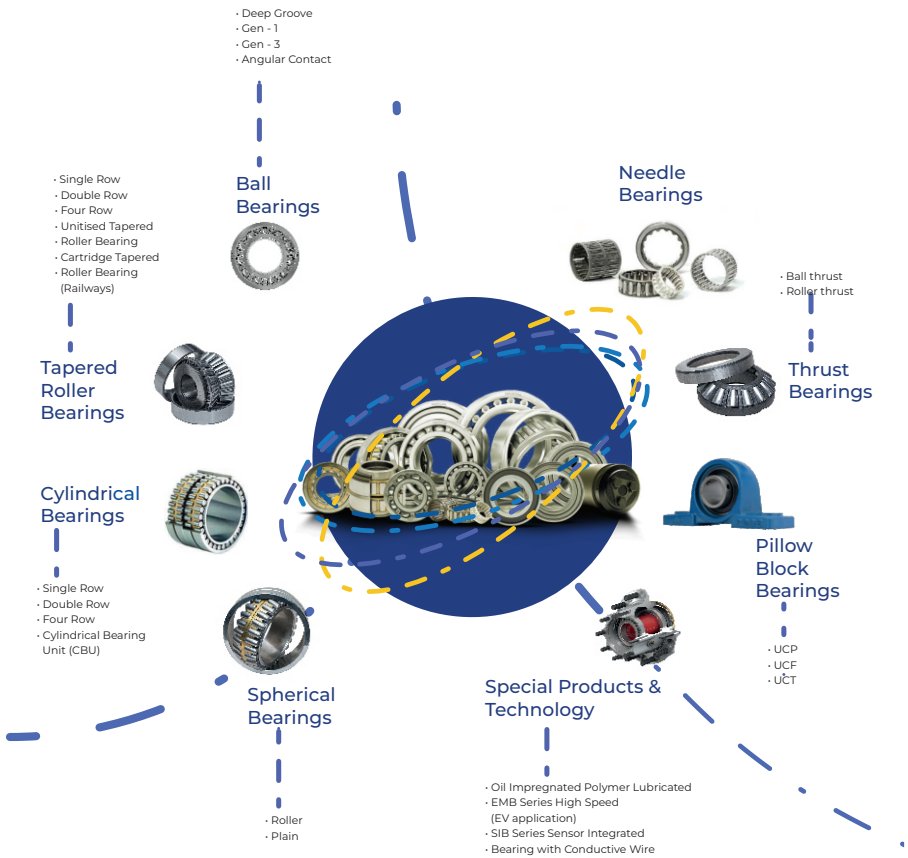
Founded in 1946, NBC is India’s first bearings manufacturer and the last word in quality and durability. In 2020, the company acquired leading European manufacturer, Kinex Bearings to further boost its expertise.

75 years since its beginning, NBC remains India's leading bearings manufacturer andexporter. NBC is also the world’s only bearings manufacturer to receive the prestigious Deming Grand Prize for Total Quality Management.

- 1946 India's first bearing manufacturer
- 250+ million bearings manufactured/ annum
- 3100+ variants of bearings offered
- 5 manufacturing locations
- Leading exporter
- Happy customers in 30+ countries
- R&D and Innovation Centre
- 2800+People
- Automotive
- Industrial
- Railway
- Aerospace

Products from NBC

Since the challenges faced by industry are many, NBC offers a diverse range of exceptional bearings. NBC bearings are available in sizes from 04 mm bore to 2000 mm outer diameter.



∗ Products with special features like high temperature application, special heat treatment, coated roller/races and cage options are also available across product range.

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10 Fits

10.1 The Necessity of a Proper Fit

In some cases improper fit may lead to damage and shorten bearing life. Therefore, it is necessary to make a careful analysis while selecting a proper fit.
Some of the negative conditions caused by improper fit are listed below:

- Raceway cracking, early pitting and displacement of raceways
- Raceway & shaft or housing abrasion caused by creeping in fretting corrosion
- Seizing caused by loss of internal clearance
- Increased noise & lowered rotational accuracy due to raceway groove deformation.

Selection of fits : Selection of proper fit depended upon thorough analysis of bearing operating conditions, including consideration of following factors:

(1) Condition of Rotation

This condition refer to the rotation of bearing ring being considered in relation to the direction of load. There are 3 different conditions:

- Rotating load
- Stationery load
- Direction of load indeterminate

(2) Magnitude of the load

The interference fit of a bearing's inner ring on its seating will be loosened with the increasing load, as the ring will expand under the influence of rotating load, & ring may begin co creep. If it is of shock character, greater interference is required.

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The loss of interference due to increasing load can be estimated using the following equation:

When Fr ≤: 0.3Cor

$$\Delta dp = 0.08 \sqrt{\frac{d.Fr}{B}}$$

When Fr ≥ 0.3 Cor

$\Delta dp = 0.02 (Fr/B)$

where,

Δdp = Interference decrease of inner ring (μm)

Fr = Radial load (N)

B = Inner ring width (mm)

Cor= Basic static load (N)

(3) Bearing Internal Clearance

An interference fit of a bearing on the shaft or in housing means that ring is elastically deformed (expanded or compressed) and bearing's internal clearance reduced.

The internal clearance and permissible reduction depend on the type and size of the bearing.

- The reduction in clearance due to interference fit can be so large that bearings with an internal clearance which is greater than normal have to be used.
- The expansion of the inner ring and contraction of outer ring can be assumed to be approximately 60-80% of the interference, depending on the material of shaft and housing.

(4) Temperature Condition

Interference between inner ring & steel shalt is reduced as a result of temperature increase (difference between bearing temperature and ambient temperature). This can result in an easing of fit of the inner ring on its seating. While outer ring expansion may result in increase in clearance.

The decrease of the interference of the inner ring due to this temperature difference may be calculated using following equation: $\Delta dt = 0.0015 \times d \times \Delta T$

Where Δdt= effective interference for temperature difference (μm)

ΔT=Temperature difference between bearing temperature ambient temperature (deg. C).

d =Bearing bore diameter (mm)

(5) Running Accuracy Requirement

To reduce resilience and vibration, clearance fit should generally not be used for bearings, where high demands are placed on running accuracy.

(6) Design& Material of Shaft & Housing

The fit of a bearing ring on its seating must not lead to uneven distortion of the ring (out of roundness).This can be caused by discontinuity in the housing surface. Split housings are therefore not suitable where outer rings are to have an interference fit.

(7) Ease of Mounting &Dismounting

Bearings with clearance fit are usually easier to mount or dismount than those having interference fit. Where operating condition necessitate interference fit and it is essential that mounting &dismounting can be done easily, separable bearings or bearings with taper bore and adaptor or withdrawal sleeve may be used.

(8) Displacement of Non-Locating bearings

If non-separable bearings are used as floating bearings, if the ring is under stationary load, so that axial displacement has to take place in the housing bore, a hardened intermediate bushing is often fitted to the outer ring.

(9) Effective Interference and finish of shaft &housing

Roughness of the fitted surface is reduced since the roughness of the fitted surface is reduced during fitting, the effective interference becomes less than the apparent interference.

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The amount of this interference decrease varies depending on roughness of the surfaces.

Normally, manufacturers assume the following interference reductions:

For ground shaft: 1-2.5 Micron

Machined Shaft: 5-7 Micron

(10) Fitting stress & ring expansion and contraction

While calculating the minimum required amount of interference, following factors should be factors should be taken into consideration:

- Interference is reduced by radial load
- Interference is reduced by difference between bearing temperature and ambient temperature
- Interference is reduced by variation of fitted surfaces

Important details on fits: Maximum interference should not exceed the ratio of 1:1000 of shaft or outside diameter.

Tight interference fits are recommended for:

(a) Operating conditions with large vibrations or shock loads

(b) Application using hollow shaft of housing with thin walls

(c) Application using housing made of light alloys or plastic.

Loose interferences are recommended for:

(a) Application requiring high running accuracy

(b) Application using small size bearings or thin walled bearings.

Shaft and housing material, geometry, hardness and surface finish must be carefully controlled.

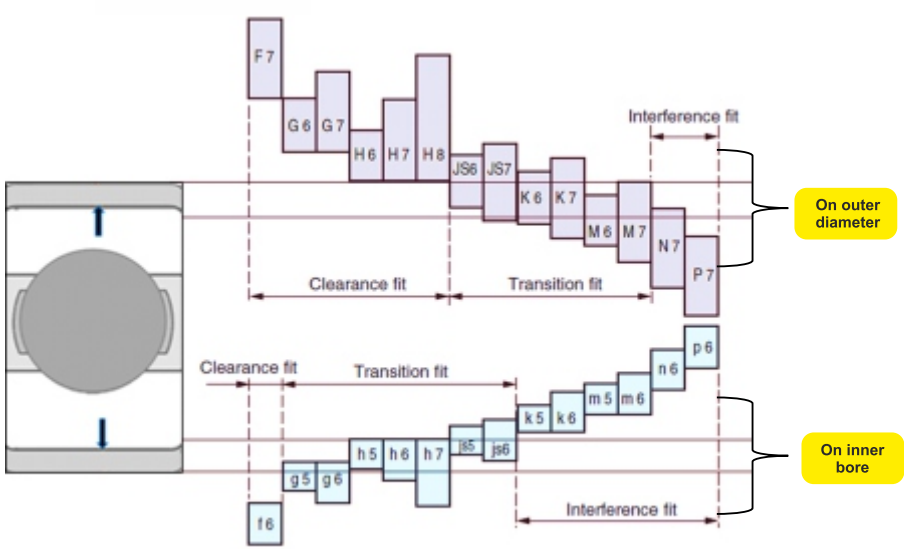
- Ground shafts should be finished to 1 .3 micron Ra or better;
- For turned shafts a finish of 2.5 micron Ra or better; and
- Housing bores should be finished to 4 micron Ra or better.

To avoid shearing of aluminum and magnesium housing during bearing installation, steel inserts should be used; alternatively special lubricants may be used for Freezing and heating to facilitate assembly. A minimum interference fit of 0.0015" and 0.001" per inch of diameter is required for magnesium and aluminum housing respectively.

Where bearings are to be pressed onto a hollow shaft, allowance must be made for contraction of the hollow shaft in order to maintain the desired radial pressure.

10.2 Housing & Shaft Tolerance Class

NEI engineering department should be consulted for proper fitting practices on all special applications. For normal class bearing shaft and housing tolerances are given in table below. The tolerances are for solid steel shaft & housing of cast iron and steel.



Shaft & Housing tolerances

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Shaft tolerance class generally for radial bearings (classes 0, 6X and 6)

Type of load	Condition	Example	Shaft diameters			
			Ball bearings	Cylindrical, needle and tapered roller bearings	Spherical roller bearings	Tolerance class symbol
Rotating inner ring load	Light and variable loads (P<0,06C)	Conveyers lightly loaded mechanisms, bearings	18...100 >100...140	≤40 >40...100	- -	j6 k6
	Normal and heavy loads (P>0, 06C)	General mechanical engineering electric motors, turbines, pups, gearboxes,	≤18 >18...100 >100..140 >140...200 >200...280 - -	- ≤40 >40...100 >100..140 >140...200 >200...400 - -	- ≤ 40 > 40...65 > 65..100 > 100...140 > 140...280 > 280...500 > 500	j5 K5(k6) m5(m6) m6 n6 p6 r6 r7
	Heavy loads and shock loads, ardous working conditions (P>0, 12C)	Heavy duty railway vehicles axle bearings, traction motors, rolling mills	- - -	>50...140 >140...200 200	>50...100 >100...200 > 200	n6 p6 r6
	High running accuracy, light loads (P<0,06C)	Machine tools	≤ 18 > 18...100 > 100...200 -	- ≤ 40 > 40...100 > 140...200	- - - -	h5 j5 k5 m5
Stationary inner ring load	Radial bearings with cylindrical core		All diameters			
	Easy axial displacement of inner ring on shaft desirable	Wheels on non-roating shafts (free wheels)				g6(f6)
	Axial displacement of inner ring on shaft not necessary	Tension pullyes, sheaves				h6
Axial load	Common to all shaft diameter. Shaft & inner is not fixed		≤250 >250	≤250 >250	<250 >250	j6 js6

Fits for shaft for Tapered bore bearing (normal class) with adapter / withdrawal sleeve

All loads	**For all sizes general applications**	**All shaft diameters**	**h9**

Housing tolerance class generally for radial bearings (classes 0, 6X and 6)

Split or Single (Housing rotating outer ring load)

Load type	Conditions	Example	Tolerance class	Outer ring axial displacement in non - separable bearing
Rotating outer ring load	Light and variable loads (P≤0,06C)	Roller bearing wheel hubs, connecting rod bearing	M7	Outer ring cannot move axially
	Normal and heavy loads (P>0,06C)	Ball bearing wheel hubs, connecting rod bearings, crane traveling wheels	N7	
	Rotating outer ring load Heavy loads on bearings in thin walled housings, heavy shock loads (P>0,12C)	Conveyer rollers, rope sheaves, belt tension pulleys	P7	
Direction of load indeterminate	Normal and heavy loads (P > 0,06C). Outer ring displacement is not necessary	Crank shaft main bearing	K7	Outer ring cannot move axially
		Electric motors, pumps crankshaft main bearing		
	Heavy shock loads	Traction motors	M7	

Split or Single Housing (Stationary outer load)

Load type	Conditions	Example	Tolerance class	Outer ring axial displacement in non- separable bearing
Stationary outer load	Loads of all kinds	General mechanical engineering, railway axle boxes	H7	Outer ring can move axially
	Light and normal loads Desirable outer ring displacement (P≤0,12 C)		H8	Outer ring cannot move axially
	Quiet operation	Electric motor	H6	
	Heat conduction through shaft	Drying cylinders, large electrical machines with spherical roller bearings	G7	
Direction of load indeterminate	Light and normal loads Desirable outer ring displacement (P≤0,12 C)	medium-sized electric motors, pumps, crankshaft main bearings	J7	Outer ring can move axially

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Numeric value table of fitting for radial bearing of ‘Normal class’ for metric size

Table for fit on shaft — Unit µm

Nominal shaft diameter in mm		over	3	6	10	18	30	50	65	80	100	120	140	160
		incl.	6	10	18	30	50	65	80	100	120	140	160	180
Deviations of bearing bore diameter in m (tolerance class Normal)		tdmp	0 -8	0 -8	0 -8	0 -10	0 -12	0 -15	0 -15	0 -20	0 -20	0 -25	0 -25	0 -25
Shaft deviation, fit interference or fit clearance in m														
Clearance fit	f6		-10 -18 / 2 7 18	-13 -22 / 5 11 22	-16 -27 / 8 15 27	-20 -33 / 10 17 33	-25 -41 / 13 22 41	-30 -49 / 15 26 49	-30 -49 / 15 26 49	-36 -58 / 16 50 58	-36 -58 / 16 50 58	-43 -68 / 18 34 68	-43 -68 / 18 34 68	-43 -68 / 18 34 68
Transition fit	g5		-4 -9 / 4 0 9	-5 -11 / 3 2 11	-6 -14 / 2 3 14	-6 -16 / 3 3 16	-9 -20 / 3 5 20	-10 -23 / 5 4 23	-10 -23 / 5 4 23	-12 -27 / 8 4 27	-12 -27 / 8 4 27	-14 -32 / 11 3 32	-14 -32 / 11 3 32	-14 -32 / 11 3 32
	g6		-4 -12 / 4 1 12	-5 -14 / 3 3 14	-6 -17 / 2 4 17	-7 -20 / 3 5 20	-9 -25 / 3 6 25	-10 -29 / 5 6 29	-10 -29 / 5 6 29	-12 -34 / 8 6 34	-12 -34 / 8 6 34	-14 -39 / 11 6 39	-14 -39 / 11 6 39	-14 -39 / 11 6 39
	h5		0 -5 / 8 4 5	0 -6 / 8 3 6	0 -8 / 8 3 8	0 -9 / 10 4 9	0 -11 / 12 4 11	0 -13 / 15 6 13	0 -13 / 15 6 13	0 -15 / 20 8 15	0 -15 / 20 8 15	0 -18 / 25 11 18	0 -18 / 25 11 18	0 -18 / 25 11 18
	h6		0 -8 / 8 3 8	0 -9 / 8 2 9	0 -11 / 8 2 11	0 -13 / 10 2 13	0 -16 / 12 3 16	0 -19 / 15 4 19	0 -19 / 15 4 19	0 -22 / 20 6 22	0 -22 / 20 6 22	0 -25 / 25 8 25	0 -25 / 25 8 25	0 -25 / 25 8 25
	j5		3 -2 / 11 7 2	4 -2 / 12 7 2	5 -3 / 13 8 3	5 -4 / 15 9 4	6 -5 / 18 10 5	6 -7 / 21 12 7	6 -7 / 21 12 7	6 -9 / 26 14 9	6 -9 / 26 14 9	7 -11 / 32 18 11	7 -11 / 32 18 11	7 -11 / 32 18 11
	j6		6 -2 / 14 8 2	7 -2 / 15 9 2	8 -3 / 16 10 3	9 -4 / 19 11 4	11 -5 / 23 14 5	12 -7 / 27 16 7	12 -7 / 27 16 7	13 -9 / 33 19 9	13 -9 / 33 19 9	14 -11 / 39 22 11	14 -11 / 39 22 11	14 -11 / 39 22 11
	js5		2.5 -2.5 / 11 6 3	3 -3 / 11 6 3	4 -4 / 12 6 4	4.5 -4.5 / 15 9 5	5.5 -5.5 / 18 10 6	6.5 -6.5 / 22 13 7	6.5 -6.5 / 22 13 7	7.5 -7.5 / 28 16 8	7.5 -7.5 / 28 16 8	9 -9 / 34 20 9	9 -9 / 34 20 9	9 -9 / 34 20 9
	js6		4 -4 / 12 7 4	4.5 -4.5 / 13 7 5	5.5 -5.5 / 14 8 6	6.5 -6.5 / 17 9 7	8 -8 / 20 11 8	9.5 -9.5 / 25 13 10	9.5 -9.5 / 25 13 10	11 -11 / 31 17 11	11 -11 / 31 17 11	12.5 -12.5 / 38 21 13	12.5 -12.5 / 38 21 13	12.5 -12.5 / 38 21 13
	k5		6 1 / 14 9 1	7 1 / 15 10 1	9 1 / 17 12 1	11 2 / 21 15 2	13 2 / 25 17 2	15 2 / 30 21 2	15 2 / 30 21 2	18 3 / 38 26 3	18 3 / 38 26 3	21 3 / 46 32 3	21 3 / 46 32 3	21 3 / 46 32 3
	k6		9 1 / 17 11 1	10 1 / 18 12 1	12 1 / 20 14 1	15 2 / 25 17 2	18 2 / 30 21 2	21 2 / 36 25 2	21 2 / 36 25 2	25 3 / 45 31 3	25 3 / 45 31 3	28 3 / 53 36 3	28 3 / 53 36 3	28 3 / 53 36 3
	m5		9 4 / 17 13 4	12 6 / 20 15 6	15 7 / 23 18 7	17 8 / 27 21 8	20 9 / 32 24 9	24 11 / 39 30 11	24 11 / 39 30 11	28 13 / 48 36 13	28 13 / 48 36 13	33 15 / 58 44 15	33 15 / 58 44 15	33 15 / 58 44 15
	m6		12 4 / 20 15 4	15 6 / 23 17 6	18 7 / 26 20 7	21 8 / 31 23 8	25 9 / 37 27 9	30 11 / 45 34 11	30 11 / 45 34 11	35 13 / 55 42 13	35 13 / 55 42 13	40 15 / 65 48 15	40 15 / 65 48 15	40 15 / 65 48 15
	n5		13 8 / 21 17 8	16 10 / 24 19 10	20 12 / 28 23 12	24 15 / 34 28 15	28 17 / 40 32 17	33 20 / 48 39 20	33 20 / 48 39 20	38 23 / 58 46 23	38 23 / 58 46 23	45 27 / 70 56 27	45 27 / 70 56 27	45 27 / 70 56 27
	n6		16 8 / 24 19 8	19 10 / 27 21 10	23 12 / 31 25 12	28 15 / 38 30 15	33 17 / 45 36 17	39 20 / 54 43 20	39 20 / 54 43 20	45 23 / 65 51 23	45 23 / 65 51 23	52 27 / 77 60 27	52 27 / 77 60 27	52 27 / 77 60 27
	p6		20 12 / 28 23 12	24 15 / 32 26 15	29 18 / 37 21 18	35 22 / 45 37 22	42 26 / 54 45 26	51 32 / 66 55 32	51 32 / 66 55 32	59 37 / 79 65 37	59 37 / 79 65 37	68 43 / 93 76 43	68 43 / 93 76 43	68 43 / 93 76 43
	p7		24 12 / 32 25 15	30 15 / 38 30 15	36 18 / 44 35 18	43 22 / 53 43 22	51 26 / 63 51 26	62 32 / 77 62 32	62 32 / 77 62 32	72 37 / 92 73 37	72 37 / 92 73 37	83 43 / 108 87 43	83 43 / 108 87 43	83 43 / 108 87 43

Table for fit on shaft — Unit µm

200 220	220 250	250 280	280 315	315 355	355 400	400 450	450 500	500 560	560 630	630 710	710 800	800 900
0 -30	0 -30	0 -35	0 -35	0 -40	0 -40	0 -45	0 -45	0 -50	0 -50	0 -75	0 -75	0 -100
-50 -79 / 20 40 79	-50 -79 / 20 40 79	-56 -88 / 21 44 88	-56 -88 / 21 44 88	-62 -98 / 22 47 98	-62 -98 / 22 47 98	-68 -108 / 23 51 108	-68 -108 / 23 51 108	-76 120 / 26 58 120	-76 120 / 26 58 120	-80 -130 / 5 47 130	-80 -130 / 5 47 130	-86 -146 / 14 39 146
-15 -35 / 15 2 35	-15 -35 / 15 2 35	-17 -40 / 18 1 40	-17 -40 / 18 1 40	-18 -43 / 22 0 43	-18 -43 / 22 0 43	-20 -47 / 25 1 47	-20 -47 / 25 1 47	- - / - -	- - / - -	- - / - -	- - / - -	- - / - -
-15 -44 / 15 5 44	-15 -44 / 15 5 44	-17 -49 / 18 4 49	-17 -49 / 18 4 49	-18 -54 / 22 3 54	-18 -54 / 22 3 54	-20 -60 / 25 3 60	-20 -60 / 25 3 60	-22 -66 / 28 4 66	-22 -66 / 28 4 66	-24 -74 / 51 9 74	-24 -74 / 51 9 74	-26 -82 / 74 24 82
0 -20 / 30 13 20	0 -20 / 30 13 20	0 -23 / 35 16 23	0 -23 / 35 16 23	0 -25 / 40 18 25	0 -25 / 40 18 25	0 -27 / 45 21 27	0 -27 / 45 21 27	0 -32 / 50 23 32	0 -32 / 50 23 32	0 -36 / 75 38 36	0 -36 / 75 38 36	0 -40 / 100 53 40
0 -29 / 30 10 29	0 -29 / 30 10 29	0 -32 / 35 13 32	0 -32 / 35 13 32	0 -36 / 40 15 36	0 -36 / 40 15 36	0 -40 / 45 17 40	0 -40 / 45 17 40	0 -44 / 50 18 44	0 -44 / 50 18 44	0 -50 / 75 33 50	0 -50 / 75 33 50	0 -56 / 100 48 56
7 -13 / 37 20 13	7 -13 / 37 20 13	7 -16 / 42 23 16	7 -16 / 42 23 16	7 -18 / 47 25 18	7 -18 / 47 25 18	7 -20 / 52 28 20	7 -20 / 52 28 20	- - / - -	- - / - -	- - / - -	- - / - -	- - / - -
16 -13 / 46 26 13	16 -13 / 46 26 13	16 -16 / 51 29 16	16 -16 / 51 29 16	18 -18 / 58 33 18	18 -18 / 58 33 18	20 -20 / 65 37 20	20 -20 / 65 37 20	- - / - -	- - / - -	- - / - -	- - / - -	- - / - -
10 -10 / 40 23 10	10 -10 / 40 23 10	11.5 -11.5 / 47 27 12	11.5 -11.5 / 47 27 12	12.5 -12.5 / 53 32 13	12.5 -12.5 / 53 32 13	13.5 -13.5 / 59 35 14	13.5 -13.5 / 59 35 14	16 -16 / 65 38 16	16 -16 / 65 38 16	18 -18 / 91 55 18	18 -18 / 91 55 18	20 -20 / 118 72 20
14.5 -14.5 / 45 25 15	14.5 -14.5 / 45 25 15	16 -16 / 51 29 16	16 -16 / 51 29 16	18 -18 / 58 33 18	18 -18 / 58 33 18	20 -20 / 65 37 20	20 -20 / 65 37 20	22 -22 / 72 40 22	22 -22 / 72 40 22	25 -25 / 100 58 25	25 -25 / 100 58 25	28 -28 / 128 76 28
24 4 / 54 37 4	24 4 / 54 37 4	27 4 / 62 43 4	27 4 / 62 43 4	29 4 / 69 47 4	29 4 / 69 47 4	32 5 / 77 53 5	32 5 / 77 53 5	- - / - -	- - / - -	- - / - -	- - / - -	- - / - -
33 4 / 63 43 4	33 4 / 63 43 4	36 4 / 71 49 4	36 4 / 71 49 4	40 4 / 80 55 4	40 4 / 80 55 4	45 5 / 90 62 5	45 5 / 90 62 5	44 0 / 94 62 0	44 0 / 94 62 0	50 0 / 125 83 0	50 0 / 125 83 0	56 0 / 156 104 0
37 17 / 67 50 17	37 17 / 67 50 17	43 20 / 78 59 20	43 20 / 78 59 20	46 21 / 86 64 21	46 21 / 86 64 21	50 23 / 95 71 23	50 23 / 95 71 23	- - / - -	- - / - -	- - / - -	- - / - -	- - / - -
46 17 / 76 56 17	46 17 / 76 56 17	52 20 / 57 65 20	52 20 / 57 65 20	57 21 / 97 72 21	57 21 / 97 72 21	63 23 / 108 80 23	63 23 / 108 80 23	70 26 / 120 88 26	70 26 / 120 88 26	80 30 / 155 113 30	80 30 / 155 113 30	90 34 / 190 138 34
51 31 / 81 64 31	51 31 / 81 64 31	57 34 / 92 73 34	57 34 / 92 73 34	62 37 / 102 80 37	62 37 / 102 80 37	67 40 / 112 88 40	67 40 / 112 88 40	- - / - -	- - / - -	- - / - -	- - / - -	- - / - -
60 31 / 90 70 31	60 31 / 90 70 31	66 34 / 101 79 34	66 34 / 101 79 34	73 37 / 113 88 37	73 37 / 113 88 37	80 40 / 125 97 40	80 40 / 125 97 40	88 44 / 138 106 44	88 44 / 138 106 44	100 50 / 175 133 50	100 50 / 175 133 50	112 56 / 212 160 56
79 50 / 109 89 50	79 50 / 109 89 50	88 56 / 123 101 56	88 56 / 123 101 56	98 62 / 138 113 62	98 62 / 138 113 62	108 68 / 153 125 68	108 68 / 153 125 68	122 78 / 172 140 78	122 78 / 172 140 78	138 88 / 213 171 88	138 88 / 213 171 88	156 100 / 256 204 100
96 50 / 126 101 50	96 50 / 126 101 50	108 56 / 143 114 56	108 56 / 143 114 56	119 62 / 159 127 62	119 62 / 159 127 62	131 68 / 176 139 68	131 68 / 176 139 68	148 78 / 198 158 78	148 78 / 198 158 78	168 88 / 243 199 88	168 88 / 243 199 88	190 100 / 290 227 100

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Numeric value table of fitting for radial bearing of 'Normal class' for metric size

Nominal housing bore diameter in mm																	
	over incl.	6 10		10 18		18 30		30 50		50 80		80 120		120 150		150 180	
Deviations of bearing outside diameter in m (tolerance class Normal)																	
	tdmp	0 -8		0 -8		0 -9		0 -11		0 -13		0 -15		0 -18		0 -25	
Housing deviation, fit interference or fit clearance in m																	
Clearance Fit	E8	47 25	25 35 55	59 32	32 44 67	73 40	40 54 82	89 50	50 67 100	106 60	60 79 119	126 72	72 85 141	148 85	85 112 166	148 85	85 114 173
	F7	28 13	13 21 36	34 16	16 25 42	41 20	20 30 50	50 25	25 37 61	60 30	30 44 73	71 36	36 53 86	83 43	43 62 101	83 43	43 64 108
	G6	14 5	5 11 22	17 6	6 12 25	20 7	7 14 29	25 9	9 18 36	29 10	10 21 42	34 12	12 24 49	39 14	14 28 57	39 14	14 31 64
	G7	20 5	5 13 28	24 6	6 15 32	28 7	7 17 37	34 9	9 21 45	40 10	10 24 53	47 12	12 29 62	54 14	14 33 72	54 14	14 36 79
	H6	9 0	0 6 17	11 0	0 6 19	13 0	0 7 22	16 0	0 9 27	19 0	0 11 32	22 0	0 12 37	25 0	0 14 43	25 0	0 17 50
	H7	15 0	0 8 23	18 0	0 9 26	21 0	0 10 30	25 0	0 12 36	30 0	0 14 43	35 0	0 17 50	40 0	0 19 58	40 0	0 22 65
	H8	22 0	0 10 30	27 0	0 12 35	33 0	0 14 42	39 0	0 17 50	46 0	0 20 59	54 0	0 23 69	63 0	0 27 81	63 0	0 29 88
	J6	5 –4	4 2 13	6 –5	5 1 14	8 –5	5 2 17	10 –6	6 3 21	13 –6	6 5 26	16 –6	6 6 31	18 –7	7 7 36	18 –7	7 10 43

	over incl.	180 250		250 315		315 400		400 500		500 630		630 800		800 1000		1000 1250	
	tdmp	0 -30		0 -35		0 -40		0 -45		0 -50		0 -75		0 -100		0 -125	
Clearance Fit	E8	172 100	100 134 202	191 110	110 149 226	214 125	125 168 254	232 135	135 182 277	255 145	145 199 305	285 160	160 227 360	310 170	170 250 410	360 195	195 292 485
	F7	96 50	50 75 126	108 56	56 85 143	119 62	62 94 159	131 68	68 104 176	146 76	76 116 196	160 80	80 132 235	176 86	86 149 276	203 98	98 175 328
	G6	44 15	15 35 74	49 17	17 39 84	54 18	18 43 94	60 20	20 48 105	66 22	22 54 116	74 24	24 66 149	82 26	26 78 182	94 28	28 93 219
	G7	61 15	15 40 91	69 17	17 46 104	75 18	18 50 115	83 20	20 56 128	92 22	22 62 142	104 24	24 76 179	116 26	26 89 216	133 28	28 105 258
	H6	29 0	0 20 59	32 0	0 22 67	36 0	0 25 76	40 0	0 28 85	44 0	0 32 94	50 0	0 42 125	56 0	0 52 156	66 0	0 64 191
	H7	46 0	0 25 76	52 0	0 29 87	57 0	0 32 97	63 0	0 36 108	70 0	0 40 120	80 0	0 52 155	90 0	0 63 190	105 0	0 77 230
	H8	72 0	0 34 102	81 0	0 39 116	89 0	0 43 129	97 0	0 47 142	110 0	0 54 160	125 0	0 67 200	140 0	0 80 240	165 0	0 97 290
	J6	22 –7	7 13 52	25 –7	7 15 60	29 –7	7 18 69	33 –7	7 21 78	-	-	-	-	-	-	-	-

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Numeric value table of fitting for radial bearing of 'Normal class' for metric size

Housing Fits — Unit µm

Transition fit	J7	8 −7	7 1 16	10 −8	8 1 18	12 −9	9 1 21	14 −11	11 1 25	18 −12	12 2 31	22 −13	13 4 37	26 −14	14 5 44	26 −14	14 8 51
	JS6	4.5 −4.5	4.5 2 12.5	5.5 −5.5	5.5 1 13.5	6.5 −6.5	6.5 0 15.5	8 −8	8 1 19	9.5 −9.5	9.5 0 22.5	11 −11	11 1 26	12.5 −12.5	12.5 1 30.5	12.5 −12.5	12.5 3 37.5
	JS7	7.5 −7.5	7,5 1 15.5	9 −9	9 0 17	10.5 −10.5	10.5 1 19.5	12.5 −12.5	12.5 1 23.5	15 −15	15 1 28	17.5 −17.5	17.5 1 32.5	20 −20	20 1 38	20 −20	20 1 45
	K6	2 −7	7 1 10	2 −9	9 3 10	9 3 10	11 4 11	3 −13	13 4 14	4 −15	15 4 17	4 −18	18 6 19	4 −21	21 7 22	4 −21	21 4 29
	K7	5 −10	10 2 13	6 −12	12 3 14	6 −15	15 5 15	7 −18	18 6 18	9 −21	21 7 22	10 −25	25 8 25	12 −28	28 9 30	12 −28	28 6 37
	M6	−3 −12	12 6 5	−4 −15	15 9 4	−4 −17	17 10 5	−4 −20	20 11 7	−5 −24	24 13 8	−6 −28	28 16 9	−8 −33	33 19 10	−8 −33	33 16 17
	M7	0 −15	15 7 8	0 −18	18 9 8	0 −21	21 11 9	0 −25	25 13 11	0 −30	30 16 13	0 −35	35 18 15	0 −40	40 21 18	0 −40	40 18 25
	N6	−7 −16	16 10 1	−9 −20	20 14 1	−11 −24	24 17 2	−12 −28	28 19 1	−14 −33	33 22 1	−16 −38	38 26 1	−20 −45	45 31 2	−20 −45	45 28 5
Interference Fit	N7	−4 −19	19 11 4	−5 −23	23 14 3	−7 −28	28 18 2	−8 −33	33 21 3	−9 −39	39 25 4	−10 −45	45 28 5	−12 −52	52 33 3	−12 −52	52 30 13
	P6	−12 −21	21 15 4	−15 −26	26 20 7	−18 −31	31 24 9	−21 −37	37 28 10	−26 −45	45 34 13	−30 −52	52 40 15	−36 −61	61 47 18	−36 −61	61 44 11
	P7	−9 −24	24 16 1	−11 −29	29 20 3	−14 −35	35 25 5	−17 −42	42 30 6	−21 −51	51 37 8	−24 −59	59 42 9	−28 −68	68 49 10	−28 −68	68 46 3

Housing Fits — Unit µm

30 −16	16 9 60	36 −16	16 13 71	39 −18	18 14 79	43 −20	20 16 88	-	-	-	-	-	-	-	-
14.5 −14.5	14.5 5 44.5	16 −16	16 7 51	18 −18	18 6 58	20 −20	20 8 65	22 −22	22 10 72	25 −25	25 17 100	28 −28	28 24 128	33 −33	33 31 158
23 −23	23 2 53	26 −26	26 3 61	28.5 −28.5	28.5 3 68.5	31.5 −31.5	31.5 4 76.5	35 −35	35 5 85	40 −40	40 12 115	45 −45	45 18 145	52.5 −52.5	52 24 177
5 −24	24 4 35	5 −27	27 5 40	7 −29	29 4 47	8 −32	32 4 53	0 −44	44 12 50	0 −50	50 8 75	0 −56	56 4 100	0 −66	66 2 125
13 −33	33 8 43	16 −36	36 7 51	17 −40	40 8 57	18 −45	45 9 63	0 −70	70 30 50	0 −80	80 28 75	0 −90	90 27 100	0 −105	105 28 125
−8 −37	37 17 22	−9 −41	41 19 26	−10 −46	46 21 30	−10 −50	50 22 35	−26 −70	70 38 24	−30 −80	80 38 45	−34 −90	90 38 66	−40 −106	106 45 85
0 −46	46 21 30	0 −52	52 23 35	0 −57	57 25 40	0 −63	63 27 45	−26 −96	96 56 24	−30 −110	110 58 45	−34 −124	124 61 66	−40 −145	145 68 85
−22 −51	51 31 8	−25 −57	57 35 10	−26 −62	62 37 14	−27 −67	67 39 18	−44 −88	88 56 6	−50 −100	100 58 25	−56 −112	112 60 44	−66 −132	132 67 59
−14 −60	60 35 16	−14 −66	66 37 21	−16 −73	73 41 24	−17 −80	80 44 28	−44 −114	114 74 6	−50 −130	130 78 25	−56 −146	146 83 44	−66 −171	171 94 59
−41 −70	70 50 11	−47 −79	79 57 12	−51 −87	87 62 11	−55 −95	95 67 10	−78 −122	122 90 28	−88 −138	138 96 13	−100 −156	156 104 0	−120 −186	186 121 5
−33 −79	79 54 3	−36 −88	88 59 1	−41 −98	98 66 1	−45 −108	108 72 0	−78 −148	148 108 28	−88 −168	168 126 13	−100 −190	190 127 0	−120 −225	225 148 5

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Limits and Fits Guideline TAPERED ROLLER BEARINGS
ABMA RECOMMENDED FITTING PRACTICE
Shaft and housing material, geometry, hardness and surface finish must be carefully controlled. Ground shafts should be finished to 1.3 micron Ra or better; for turned shafts a finish of 2.5µm Ra or better; and housing bores should be finished to 4 micron Ra or better.

To avoid shearing aluminum and magnesium housing during bearing installation, steel inserts should be used ; alternatively special lubricants may be used for freezing and heating to facilitate assembly.
A minimum interference fit is required for aluminum of 0.0010* per inch of diameter, for magnesium of 0.0015" per inch of diameter.

Where bearings are to be pressed onto a hollow shaft, allowance must be made for contraction of the hollow shaft in order to maintain the desired radial pressure.

AFBMA AUTOMOTIVE TAPERED CONE FITTING PRACTICE.

Use	Application	Fit Type	Cone Bore B*	Shaft Diameter B*	Fit	Cone Bore B*	Shaft Diameter B*	Fit
			Upto 3" bore			Above 3" bore		
Automotive Rotating Shafts	Pinion, transmission rear wheels, crossshaft, transfer case	Adjustable cones	+0.0005 -0.0000	+0.0005 +0.0000	0.0005T 0.0005L	+0.0010 -0.0000	+0.0015 +0.0005	0.0015T 0.0005L
		Non-Adjustable cones	+0.0005 -0.0000	+0.0015 +0.0010	0.0015T 0.0005T	+0.0010 -0.0000	+0.0025 +0.0015	0.0025T 0.0005T
	Differential	Non-Adjustable cones	+0.0005 -0.0000	+0.0025 +0.0015	0.0025T 0.0010T	+0.0010 -0.0000	+0.0035 +0.0025	0.0035T 0.0015T
Automotive Stationary Shafts	Front wheels, full floating rear wheels trailer wheels	Adjustable cones	+0.0005 -0.0000	-0.0002 -0.0007	0.0002L 0.0012L	+0.0010 -0.0000	-0.0002 -0.0012	0.0002L 0.0022L

AFBMA AUTOMOTIVE TAPERED CUP FITTING PRACTICE.

Use	Application	Fit Type	Cup O.D. D*	Housing Bore D*	Fit	Cup O.D. D*	Housing Bore D*	Fit	Cup O.D. D*	Housing Bore D*	Fit
			Less 3" O.D.			3" to 5"O.D.			Above 5" O.D.		
Auto-motive	Front wheels, full floating rear wheels pinion, differntial	Non-Adjustable cups	+0.0010 -0.0000	-0.0015 -0.0005	0.0025T 0.0005T	+0.0010 -0.0000	-0.0020 -0.0010	0.0030T 0.0010T	+0.0010 -0.0000	-0.0030 -0.0010	0.0040T 0.0010T
	Differential	Non-Adjustable cups	+0.0010 -0.0000	+0.0010 +0.0020	0.0000L 0.0020L	+0.0010 -0.0000	+0.0010 +0.0020	0.0000L 0.0020L	+0.0010 -0.0000	-0.0000 +0.0020	0.0010T 0.0020L
	Rear wheels, trans-mission, cross shaft & other application	Adjustable cups	+0.0010 -0.0000	-0.0000 +0.0010	0.0010T 0.0010L	-0.0010 -0.0000	+0.0000 +0.0010	0.0010T 0.0010L	-0.0010 -0.0000	-0.0000 +0.0020	0.0010T -0.0020L

*D - Normal cup O.D., L - Loose, T - Tight

THE NBC PRODUCT ENGINEERING DEPARTMENT SHOULD BE CONSULTED FOR PROPER FITIING PRACTICE ON ALL SPECIAL APPLICATIONS. AFBMA AUTOMOTIVE TAPERED CONE FITTING PRACTICE.

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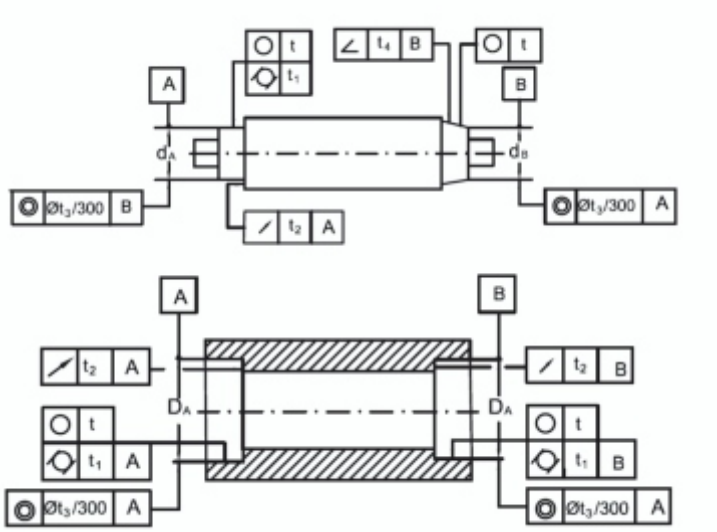
Table: ISO Tolerance grade for dimensions

over	incl.	IT0	IT1	IT2	IT3	IT4	IT5	IT6	IT7	IT8	IT9	IT10	IT11	IT12
mm		µm												
1	3	0,5	0,8	1,2	2	3	4	6	10	14	25	40	60	100
3	6	0,6	1	1,5	2,5	4	5	8	12	18	30	48	75	120
6	10	0,6	1	1,5	2,5	4	6	9	15	22	36	58	90	150
10	18	0,8	1,2	2	3	5	8	11	18	27	43	70	110	180
18	30	1	1,5	2,5	4	6	9	13	21	33	52	84	130	210
30	50	1	1,5	2,5	4	7	11	16	25	39	62	100	160	250
50	80	1,2	2	3	5	8	13	19	30	46	74	120	190	300
80	120	1,5	2,5	4	6	10	15	22	35	54	87	140	220	350
120	180	2	3,5	5	8	12	18	25	40	63	100	160	250	400
180	250	3	4,5	7	10	14	20	29	46	72	115	185	290	460
250	315	4	6	8	12	16	23	32	52	81	130	210	320	520
315	400	5	7	9	13	18	25	36	57	89	140	230	360	570
400	500	6	8	10	15	20	27	40	63	97	155	250	400	630
500	630	–	–	–	–	–	28	44	70	110	175	280	440	700
630	800	–	–	–	–	–	35	50	80	125	200	320	500	800
800	1 000	–	–	–	–	–	36	56	90	140	230	360	560	900
1 000	1 250	–	–	–	–	–	42	66	105	165	260	420	660	1 050
1 250	1 600	–	–	–	–	–	50	78	125	195	310	500	780	1 250
1 600	2 000	–	–	–	–	–	60	92	150	230	370	600	920	1 500
2 000	2 500	–	–	–	–	–	70	110	175	280	440	700	1 100	1 750

10.4 Shaft and housing accuracies



Tolerance name	Fit	Symbol of deviation		Permissible deviation depending on the tolerance class				
				P0 P6X	P6	P5	P4(SP)	P2(UP)
Tolerance of dimension	shaft housing	-	-	IT6(IT5) IT7(IT6)	IT5 IT6	IT4 IT5	IT4 IT4	IT3 IT4
Tolerance of roundness and cylindricity	shaft	○ ⌭	t,t1	$\frac{IT4}{2}\left(\frac{IT3}{2}\right)$	$\frac{IT3}{2}\left(\frac{IT2}{2}\right)$	$\frac{IT2}{2}$	$\frac{IT1}{2}$	$\frac{IT0}{2}$
	housing		t,t1	$\frac{IT5}{2}\left(\frac{IT4}{2}\right)$	$\frac{IT4}{2}\left(\frac{IT2}{2}\right)$	$\frac{IT3}{2}$	$\frac{IT2}{2}$	$\frac{IT1}{2}$
Tolerance of face runout	shaft housing	↗	t2	IT4 (IT3) IT5 (IT4)	IT3 (IT2) IT4 (IT3)	IT2 IT2	IT1 IT2	IT0 IT1
Tolerance of concentricity	shaft housing	◎	t3	IT5 IT6	IT4 IT5	IT4 IT5	IT3 IT4	IT3 IT3
Tolerance of angularity	shaft	<	t4	$\frac{IT7}{2}$	$\frac{IT6}{2}$	$\frac{IT4}{2}$	$\frac{IT3}{2}$	$\frac{IT2}{2}$

For IT grade values refer table for ISO tolerance grade.