

# NEEDLE ROLLER BEARINGS

# C

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## **C** NEEDLE ROLLER BEARINGS

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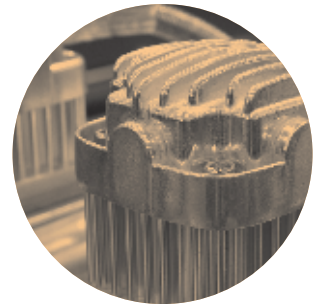
# NEEDLE ROLLER BEARINGS

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## NEEDLE ROLLER AND CAGE RADIAL ASSEMBLIES

**Overview:** Needle roller and cage assemblies are a complement of needle rollers held in place by a cage. The mating shaft and housing are normally used as inner and outer raceways. The unitized design allows for easy handling and installation. Controlled-contour rollers reduce end stresses and permit operation under moderate misalignment. A variety of cage designs, styles and materials, as well as multiple roller paths and segmented constructions, meet broad application requirements.

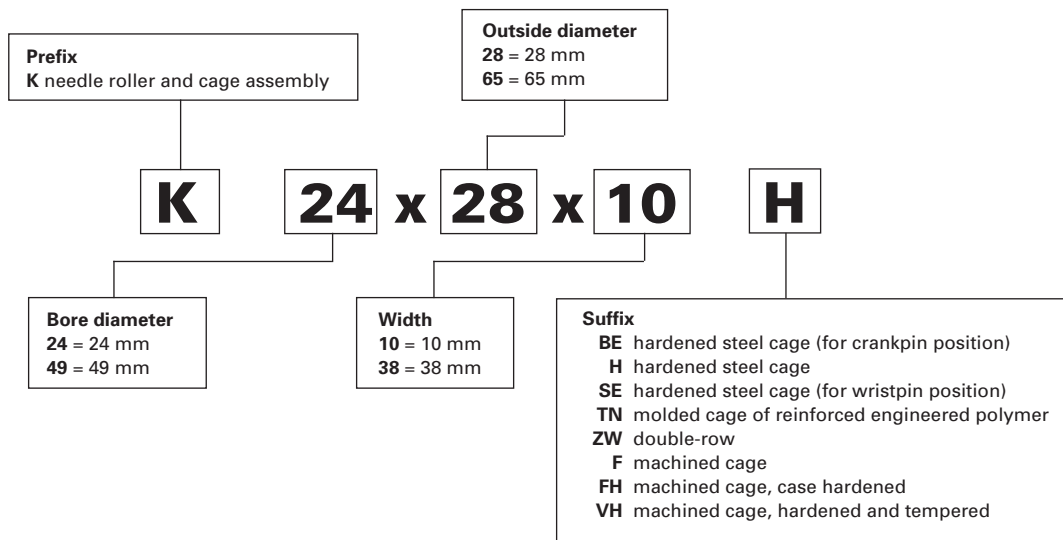
- **Sizes:** 6 mm - 150 mm bore.
- **Markets:** Automotive and truck transmissions, agricultural and construction equipment, two-cycle engines, pumps and compressors.
- **Features:** Special coatings and platings; split and segmented designs for simplified mounting; engineered polymer cages.
- **Benefits:** High load capacity and high limiting speed within the smallest envelope.



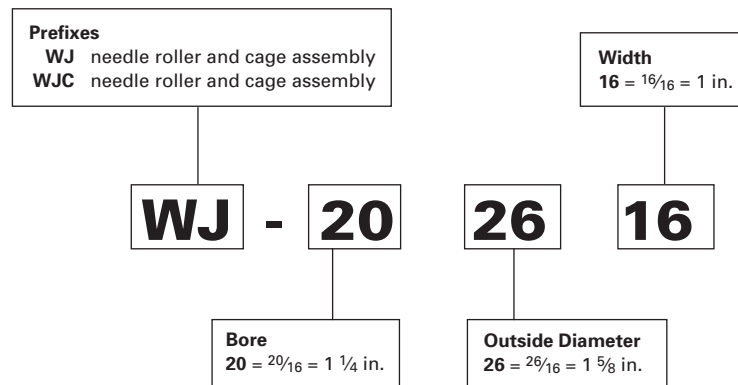


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## Radial Needle Roller and Cage Assemblies – Metric Nominal Dimensions



## Radial Needle Roller and Cage Assemblies – Inch Nominal Dimensions





# ***Needle Roller Bearings and Cage Radial Assemblies***

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## NEEDLE ROLLER AND CAGE RADIAL ASSEMBLIES

### METRIC SERIES

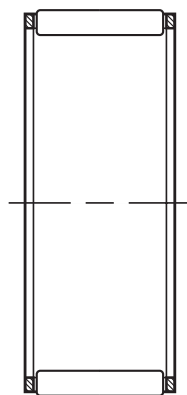
Timken® Torrington® metric series needle roller and cage radial assemblies are available in a variety of sizes and designs. This catalog includes the most popular, standardized and non-standard designs.

### REFERENCE STANDARDS ARE:

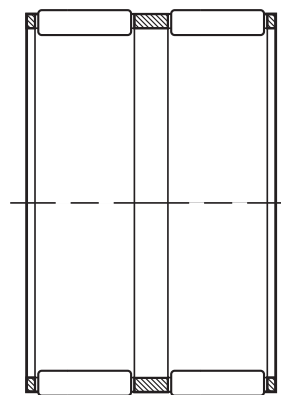
- **ISO 3030** – Needle roller bearings – Needle roller and cage radial assemblies – Boundary dimensions and tolerances
- **DIN 5405 Part 1** – Rolling bearings – needle bearings – Radial needle roller and cage assemblies.
- **ANSI/ABMA 18.1** – Needle roller bearings – Radial, metric design.

Before selecting specific metric series needle roller and cage radial assemblies, the engineering section of this catalog should be reviewed.

### Types of Metric Series Needle Roller and Cage Radial Assemblies



K ...



K ... ZW

### Suffixes

<b>TN</b>	molded cage of reinforced engineered polymer
<b>ZW</b>	double - row
<b>TNZW</b>	molded cage of reinforced engineered polymer – double - row
<b>H</b>	hardened steel cage
<b>F</b>	machined cage
<b>FH</b>	machined cage, case hardened
<b>FV</b>	machined cage, hardened and tempered

### CONSTRUCTION

Needle roller and cage radial assemblies have a steel cage that provides both inward and outward retention for the needle rollers. The designs provide maximum cage strength consistent with the inherent high load ratings of needle roller bearings. Accurate guidance of the needle rollers by the cage bars allows for operation at high speeds. Needle roller and cage assemblies have either one or two rows of needle rollers.

Also listed are metric series needle roller and cage assemblies using molded, one piece glass reinforced engineered polymer cages (suffix TN). These operate well at temperatures up to

120° C over extended periods. However, care should be exercised when these assemblies are lubricated with oils containing additives as service life may be reduced if the operating temperature exceeds 100° C. At such high temperatures oil can deteriorate with time and it is suggested that oil change intervals are observed.

Needle rollers with relieved ends used in these assemblies are made of high carbon chrome steel, through-hardened, ground and lapped to close tolerances for diameter and roundness. See the engineering section of this catalog for further discussion of relieved end rollers.

## DIMENSIONAL ACCURACY

### NEEDLE ROLLER GROUPS (GAGES)

Metric series needle roller and cage radial assemblies are supplied with needle roller complements subdivided into groups (gages) shown in Table 1. The groups are at Timken's option if nothing to the contrary is agreed upon at the time of ordering. This is in accordance with Grade G2 specified in ISO 3096 standard (see needle rollers, page C326). The group limits of the needle rollers are indicated on the package. Labels of identifying colors show the group limits of the needle rollers. The needle roller and cage assemblies of one shipment usually contain needle rollers with group limits of between 0 to -2, and -5 to -7 mm (colors red, blue and white). Information on needle roller and cage assemblies with needle rollers of different group limits will be supplied on request.

TABLE 1 – NEEDLE ROLLER GROUP LIMITS (GRADE G2)

Group	Tolerance µm	Marking	Identifying color of label or on package
0	-2	P0M2	
-1	-3	M1M3	red
-2	-4	M2M4	
-3	-5	M3M5	blue
-4	-6	M4M6	
-5	-7	M5M7	white (gray)
-6	-8	M6M8	
-7	-9	M7M9	green
-8	-10	M8M10	
-9	-11	M9M11	yellow

In the marking of the gages, P identifies zero (0) or plus (+), M identifies minus (-).

## MOUNTING DIMENSIONS

### DESIGN OF RACEWAYS

Needle roller and cage radial assemblies use the housing bore as the outer raceway and the shaft as the inner raceway. In order to realize full bearing load rating and life the housing bore and the shaft raceways must have the correct geometric and metallurgical characteristics. The housing should be of sufficient cross section to maintain adequate roundness and running clearance under load. Additional design details for housings and shafts used as outer and inner raceway can be found in the engineering section of this catalog. The only limit to precision of the radial clearance of a mounted assembly is the capability of the user to hold close tolerances on the inner and outer raceways. The suggested shaft tolerances listed in Table 2 are based on housing bore tolerance G6 and apply to metric series radial needle roller and cage assemblies with needle rollers of group limits between P0M2 and M5M7.

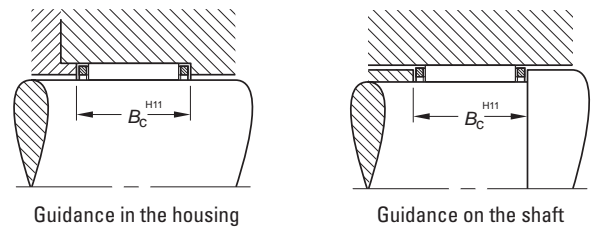
TABLE 2 – SUGGESTED SHAFT TOLERANCES FOR HOUSING BORES MACHINED TO G6

Nominal shaft diameter in mm	SHAFT TOLERANCE	
	≤ 80	> 80
smaller than normal	j5	h5
normal	h5	g5
larger than normal	g6	f6

### AXIAL GUIDANCE REQUIREMENTS

Needle roller and cage radial assembly must be axially guided by shoulders or other suitable means. The end guiding surfaces should be hardened to minimize wear and must provide sufficient axial clearance to prevent end locking of the assembly. Length tolerance H11 is suggested.

If end guidance is provided by a housing shoulder at one end and by a shaft shoulder at the other end the shaft must be axially positioned to prevent end locking of needle roller and cage assembly. The housing and shaft shoulder heights should be 70 to 90 percent of the needle roller diameter to provide proper axial guidance.



### MOUNTING IN SETS

Needle roller and cage radial assemblies that are mounted side by side must have needle rollers of the same group limits to ensure uniform load distribution.

## LUBRICATION

Oil is the preferred lubricant for most applications. In critical applications involving high speeds, ample oil flow must be provided. Where assemblies are subjected to high centrifugal forces, such as in epicyclic gearing, or inertia forces as in the small end of a connecting rod, the contact pressure between the cage and the raceway guiding surface becomes critical. The allowable contact pressure depends on a combination of the induced force and the rubbing velocity between the cage and raceway and the rate of lubricant flow. Consult your Timken representative when cages will be subjected to high induced forces.

## SPECIAL DESIGNS

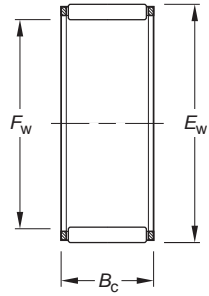
Needle roller and cage radial assemblies made to special dimensions or configurations, such as those which are split to assemble around a one piece crankshaft, can be made available on special order. Special coated or plated cages to enhance life under conditions of marginal lubrication and high induced forces can also be made available.



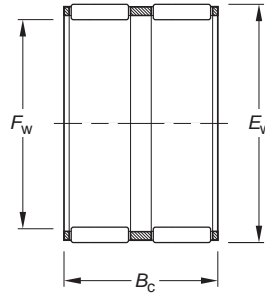
# NEEDLE ROLLER BEARINGS

## SINGLE-ROW, DOUBLE-ROW ASSEMBLIES

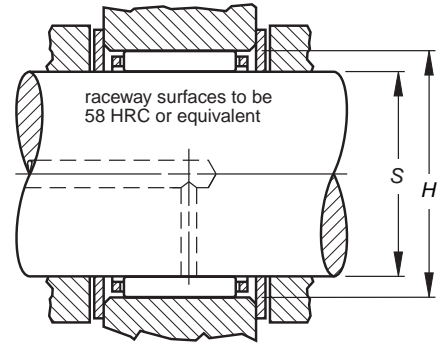
### METRIC SERIES



K



K.ZW



Shaft Dia.	Dimensions mm/in.			Assembly Designation	Load Ratings		Limiting Speed		C <sub>9</sub>	Mounting Dimensions mm/in.				Wt. kg/lbs.
	F <sub>w</sub>	E <sub>w</sub>	B <sub>c</sub>		C	C <sub>0</sub>	Grease	Oil		Max.	Min.	Min.	Max.	
mm	mm	mm	mm				RPM			S	H			
4	4	7	7.0	K4X7X7TN	1.83	1.32	34000	52000	—	4.000	3.995	7.005	7.014	0.00
	0.1575	0.2756	0.276		411	297								
5	5	8	8.0	K5X8X8TN	2.18	1.71	31000	47000	—	5.000	4.995	8.005	8.014	0.001
	0.1969	0.3150	0.315		490	384				0.1969	0.1967	0.3152	0.3155	0.002
	5	8	10.0	K5X8X10TN	3.04	2.63	31000	47000	—	5.000	4.995	8.005	8.014	0.001
0.1969	0.3150	0.394		683	591				0.1969	0.1967	0.3152	0.3155	0.002	
5	5	9	13.0	K5X9X13TN	4.29	3.55	26000	40000	—	5.000	4.995	9.005	9.014	0.002
	0.1969	0.3543	0.512		964	798				0.1969	0.1967	0.3545	0.3549	0.004
6	6	9	8.0	K6X9X8	3.19	2.90	29000	44000	0.0116	6.000	5.995	9.005	9.014	0.001
	0.2362	0.3543	0.315		717	652				0.2362	0.2360	0.3545	0.3549	0.002
	6	9	8.0	K6X9X8TN	2.47	2.07	29000	44000	—	6.000	5.995	9.005	9.014	0.001
0.2362	0.3543	0.315		555	465				0.2362	0.2360	0.3545	0.3549	0.002	
6	6	9	10.0	K6X9X10TN	3.07	2.74	29000	44000	—	6.000	5.995	9.005	9.014	0.001
	0.2362	0.3543	0.394		690	616				0.2362	0.2360	0.3545	0.3549	0.002
	7	10	8.0	K7X10X8TN	2.74	2.44	28000	42000	—	7.000	6.994	10.005	10.014	0.001
0.2756	0.3937	0.315		616	549				0.2756	0.2754	0.3939	0.3943	0.002	
7	7	10	10.0	K7X10X10TN	3.40	3.22	28000	42000	—	7.000	6.994	10.005	10.014	0.001
	0.2756	0.3937	0.394		764	724				0.2756	0.2754	0.3939	0.3943	0.002
	7	11	15.0	K7X11X15TN	6.44	6.24	23000	35000	—	7.000	6.994	11.006	11.017	0.000
0.2756	0.4331	0.591		1450	1400				0.2756	0.2754	0.4333	0.4337	0.000	
8	8	11	8.0	K8X11X8FV	3.23	3.11	26000	41000	0.0132	8.000	7.994	11.006	11.017	0.002
	0.3150	0.4331	0.315		726	699				0.3150	0.3147	0.4333	0.4337	0.004
	8	11	8.0	K8X11X8TN	2.34	2.05	26000	41000	—	8.000	7.994	11.006	11.017	0.002
	0.3150	0.4331	0.315		526	461				0.3150	0.3147	0.4333	0.4337	0.003
8	8	11	10.0	K8X11X10	4.57	4.89	26000	41000	0.0148	8.000	7.994	11.006	11.017	0.002
	0.3150	0.4331	0.394		1030	1100				0.3150	0.3147	0.4333	0.4337	0.004
	8	11	10.0	K8X11X10FV	4.01	4.11	26000	41000	0.0142	8.000	7.994	11.006	11.017	0.002
0.3150	0.4331	0.394		901	924				0.3150	0.3147	0.4333	0.4337	0.004	
8	8	11	13.0	K8X11X13H	5.22	5.78	26000	41000	0.0154	8.000	7.994	11.006	11.017	0.003
	0.3150	0.4331	0.512		1170	1300				0.3150	0.3147	0.4333	0.4337	0.007
	8	12	10.0	K8X12X10F	5.05	4.69	22000	33000	0.0143	8.000	7.994	12.006	12.017	0.002
0.3150	0.4724	0.394		1140	1050				0.3150	0.3147	0.4727	0.4731	0.004	
9	9	12	10.0	K9X12X10FH	4.27	4.60	26000	40000	0.0153	9.000	8.994	12.006	12.017	0.003
	0.3543	0.4724	0.394		960	1030				0.3543	0.3541	0.4727	0.4731	0.007
	9	12	10.0	K9X12X10FV	4.27	4.60	26000	40000	0.0153	9.000	8.994	12.006	12.017	0.002
	0.3543	0.4724	0.394		960	1030				0.3543	0.3541	0.4727	0.4731	0.004
	9	12	13.0	K9X12X13F	5.57	6.47	26000	40000	0.0167	9.000	8.994	12.006	12.017	0.003
0.3543	0.4724	0.512		1250	1450				0.3543	0.3541	0.4727	0.4731	0.007	
9	9	12	13.0	K9X12X13FH	5.57	6.47	26000	40000	0.0167	9.000	8.994	12.006	12.017	0.003
	0.3543	0.4724	0.512		1250	1450				0.3543	0.3541	0.4727	0.4731	0.007
	9	12	13.0	K9X12X13FV	5.57	6.47	26000	40000	0.0167	9.000	8.994	12.006	12.017	0.003
0.3543	0.4724	0.512		1250	1450				0.3543	0.3541	0.4727	0.4731	0.007	
9	9	13	8.0	K9X13X8H	3.96	3.50	21000	32000	0.0139	9.000	8.994	13.006	13.017	0.003
	0.3543	0.5118	0.315		890	787				0.3543	0.3541	0.5120	0.5125	0.007
10	10	13	10.0	K10X13X10	5.40	6.43	25000	39000	0.0174	10.000	9.994	13.006	13.017	0.002
	0.3937	0.5118	0.394		1210	1450				0.3937	0.3935	0.5120	0.5125	0.004

Shaft Dia.	Dimensions mm/in.			Assembly Designation	Load Ratings		Limiting Speed		C <sub>q</sub>	Mounting Dimensions mm/in.				Wt. kg/lbs.
	-0.2 - .008 -0.55 - .022				kN/lbf.		Grease	Oil		Max.	Min.	Min.	Max.	
	mm	F <sub>w</sub>	E <sub>w</sub>		B <sub>c</sub>	C	C <sub>0</sub>	RPM		S	H			
10	10	13	10.0	K10X13X10H	5.40	6.43	25000	39000	0.0174	10.000	9.994	13.006	13.017	0.002
	0.3937	0.5118	0.394		1210	1450				0.3937	0.3935	0.5120	0.5125	
10	10	13	10.0	K10X13X10TN	4.29	4.77	25000	39000	—	10.000	9.994	13.006	13.017	0.002
	0.3937	0.5118	0.394		964	1070				0.3937	0.3935	0.5120	0.5125	
10	10	13	13.0	K10X13X13	5.90	7.16	25000	39000	0.0178	10.000	9.994	13.006	13.017	0.003
	0.3937	0.5118	0.512		1330	1610				0.3937	0.3935	0.5120	0.5125	
10	10	13	16.0	K10X13X16	7.43	9.64	25000	39000	0.0192	10.000	9.994	13.006	13.017	0.004
	0.3937	0.5118	0.630		1670	2170				0.3937	0.3935	0.5120	0.5125	
10	10	14	10.0	K10X14X10H	6.12	6.29	20000	31000	0.0167	10.000	9.994	14.006	14.017	0.003
	0.3937	0.5512	0.394		1380	1410				0.3937	0.3935	0.5514	0.5519	
10	10	14	13.0	K10X14X13H	7.88	8.71	20000	31000	0.0181	10.000	9.994	14.006	14.017	0.004
	0.3937	0.5512	0.512		1770	1960				0.3937	0.3935	0.5514	0.5519	
10	10	16	12.0	K10X16X12F	8.39	7.47	15000	24000	0.0168	10.000	9.994	16.006	16.017	0.006
	0.3937	0.6299	0.472		1890	1680				0.3937	0.3935	0.6302	0.6306	
10	10	16	12.0	K10X16X12TN	7.50	6.40	15000	24000	—	10.000	9.994	16.006	16.017	0.005
	0.3937	0.6299	0.472		1690	1440				0.3937	0.3935	0.6302	0.6306	
12	12	15	10.0	K12X15X10H	5.85	7.51	24000	37000	0.0195	12.000	11.992	15.006	15.017	0.003
	0.4724	0.5906	0.394		1320	1690				0.4724	0.4721	0.5908	0.5912	
12	12	15	13.0	K12X15X13H	6.78	9.03	24000	37000	0.0204	12.000	11.992	15.006	15.017	0.004
	0.4724	0.5906	0.512		1520	2030				0.4724	0.4721	0.5908	0.5912	
12	12	16	13.0	K12X16X13	7.49	8.51	19000	30000	0.0194	12.000	11.992	16.006	16.017	0.000
	0.4724	0.6299	0.512		1680	1910				0.4724	0.4721	0.6302	0.6306	
12	12	17	13.0	K12X17X13	8.93	9.29	16000	25000	0.0194	12.000	11.992	17.006	17.017	0.008
	0.4724	0.6693	0.512		2010	2090				0.4724	0.4721	0.6695	0.6700	
12	12	18	12.0	K12X18X12H	9.76	9.40	14000	22000	0.0191	12.000	11.992	18.006	18.017	0.009
	0.4724	0.7087	0.472		2190	2110				0.4724	0.4721	0.7089	0.7093	
13	13	17	10.0	K13X17X10	7.22	8.33	19000	29000	0.0199	13.000	12.992	17.006	17.017	0.004
	0.5118	0.6693	0.394		1620	1870				0.5118	0.5115	0.6695	0.6700	
13	13	18	15.0	K13X18X15F	10.8	12.1	16000	25000	0.0213	13.000	12.992	18.006	18.017	0.008
	0.5118	0.7087	0.591		2430	2720				0.5118	0.5115	0.7089	0.7093	
14	14	18	8.0	K14X18X8	5.39	5.82	19000	29000	0.0188	14.000	13.992	18.006	18.017	0.004
	0.5512	0.7087	0.315		1210	1310				0.5512	0.5509	0.7089	0.7093	
14	14	18	10.0	K14X18X10	7.17	8.41	19000	29000	0.0206	14.000	13.992	18.006	18.017	0.005
	0.5512	0.7087	0.394		1 610	1890				0.5512	0.5509	0.7089	0.7093	
14	14	18	13.0	K14X18X13	9.73	12.5	19000	29000	0.0227	14.000	13.992	18.006	18.017	0.006
	0.5512	0.7087	0.512		2190	2810				0.5512	0.5509	0.7089	0.7093	
14	14	18	15.0	K14X18X15	10.5	13.8	19000	29000	0.0233	14.000	13.992	18.006	18.017	0.007
	0.5512	0.7087	0.591		2360	3100				0.5512	0.5509	0.7089	0.7093	
14	14	18	17.0	K14X18X17H	12.4	17.1	19000	29000	0.0246	14.000	13.992	18.006	18.017	0.008
	0.5512	0.7087	0.669		2790	3840				0.5512	0.5509	0.7089	0.7093	
14	14	19	13.0	K14X19X13H	10.2	11.4	16000	24000	0.0217	14.000	13.992	19.007	19.020	0.008
	0.5512	0.7480	0.512		2290	2560				0.5512	0.5509	0.7483	0.7488	
14	14	19	18.0	K14X19X18F	13.2	16.0	16000	24000	0.0236	14.000	13.992	19.007	19.020	0.011
	0.5512	0.7480	0.709		2970	3600				0.5512	0.5509	0.7483	0.7488	
14	14	20	12.0	K14X20X12	10.5	10.6	14000	21000	0.0209	14.000	13.992	20.007	20.020	0.009
	0.5512	0.7874	0.472		2360	2380				0.5512	0.5509	0.7877	0.7882	
15	15	18	14.0	K15X18X14TN	7.92	11.9	13000	23000	—	15.000	14.992	18.006	18.017	0.003
	0.5906	0.7087	0.551		1780	2680				0.5906	0.5902	0.7089	0.7093	
15	15	18	16.0	K15X18X16F	8.36	12.6	13000	23000	0.0244	15.000	14.992	18.006	18.017	0.005
	0.5906	0.7087	0.630		1880	2830				0.5906	0.5902	0.7089	0.7093	
15	15	18	17.0	K15X18X17	8.08	12.1	23000	36000	0.0241	15.000	14.992	18.006	18.017	0.005
	0.5906	0.7087	0.669		1820	2720				0.5906	0.5902	0.7089	0.7093	
15	15	19	10.0	K15X19X10	7.87	9.69	18000	28000	0.0220	15.000	14.992	19.007	19.020	0.005
	0.5906	0.7480	0.394		1770	2180				0.5906	0.5902	0.7483	0.7488	
15	15	19	13.0	K15X19X13	9.66	12.6	18000	28000	0.0235	15.000	14.992	19.007	19.020	0.007
	0.5906	0.7480	0.512		2170	2830				0.5906	0.5902	0.7483	0.7488	
15	15	19	17.0	K15X19X17	12.3	17.2	18000	28000	0.0254	15.000	14.992	19.007	19.020	0.009
	0.5906	0.7480	0.669		2770	3870				0.5906	0.5902	0.7483	0.7488	

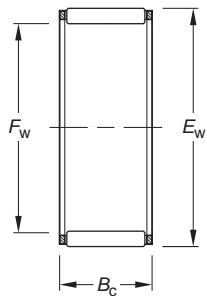
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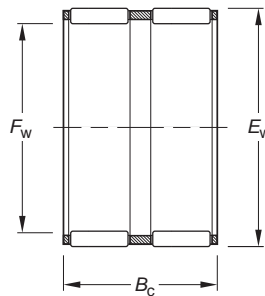
# NEEDLE ROLLER BEARINGS

## SINGLE-ROW, DOUBLE-ROW ASSEMBLIES — continued

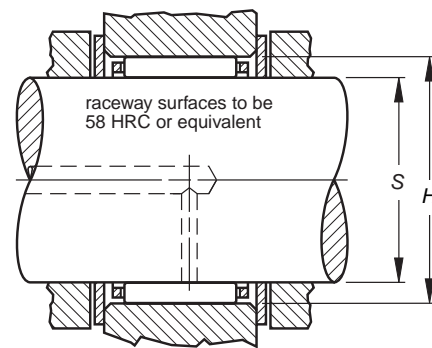
### METRIC SERIES



K



K.ZW



Shaft Dia.	Dimensions mm/in.			Assembly Designation	Load Ratings		Limiting Speed			Mounting Dimensions mm/in.				Wt. kg/lbs.	
	-0.2 -0.008 -0.55 -0.022				kN/lbf.		Grease	Oil	C <sub>g</sub>	Max.	Min.	Min.	Max.		
	mm	F <sub>w</sub>	E <sub>w</sub>		B <sub>c</sub>	C	C <sub>0</sub>	RPM		S	H				
16	15	19	17.0	K15X19X17H	12.3	17.2	18000	28000	0.0254	15.000	14.992	19.007	19.020	0.009	
	0.5906	0.7480	0.669		2770	3870				0.5906	0.5902	0.7483	0.7488	0.020	
	15	19	22.0	K15X19X22ZW	12.2	17.0	18000	28000	0.0253	15.000	14.992	19.007	19.020	0.010	
	0.5906	0.7480	0.866		2740	3820				0.5906	0.5902	0.7483	0.7488	0.022	
	15	20	13.0	K15X20X13H	9.93	11.3	16000	24000	0.0222	15.000	14.992	20.007	20.020	0.008	
	0.5906	0.7874	0.512		2230	2540				0.5906	0.5902	0.7877	0.7882	0.018	
	15	21	15.0	K15X21X15	13.4	14.8	14000	21000	0.0233	15.000	14.992	21.007	21.020	0.013	
	0.5906	0.8268	0.591		3010	3330				0.5906	0.5902	0.8270	0.8276	0.029	
	15	21	21.0	K15X21X21H	18.0	21.7	14000	21000	0.0256	15.000	14.992	21.007	21.020	0.018	
	0.5906	0.8268	0.827		4050	4880				0.5906	0.5902	0.8270	0.8276	0.040	
	16	16	20	8.0	K16X20X8F	6.37	7.51	18000	28000	0.0212	16.000	15.992	20.007	20.020	0.005
	0.6299	0.7874	0.315		1430	1690				0.6299	0.6296	0.7877	0.7882	0.011	
	16	16	20	10.0	K16X20X10	7.82	9.76	18000	28000	0.0226	16.000	15.992	20.007	20.020	0.006
	0.6299	0.7874	0.394		1760	2190				0.6299	0.6296	0.7877	0.7882	0.013	
	16	16	20	10.0	K16X20X10H	7.82	9.76	18000	28000	0.0226	16.000	15.992	20.007	20.020	0.006
0.6299	0.7874	0.394		1760	2190				0.6299	0.6296	0.7877	0.7882	0.013		
16	16	20	10.6	K16X20X10,6TN1	6.06	7.01	18000	28000	—	16.000	15.992	20.007	20.020	0.003	
0.6299	0.7874	0.417		1360	1580				0.6299	0.6296	0.7877	0.7882	0.007		
16	16	20	13.0	K16X20X13	10.1	13.5	18000	28000	0.0245	16.000	15.992	20.007	20.020	0.007	
0.6299	0.7874	0.512		2270	3030				0.6299	0.6296	0.7877	0.7882	0.015		
16	16	20	14.0	K16X20X14	10.8	14.8	18000	28000	0.0251	16.000	15.992	20.007	20.020	0.007	
0.6299	0.7874	0.551		2430	3330				0.6299	0.6296	0.7877	0.7882	0.015		
16	16	20	17.0	K16X20X17F	11.9	16.8	18000	28000	0.0259	16.000	15.992	20.007	20.020	0.009	
0.6299	0.7874	0.669		2680	3780				0.6299	0.6296	0.7877	0.7882	0.020		
16	16	20	17.0	K16X20X17H	12.9	18.5	18000	28000	0.0265	16.000	15.992	20.007	20.020	0.008	
0.6299	0.7874	0.669		2900	4160				0.6299	0.6296	0.7877	0.7882	0.018		
16	16	20	20.0	K16X20X20	13.4	19.5	18000	28000	0.0269	16.000	15.992	20.007	20.020	0.011	
0.6299	0.7874	0.787		3010	4380				0.6299	0.6296	0.7877	0.7882	0.024		
16	16	21	10.0	K16X21X10HD	7.69	8.22	18000	28000	0.0211	16.000	15.992	21.007	21.020	0.007	
0.6299	0.8268	0.394		1730	1850				0.6299	0.6296	0.8270	0.8276	0.015		
16	16	22	12.0	K16X22X12	11.2	11.9	19000	29000	0.0227	16.000	15.992	22.007	22.020	0.010	
0.6299	0.8661	0.472		2520	2680				0.6299	0.6296	0.8664	0.8669	0.022		
16	16	22	16.0	K16X22X16	14.9	17.2	19000	29000	0.0248	16.000	15.992	22.007	22.020	0.014	
0.6299	0.8661	0.630		3350	3870				0.6299	0.6296	0.8664	0.8669	0.031		
16	16	22	16.0	K16X22X16H.ZB2	14.9	17.2	19000	29000	0.0248	16.000	15.992	22.007	22.020	0.014	
0.6299	0.8661	0.630		3350	3870				0.6299	0.6296	0.8664	0.8669	0.031		
16	16	22	20.0	K16X22X20	18.6	22.9	19000	29000	0.0267	16.000	15.992	22.007	22.020	0.017	
0.6299	0.8661	0.787		4180	5150				0.6299	0.6296	0.8664	0.8669	0.037		
16	16	24	20.0	K16X24X20	20.2	21.4	20000	30000	0.0255	16.000	15.992	24.007	24.020	0.025	
0.6299	0.9449	0.787		4540	4810				0.6299	0.6296	0.9452	0.9457	0.055		
17	17	20	10.0	K17X20X10	5.96	8.53	16000	25000	0.0234	17.000	16.992	20.007	20.020	0.004	
0.6693	0.7874	0.394		1340	1920				0.6693	0.6690	0.7877	0.7882	0.009		
17	17	21	10.0	K17X21X10	8.12	10.4	17000	26000	0.0236	17.000	16.992	21.007	21.020	0.006	
0.6693	0.8268	0.394		1830	2340				0.6693	0.6690	0.8270	0.8276	0.013		
17	17	21	12.8	K17X21X13H	10.5	14.5	17000	26000	0.0256	17.000	16.992	21.007	21.020	0.008	
0.6693	0.8268	0.504		2360	3260				0.6693	0.6690	0.8270	0.8276	0.018		

Shaft Dia.	Dimensions mm/in.			Assembly Designation	Load Ratings		Limiting Speed		C <sub>q</sub>	Mounting Dimensions mm/in.				Wt. kg/lbs.
	-0.2 - .008 -0.55 - .022				kN/lbf.		Grease	Oil		Max.	Min.	Min.	Max.	
	mm	F <sub>w</sub>	E <sub>w</sub>		B <sub>c</sub>	C	C <sub>0</sub>	RPM		S	H			
	17	21	13.0	K17X21X13	10.5	14.5	17000	26000	0.0256	17.000	16.992	21.007	21.020	0.008
	0.6693	0.8268	0.512		2360	3260				0.6693	0.6690	0.8270	0.8276	
	17	21	15.0	K17X21X15	11.4	16.1	17000	26000	0.0263	17.000	16.992	21.007	21.020	0.008
	0.6693	0.8268	0.591		2560	3620				0.6693	0.6690	0.8270	0.8276	
	17	21	17.0	K17X21X17H	13.4	19.8	17000	26000	0.0277	17.000	16.992	21.007	21.020	0.011
	0.6693	0.8268	0.669		3010	4450				0.6693	0.6690	0.8270	0.8276	
	17	22	20.0	K17X22X20FH	17.0	23.3	17000	27000	0.0280	17.000	16.992	22.007	22.020	0.015
	0.6693	0.8661	0.787		3820	5240				0.6693	0.6690	0.8664	0.8669	
	17	23	15.0	K17X23X15F	14.1	16.3	18000	27000	0.0251	17.000	16.992	23.007	23.020	0.010
	0.6693	0.9055	0.591		3170	3660				0.6693	0.6690	0.9058	0.9063	
18	18	22	8.0	K18X22X8F	6.32	7.70	16000	24000	0.0224	18.000	17.992	22.007	22.020	0.005
	0.7087	0.8661	0.315		1420	1730				0.7087	0.7083	0.8664	0.8669	
	18	22	10.0	K18X22X10	8.41	11.1	16000	24000	0.0246	18.000	17.992	22.007	22.020	0.006
	0.7087	0.8661	0.394		1890	2500				0.7087	0.7083	0.8664	0.8669	
	18	22	10.0	K18X22X10H	8.41	11.1	16000	24000	0.0246	18.000	17.992	22.007	22.020	0.006
	0.7087	0.8661	0.394		1890	2500				0.7087	0.7083	0.8664	0.8669	
	18	22	13.0	K18X22X13H	10.8	15.4	16000	24000	0.0266	18.000	17.992	22.007	22.020	0.008
	0.7087	0.8661	0.512		2430	3460				0.7087	0.7083	0.8664	0.8669	
	18	22	14.0	K18X22X14	11.6	16.8	16000	24000	0.0272	18.000	17.992	22.007	22.020	0.009
	0.7087	0.8661	0.551		2610	3780				0.7087	0.7083	0.8664	0.8669	
	18	22	14.0	K18X22X14FV	11.3	16.3	16000	24000	0.0270	18.000	17.992	22.007	22.020	0.009
	0.7087	0.8661	0.551		2540	3660				0.7087	0.7083	0.8664	0.8669	
	18	22	17.0	K18X22X17H	13.3	19.9	16000	24000	0.0284	18.000	17.992	22.007	22.020	0.009
	0.7087	0.8661	0.669		2990	4470				0.7087	0.7083	0.8664	0.8669	
	18	22	20.0	K18X22X20F	15.0	23.4	16000	24000	0.0296	18.000	17.992	22.007	22.020	0.011
	0.7087	0.8661	0.787		3370	5260				0.7087	0.7083	0.8664	0.8669	
	18	24	12.0	K18X24X12	11.8	13.1	17000	25000	0.0243	18.000	17.992	24.007	24.020	0.011
	0.7087	0.9449	0.472		2650	2940				0.7087	0.7083	0.9452	0.9457	
	18	24	20.0	K18X24X20H	19.4	24.9	16000	25000	0.0285	18.000	17.992	24.007	24.020	0.019
	0.7087	0.9449	0.787		4360	5600				0.7087	0.7083	0.9452	0.9457	
	18	25	22.0	K18X25X22H	23.3	28.6	17000	26000	0.0291	18.000	17.992	25.007	25.020	0.025
	0.7087	0.9843	0.866		5240	6430				0.7087	0.7083	0.9845	0.9850	
	18	26	12.0	K18X26X12FV	13.8	13.5	11000	17000	0.0238	18.000	17.992	26.007	26.020	0.020
	0.7087	1.0236	0.472		3100	3030				0.7087	0.7083	1.0239	1.0244	
	18	26	20.0	K18X26X20FZB2	21.7	24.1	17000	26000	0.0275	18.000	17.992	26.007	26.020	0.027
	0.7087	1.0236	0.787		4880	5420				0.7087	0.7083	1.0239	1.0244	
19	19	23	13.0	K19X23X13	10.8	15.5	15000	23000	0.0273	19.000	18.991	23.007	23.020	0.008
	0.7480	0.9055	0.512		2430	3480				0.7480	0.7477	0.9058	0.9063	
	19	23	17.0	K19X23X17	13.4	20.6	15000	23000	0.0293	19.000	18.991	23.007	23.020	0.011
	0.7480	0.9055	0.669		3010	4630				0.7480	0.7477	0.9058	0.9063	
20	20	24	8.0	K20X24X8F	7.31	9.60	14000	22000	0.0248	20.000	19.991	24.007	24.020	0.005
	0.7874	0.9449	0.315		1640	2160				0.7874	0.7870	0.9452	0.9457	
	20	24	10.0	K20X24X10	8.97	12.5	14000	22000	0.0265	20.000	19.991	24.007	24.020	0.006
	0.7874	0.9449	0.394		2020	2810				0.7874	0.7870	0.9452	0.9457	
	20	24	10.0	K20X24X10H	8.97	12.5	14000	22000	0.0265	20.000	19.991	24.007	24.020	0.006
	0.7874	0.9449	0.394		2020	2810				0.7874	0.7870	0.9452	0.9457	
	20	24	12.0	K20X24X12	10.7	15.7	14000	22000	0.0280	20.000	19.991	24.007	24.020	0.008
	0.7874	0.9449	0.472		2410	3530				0.7874	0.7870	0.9452	0.9457	
	20	24	13.0	K20X24X13	11.5	17.3	14000	22000	0.0287	20.000	19.991	24.007	24.020	0.008
	0.7874	0.9449	0.512		2590	3890				0.7874	0.7870	0.9452	0.9457	
	20	24	13.0	K20X24X13H	11.5	17.3	14000	22000	0.0287	20.000	19.991	24.007	24.020	0.009
	0.7874	0.9449	0.512		2590	3890				0.7874	0.7870	0.9452	0.9457	
	20	24	14.0	K20X24X14	12.4	18.9	14000	22000	0.0293	20.000	19.991	24.007	24.020	0.009
	0.7874	0.9449	0.551		2790	4250				0.7874	0.7870	0.9452	0.9457	
	20	24	17.0	K20X24X17H	14.8	23.7	14000	22000	0.0310	20.000	19.991	24.007	24.020	0.011
	0.7874	0.9449	0.669		3330	5330				0.7874	0.7870	0.9452	0.9457	
	20	26	12.0	K20X26X12	13.0	15.3	15000	23000	0.0264	20.000	19.991	26.007	26.020	0.012
	0.7874	1.0236	0.472		2920	3440				0.7874	0.7870	1.0239	1.0244	

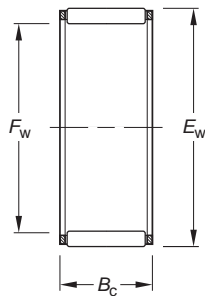
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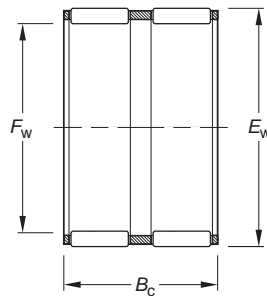
# NEEDLE ROLLER BEARINGS

## SINGLE-ROW, DOUBLE-ROW ASSEMBLIES — *continued*

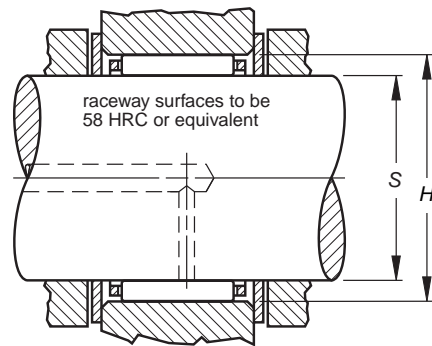
### METRIC SERIES



K



K.ZW



Shaft Dia.	Dimensions mm/in.			Assembly Designation	Load Ratings		Limiting Speed		Mounting Dimensions mm/in.	Wt. kg/lbs.				
	-0.2 -0.08 -0.55 -0.22				kN/lbf.		Grease Oil							
mm	Fw	Ew	Bc	C	Co	RPM	Cg	S	H					
	20	26	13.0	K20X26X13H	13.4	15.9	15000	23000	0.0267	20.000	19.991	26.007	26.020	0.014
	0.7874	1.0236	0.512		3010	3570								
	20	26	17.0	K20X26X17H	19.3	25.5	15000	23000	0.0300	20.000	19.991	26.007	26.020	0.017
	0.7874	1.0236	0.669		4340	5730								
	20	26	20.0	K20X26X20	20.3	27.2	15000	23000	0.0305	20.000	19.991	26.007	26.020	0.020
	0.7874	1.0236	0.787		4560	6110								
	20	28	20.0	K20X28X20H	24.6	29.0	15000	23000	0.0300	20.000	19.991	28.007	28.020	0.028
	0.7874	1.1024	0.787		5530	6520								
	20	28	25.0	K20X28X25H	29.7	37.0	15000	23000	0.0319	20.000	19.991	28.007	28.020	0.036
	0.7874	1.1024	0.984		6680	8320								
	20	30	30.0	K20X30X30H	38.9	45.8	16000	24000	0.0329	20.000	19.991	30.007	30.020	0.055
	0.7874	1.1811	1.181		8750	10300								
	20	32	36.0	K20X32X36H	49.9	57.0	16000	25000	0.0344	20.000	19.991	32.009	32.025	0.082
	0.7874	1.2598	1.417		11220	12810								
21	21	25	17.0	K21X25X17F	14.3	23.1	14000	21000	0.0315	21.000	20.991	25.007	25.020	0.012
	0.8268	0.9843	0.669		3210	5190								
	21	25	17.0	K21X25X17H	14.3	23.1	14000	21000	0.0315	21.000	20.991	25.007	25.020	0.013
	0.8268	0.9843	0.669		3210	5190								
22	22	26	10.0	K22X26X10H	9.81	14.5	13000	20000	0.0291	22.000	21.991	26.007	26.020	0.007
	0.8661	1.0236	0.394		2210	3260								
	22	26	13.0	K22X26X13H	11.8	18.3	13000	20000	0.0303	22.000	21.991	26.007	26.020	0.012
	0.8661	1.0236	0.512		2650	4110								
	22	26	17.0	K22X26X17	15.6	26.3	13000	20000	0.0332	22.000	21.991	26.007	26.020	0.015
	0.8661	1.0236	0.669		3510	5910								
	22	26	17.0	K22X26X17H	15.6	26.3	13000	20000	0.0332	22.000	21.991	26.007	26.020	0.012
	0.8661	1.0236	0.669		3510	5910								
	22	26	18.0	K22X26X18H	15.3	25.5	13000	20000	0.0329	22.000	21.991	26.007	26.020	0.017
	0.8661	1.0236	0.709		3440	5730								
	22	28	13.0	K22X28X13	13.9	17.1	13000	20000	0.0283	22.000	21.991	28.007	28.020	0.015
	0.8661	1.1024	0.512		3120	3840								
	22	28	17.0	K22X28X17H	18.2	24.2	13000	20000	0.0308	22.000	21.991	28.007	28.020	0.020
	0.8661	1.1024	0.669		4090	5440								
	22	30	15.0	K22X30X15H	19.7	22.3	14000	21000	0.0292	22.000	21.991	30.007	30.020	0.023
	0.8661	1.1811	0.591		4430	5010								
	22	30	20.0	K22X30X20FV	24.4	29.4	14000	21000	0.0313	22.000	21.991	30.007	30.020	0.031
	0.8661	1.1811	0.787		5490	6610								
	22	32	24.0	K22X32X24F	33.1	37.9	14000	22000	0.0326	22.000	21.991	32.009	32.025	0.046
	0.8661	1.2598	0.945		7440	8520								
	22	32	30.0	K22X32X30H	41.8	51.3	14000	22000	0.0351	22.000	21.991	32.009	32.025	0.057
	0.8661	1.2598	1.181		9400	11530								
23	23	28	24.0	K23X28X24F	22.4	36.2	12000	19000	0.0355	23.000	22.991	28.007	28.020	0.023
	0.9055	1.1024	0.945		5040	8140								
	23	35	16.0	K23X35X16H.ZB2	25.9	25.1	14000	21000	0.0294	23.000	22.991	35.009	35.025	0.040
	0.9055	1.3780	0.630		5820	5640								
	23	35	16.2	K23X35X16.2H	29.1	29.3	14000	21000	0.0306	23.000	22.991	35.009	35.025	0.040
	0.9055	1.3780	0.638		6540	6590								



Shaft Dia.	Dimensions mm/in. -0.2 - .008 -0.55 - .022			Assembly Designation	Load Ratings kN/lbf.		Limiting Speed		C <sub>g</sub>	Mounting Dimensions mm/in.				Wt. kg/lbs.		
	mm	F <sub>w</sub>	E <sub>w</sub>		B <sub>c</sub>	C	C <sub>0</sub>	Grease RPM		Oil RPM	S	Min.			Max.	
												H	H		H	H
24	24	28	10.0	K24X28X10H	9.67 2170	14.6 3280	12000	18000	0.0298	24.000 0.9449	23.991 0.9445	28.007 1.1026	28.020 1.1031	0.027 0.060		
	24	28	13.0	K24X28X13H	12.5 2810	20.2 4540	12000	18000	0.0323	24.000 0.9449	23.991 0.9445	28.007 1.1026	28.020 1.1031	0.010 0.022		
	24	28	16.0	K24X28X16F						24.000 0.9449	23.991 0.9445	28.007 1.1026	28.020 1.1031			
	24	28	17.0	K24X28X17H	15.4 3460	26.4 5930	12000	18000	0.0345	24.000 0.9449	23.991 0.9445	28.007 1.1026	28.020 1.1031	0.013 0.029		
	24	30	10.0	K24X30X10TN	11.3 2540	13.5 3030	12000	19000	—	24.000 0.9449	23.991 0.9445	30.007 1.1814	30.020 1.1819	0.008 0.018		
	24	30	17.0	K24X30X17H	19.8 4450	27.7 6230	12000	19000	0.0331	24.000 0.9449	23.991 0.9445	30.007 1.1814	30.020 1.1819	0.020 0.044		
	24	30	22.0	K24X30X22	25.0 5620	37.3 8390	12000	19000	0.0356	24.000 0.9449	23.991 0.9445	30.007 1.1814	30.020 1.1819	0.024 0.053		
	24	36	23.0	K24X36X23H	37.1 8340	40.1 9010	13000	20000	0.0336	24.000 0.9449	23.991 0.9445	36.009 1.4177	36.025 1.4183	0.070 0.154		
	25	25	29	10.0	K25X29X10H	9.61 2160	14.6 3280	11000	17000	0.0303	25.000 0.9843	24.991 0.9839	29.007 1.1420	29.020 1.1425	0.008 0.018	
		25	29	13.0	K25X29X13H	12.8 2880	21.1 4740	11000	17000	0.0332	25.000 0.9843	24.991 0.9839	29.007 1.1420	29.020 1.1425	0.010 0.022	
25		29	17.0	K25X29X17H	15.1 3390	26.2 5890	11000	17000	0.0351	25.000 0.9843	24.991 0.9839	29.007 1.1420	29.020 1.1425	0.016 0.035		
25		30	13.0	K25X30X13	14.6 3280	21.4 4810	11000	17000	0.0323	25.000 0.9843	24.991 0.9839	30.007 1.1814	30.020 1.1819	0.012 0.026		
25		30	17.0	K25X30X17H	18.8 4230	29.8 6700	11000	17000	0.0351	25.000 0.9843	24.991 0.9839	30.007 1.1814	30.020 1.1819	0.016 0.035		
25		30	18.0	K25X30X18	20.6 4630	33.4 7510	11000	17000	0.0361	25.000 0.9843	24.991 0.9839	30.007 1.1814	30.020 1.1819	0.017 0.037		
25		30	20.0	K25X30X20H	21.9 4920	36.1 8120	11000	17000	0.0368	25.000 0.9843	24.991 0.9839	30.007 1.1814	30.020 1.1819	0.019 0.042		
25		30	24.0	K25X30X24H	24.8 5580	42.4 9530	11000	17000	0.0383	25.000 0.9843	24.991 0.9839	30.007 1.1814	30.020 1.1819	0.024 0.053		
25		30	26.0	K25X30X26ZW	23.0 5170	38.6 8680	11000	17000	0.0374	25.000 0.9843	24.991 0.9839	30.007 1.1814	30.020 1.1819	0.027 0.060		
25		31	14.0	K25X31X14H	16.8 3780	22.7 5100	12000	18000	0.0320	25.000 0.9843	24.991 0.9839	31.009 1.2208	31.025 1.2215	0.017 0.037		
25		31	17.0	K25X31X17H	19.7 4430	27.8 6250	12000	18000	0.0337	25.000 0.9843	24.991 0.9839	31.009 1.2208	31.025 1.2215	0.020 0.044		
25		31	21.0	K25X31X21	25.1 5640	38.0 8540	12000	18000	0.0364	25.000 0.9843	24.991 0.9839	31.009 1.2208	31.025 1.2215	0.026 0.057		
25		31	21.0	K25X31X21F	25.1 5640	38.0 8540	12000	18000	0.0364	25.000 0.9843	24.991 0.9839	31.009 1.2208	31.025 1.2215	0.026 0.057		
25		31	21.0	K25X31X21H	25.1 5640	38.0 8540	12000	18000	0.0364	25.000 0.9843	24.991 0.9839	31.009 1.2208	31.025 1.2215	0.026 0.057		
25		31	24.0	K25X31X24F	25.3 5690	38.5 8660	12000	18000	0.0365	25.000 0.9843	24.991 0.9839	31.009 1.2208	31.025 1.2215	0.031 0.068		
25		31	24.0	K25X31X24FH	25.3 5690	38.5 8660	12000	18000	0.0365	25.000 0.9843	24.991 0.9839	31.009 1.2208	31.025 1.2215	0.031 0.068		
25		32	16.0	K25X32X16	19.8 4450	25.3 5690	12000	18000	0.0323	25.000 0.9843	24.991 0.9839	32.009 1.2602	32.025 1.2608	0.027 0.060		
25		33	20.0	K25X33X20FH.ZB2	25.6 5760	32.3 7260	12000	18000	0.0337	25.000 0.9843	24.991 0.9839	33.009 1.2996	33.025 1.3002	0.035 0.077		
25	33	20.0	K25X33X20H	28.8 6470	37.6 8450	12000	18000	0.0350	25.000 0.9843	24.991 0.9839	33.009 1.2996	33.025 1.3002	0.035 0.077			
25	33	24.0	K25X33X24H	32.3 7260	43.5 9780	12000	18000	0.0363	25.000 0.9843	24.991 0.9839	33.009 1.2996	33.025 1.3002	0.038 0.084			
25	33	25.0	K25X33X25H	33.0 7420	44.6 10030	12000	18000	0.0365	25.000 0.9843	24.991 0.9839	33.009 1.2996	33.025 1.3002	0.041 0.090			

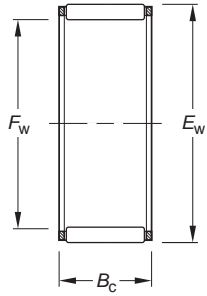
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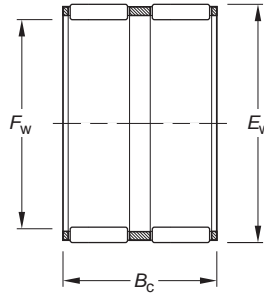
# NEEDLE ROLLER BEARINGS

## SINGLE-ROW, DOUBLE-ROW ASSEMBLIES — continued

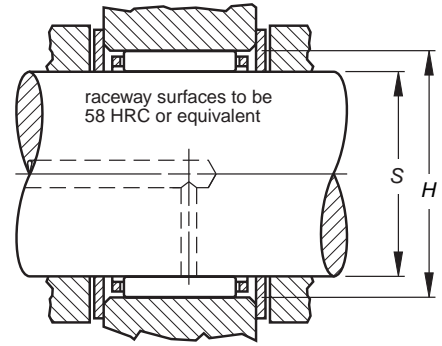
### METRIC SERIES



K



K.ZW



Shaft Dia.	Dimensions mm/in.			Assembly Designation	Load Ratings		Limiting Speed			Mounting Dimensions mm/in.				Wt. kg/lbs.
	-0.2 -0.08 -0.55 -0.22				C	Co	Grease	Oil	Co	Max.	Min.	Min.	Max.	
mm	Fw	Ew	Bc				RPM		S	H				
25	25	35	23.7	K25X35X23,7H	35.9	42.3	12000	19000	0.0354	25.000	24.991	35.009	35.025	0.050
	0.9843	1.3780	0.933		8070	9510								
25	25	35	25.0	K25X35X25H	37.8	46.2	12000	19000	0.0360	25.000	24.991	35.009	35.025	0.054
	0.9843	1.3780	0.984		8500	10390								
25	25	35	30.0	K25X35X30H	44.6	57.2	12000	19000	0.0379	25.000	24.991	35.009	35.025	0.060
	0.9843	1.3780	1.181		10030	12860								
25	25	35	30.0	K25X35X30H.ZB2	44.6	57.2	12000	19000	0.0379	25.000	24.991	35.009	35.025	0.060
	0.9843	1.3780	1.181		10030	12860								
25	25	35	36.0	K25X35X36H	52.4	70.4	12000	19000	0.0399	25.000	24.991	35.009	35.025	0.074
	0.9843	1.3780	1.417		11780	15830								
25	25	37	20.0	K25X37X20H	32.5	34.1	12000	19000	0.0328	25.000	24.991	37.009	37.025	0.055
	0.9843	1.4567	0.787		7310	7670								
26	26	30	10.0	K26X30X10F	9.46	14.5	11000	16000	0.0308	26.000	25.991	30.007	30.020	0.007
	1.0236	1.1811	0.394		2130	3260								
26	26	30	13.0	K26X30X13	12.3	20.4	10000	16000	0.0335	26.000	25.991	30.007	30.020	0.011
	1.0236	1.1811	0.512		2770	4590								
26	26	30	17.0	K26X30X17	15.0	26.3	10000	16000	0.0357	26.000	25.991	30.007	30.020	0.014
	1.0236	1.1811	0.669		3370	5910								
26	26	30	22.0	K26X30X22ZW	16.7	30.2	10000	16000	0.0370	26.000	25.991	30.007	30.020	0.018
	1.0236	1.1811	0.866		3750	6790								
28	28	32	21.0	K28X32X21F	18.7	35.7	9900	15000	0.0398	28.000	27.991	32.009	32.025	0.018
	1.1024	1.2598	0.827		4200	8030								
28	28	33	13.0	K28X33X13F	14.1	21.4	10000	15000	0.0339	28.000	27.991	33.009	33.025	0.015
	1.1024	1.2992	0.512		3170	4810								
28	28	33	13.0	K28X33X13FV	14.1	21.4	10000	15000	0.0339	28.000	27.991	33.009	33.025	0.015
	1.1024	1.2992	0.512		3170	4810								
28	28	33	17.0	K28X33X17H	19.8	33.0	10000	15000	0.0378	28.000	27.991	33.009	33.025	0.018
	1.1024	1.2992	0.669		4450	7420								
28	28	33	27.0	K28X33X27	29.0	53.8	10000	15000	0.0427	28.000	27.991	33.009	33.025	0.027
	1.1024	1.2992	1.063		6520	12090								
28	28	34	17.0	K28X34X17	21.1	31.5	10000	16000	0.0364	28.000	27.991	34.009	34.025	0.022
	1.1024	1.3386	0.669		4740	7080								
28	28	34	20.0	K28X34X20H	24.4	37.8	10000	16000	0.0381	28.000	27.991	34.009	34.025	0.025
	1.1024	1.3386	0.787		5490	8500								
28	28	35	15.0	K28X35X15H	19.5	25.6	10000	16000	0.0339	28.000	27.991	35.009	35.025	0.025
	1.1024	1.3780	0.591		4380	5760								
28	28	35	16.0	K28X35X16FH	21.5	29.1	10000	16000	0.0350	28.000	27.991	35.009	35.025	0.026
	1.1024	1.3780	0.630		4830	6540								
28	28	35	16.0	K28X35X16H	21.5	29.1	10000	16000	0.0350	28.000	27.991	35.009	35.025	0.026
	1.1024	1.3780	0.630		4830	6540								
28	28	35	27.0	K28X35X27H	35.2	54.7	10000	16000	0.0409	28.000	27.991	35.009	35.025	0.042
	1.1024	1.3780	1.063		7910	12300								
28	28	36	20.0	K28X36X20FV	27.8	37.0	10000	16000	0.0365	28.000	27.991	36.009	36.025	0.039
	1.1024	1.4173	0.787		6250	8320								
28	28	38	25.5	K28X38X25,5	40.9	52.7	11000	16000	0.0389	28.000	27.991	38.009	38.025	0.059
	1.1024	1.4961	1.004		9190	11850								

Shaft Dia.	Dimensions mm/in.			Assembly Designation	Load Ratings		Limiting Speed			Mounting Dimensions mm/in.				Wt. kg/lbs.
	-0.2 - .008 -0.55 - .022				kN/lbf.		Grease	Oil	C <sub>g</sub>	Max.	Min.	Min.	Max.	
	mm	F <sub>w</sub>	E <sub>w</sub>		B <sub>c</sub>	C	C <sub>0</sub>	RPM		S		H		
28	28	40	18.0	K28X40X18H	33.6	36.5	11000	17000	0.0349	28.000	27.991	40.009	40.025	0.060
	1.1024	1.5748	0.709		7550	8210				1.1024	1.1020	1.5752	1.5758	
28	28	40	25.0	K28X40X25H	45.5	54.0	11000	17000	0.0384	28.000	27.991	40.009	40.025	0.072
	1.1024	1.5748	0.984		10230	12140				1.1024	1.1020	1.5752	1.5758	
28	28	40	30.0	K28X40X30H	54.3	67.8	11000	17000	0.0406	28.000	27.991	40.009	40.025	0.100
	1.1024	1.5748	1.181		12210	15240				1.1024	1.1020	1.5752	1.5758	
28	28	41	25.0	K28X41X25H	49.2	57.1	11000	17000	0.0386	28.000	27.991	41.009	41.025	0.082
	1.1024	1.6142	0.984		11060	12840				1.1024	1.1020	1.6145	1.6152	
29	29	34	27.0	K29X34X27F	28.9	54.0	9700	15000	0.0434	29.000	28.991	34.009	34.025	0.033
30	30	34	13.0	K30X34X13	13.5	24.1	9200	14000	0.0372	30.000	29.991	34.009	34.025	0.011
	1.1811	1.3386	0.512		3030	5420				1.1811	1.1807	1.3389	1.3396	
30	30	35	13.0	K30X35X13H	15.6	24.9	9300	14000	0.0363	30.000	29.991	35.009	35.025	0.017
	1.1811	1.3780	0.512		3510	5600				1.1811	1.1807	1.3783	1.3789	
30	30	35	17.0	K30X35X17H	20.2	34.6	9300	14000	0.0394	30.000	29.991	35.009	35.025	0.022
	1.1811	1.3780	0.669		4540	7780				1.1811	1.1807	1.3783	1.3789	
30	30	35	20.0	K30X35X20H	23.5	41.9	9300	14000	0.0413	30.000	29.991	35.009	35.025	0.023
	1.1811	1.3780	0.787		5280	9420				1.1811	1.1807	1.3783	1.3789	
30	30	35	22.8	K30X35X23F	25.6	46.8	9300	14000	0.0425	30.000	29.991	35.009	35.025	0.028
	1.1811	1.3780	0.898		5760	10520				1.1811	1.1807	1.3783	1.3789	
30	30	35	27.0	K30X35X27H	30.6	59.0	9300	14000	0.0450	30.000	29.991	35.009	35.025	0.032
	1.1811	1.3780	1.063		6880	13260				1.1811	1.1807	1.3783	1.3789	
30	30	35	27.0	K30X35X27HZW	19.9	33.6	9300	14000	0.0391	30.000	29.991	35.009	35.025	0.033
	1.1811	1.3780	1.063		4470	7550				1.1811	1.1807	1.3783	1.3789	
30	30	36	14.0	K30X36X14	18.0	26.2	9500	15000	0.0358	30.000	29.991	36.009	36.025	0.020
	1.1811	1.4173	0.551		4050	5890				1.1811	1.1807	1.4177	1.4183	
30	30	37	17.8	K30X37X18	24.3	34.8	9600	15000	0.0377	30.000	29.991	37.009	37.025	0.033
	1.1811	1.4567	0.701		5460	7820				1.1811	1.1807	1.4570	1.4577	
30	30	37	18.0	K30X37X18FV	24.3	34.8	9600	15000	0.0377	30.000	29.991	37.009	37.025	0.033
	1.1811	1.4567	0.709		5460	7820				1.1811	1.1807	1.4570	1.4577	
30	30	40	30.0	K30X40X30H	49.2	67.8	9900	15000	0.0426	30.000	29.991	40.009	40.025	0.077
	1.1811	1.5748	1.181		11060	15240				1.1811	1.1807	1.5752	1.5758	
30	30	42	30.0	K30X42X30H	54.2	68.6	10000	16000	0.0419	30.000	29.991	42.009	42.025	0.096
	1.1811	1.6535	1.181		12180	15420				1.1811	1.1807	1.6539	1.6545	
30	30	44	26.0	K30X44X26H	52.4	59.9	10000	16000	0.0399	30.000	29.991	44.009	44.025	0.095
	1.1811	1.7323	1.024		11780	13470				1.1811	1.1807	1.7326	1.7333	
31	31	37	24.0	K30,6X36,6X24FV	27.8	46.2	9300	14000	0.0416	30.600	30.591	36.609	36.625	0.038
32	32	36	15.0	K32X36X15F	11.6	20.2	8600	13000	0.0367	32.000	31.989	36.009	36.025	0.015
	1.2598	1.4173	0.591		2610	4540				1.2598	1.2594	1.4177	1.4183	
32	32	37	13.0	K32X37X13	15.2	24.4	8700	13000	0.0372	32.000	31.989	37.009	37.025	0.018
	1.2598	1.4567	0.512		3420	5490				1.2598	1.2594	1.4570	1.4577	
32	32	37	17.0	K32X37X17H	20.0	34.8	8700	13000	0.0406	32.000	31.989	37.009	37.025	0.020
	1.2598	1.4567	0.669		4500	7820				1.2598	1.2594	1.4570	1.4577	
32	32	37	27.0	K32X37X27	29.3	56.8	8700	13000	0.0459	32.000	31.989	37.009	37.025	0.035
	1.2598	1.4567	1.063		6590	12770				1.2598	1.2594	1.4570	1.4577	
32	32	38	20.0	K32X38X20H	27.3	45.7	8800	14000	0.0423	32.000	31.989	38.009	38.025	0.030
	1.2598	1.4961	0.787		6140	10270				1.2598	1.2594	1.4964	1.4970	
32	32	38	26.0	K32X38X26H	33.2	58.8	8800	14000	0.0451	32.000	31.989	38.009	38.025	0.037
	1.2598	1.4961	1.024		7460	13220				1.2598	1.2594	1.4964	1.4970	
32	32	39	16.0	K32X39X16H	23.0	33.0	8900	14000	0.0382	32.000	31.989	39.009	39.025	0.030
	1.2598	1.5354	0.630		5170	7420				1.2598	1.2594	1.5358	1.5364	
32	32	39	18.0	K32X39X18H	25.8	38.2	8900	14000	0.0397	32.000	31.989	39.009	39.025	0.033
	1.2598	1.5354	0.709		5800	8590				1.2598	1.2594	1.5358	1.5364	
32	32	40	25.0	K32X40X25H	37.9	57.2	9000	14000	0.0431	32.000	31.989	40.009	40.025	0.052
	1.2598	1.5748	0.984		8520	12860				1.2598	1.2594	1.5752	1.5758	
32	32	40	36.0	K32X40X36H	52.3	86.4	9000	14000	0.0477	32.000	31.989	40.009	40.025	0.080
	1.2598	1.5748	1.417		11760	19420				1.2598	1.2594	1.5752	1.5758	

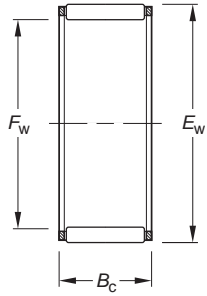
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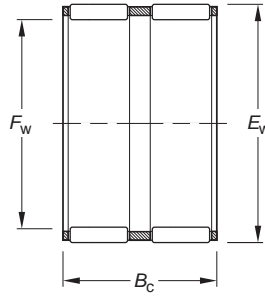
# NEEDLE ROLLER BEARINGS

## SINGLE-ROW, DOUBLE-ROW ASSEMBLIES — *continued*

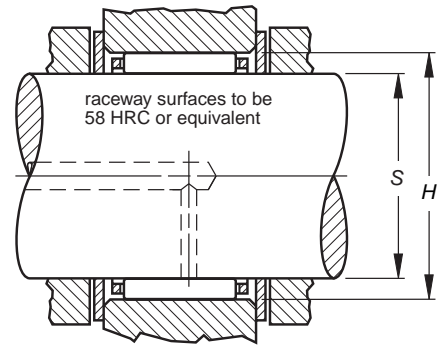
### METRIC SERIES



K



K.ZW



Shaft Dia.	Dimensions mm/in.			Assembly Designation	Load Ratings		Limiting Speed		C <sub>9</sub>	Mounting Dimensions mm/in.				Wt. kg/lbs.
	-0.2 -0.008 -0.55 -0.022				C	C <sub>0</sub>	Grease	Oil		Max.	Min.	Min.	Max.	
mm	F <sub>w</sub>	E <sub>w</sub>	B <sub>c</sub>				RPM			S		H		
32	32	42	42.0	K32X42X42H	69.2	108	9200	14000	0.0491	32.000	31.989	42.009	42.025	0.110
	1.2598	1.6535	1.654		15560	24280				1.2598	1.2594	1.6539	1.6545	
32	32	46	18.0	K32X46X18H	39.2	41.9	9600	15000	0.0374	32.000	31.989	46.009	46.025	0.075
	1.2598	1.8110	0.709		8810	9420				1.2598	1.2594	1.8114	1.8120	
32	32	46	32.0	K32X46X32H	67.0	83.4	9600	15000	0.0444	32.000	31.989	46.009	46.025	0.140
	1.2598	1.8110	1.260		15060	18750				1.2598	1.2594	1.8114	1.8120	
32	32	46	40.0	K32X46X40H	81.7	108	9600	15000	0.0473	32.000	31.989	46.009	46.025	0.158
	1.2598	1.8110	1.575		18370	24280				1.2598	1.2594	1.8114	1.8120	
33	33	51	23.0	K33X51X23H.ZB2	55.9	57.6	9600	15000	0.0401	33.000	32.989	51.010	51.029	0.140
	1.2992	2.0079	0.906		12570	12950				1.2992	1.2988	2.0083	2.0090	0.309
34	34	38	11.0	K34X38X11	12.2	21.9	8100	12000	0.0385	34.000	33.989	38.009	38.025	0.011
	1.3386	1.4961	0.433		2740	4920				1.3386	1.3381	1.4964	1.4970	
34	34	44	26.0	K34X44X26FH	42.9	58.9	8600	13000	0.0433	34.000	33.989	44.009	44.025	0.080
	1.3386	1.7323	1.024		9640	13240				1.3386	1.3381	1.7326	1.7333	
34	34	44	26.0	K34X44X26FV	42.9	58.9	8600	13000	0.0433	34.000	33.989	44.009	44.025	0.075
	1.3386	1.7323	1.024		9640	13240				1.3386	1.3381	1.7326	1.7333	
35	35	40	13.0	K35X40X13H	16.2	27.2	7900	12000	0.0398	35.000	34.989	40.009	40.025	0.018
	1.3780	1.5748	0.512		3640	6110				1.3780	1.3775	1.5752	1.5758	
35	35	40	17.0	K35X40X17H	22.1	40.8	7900	12000	0.0440	35.000	34.989	40.009	40.025	0.025
	1.3780	1.5748	0.669		4970	9170				1.3780	1.3775	1.5752	1.5758	
35	35	40	19.0	K35X40X19F.ZB2	23.2	43.2	7900	12000	0.0446	35.000	34.989	40.009	40.025	0.025
	1.3780	1.5748	0.748		5220	9710				1.3780	1.3775	1.5752	1.5758	
35	35	40	19.0	K35X40X19H.ZB2	23.2	43.2	7900	12000	0.0446	35.000	34.989	40.009	40.025	0.025
	1.3780	1.5748	0.748		5220	9710				1.3780	1.3775	1.5752	1.5758	
35	35	40	25.0	K35X40X25H	28.4	56.2	7900	12000	0.0476	35.000	34.989	40.009	40.025	0.035
	1.3780	1.5748	0.984		6380	12630				1.3780	1.3775	1.5752	1.5758	
35	35	40	27.0	K35X40X27H	29.8	59.6	7900	12000	0.0483	35.000	34.989	40.009	40.025	0.037
	1.3780	1.5748	1.063		6700	13400				1.3780	1.3775	1.5752	1.5758	
35	35	42	16.0	K35X42X16	24.5	36.8	8100	12000	0.0408	35.000	34.989	42.009	42.025	0.032
	1.3780	1.6535	0.630		5510	8270				1.3780	1.3775	1.6539	1.6545	
35	35	42	16.0	K35X42X16AH	24.5	36.8	8100	12000	0.0408	35.000	34.989	42.009	42.025	0.031
	1.3780	1.6535	0.630		5510	8270				1.3780	1.3775	1.6539	1.6545	
35	35	42	18.0	K35X42X18	27.5	42.6	8100	12000	0.0423	35.000	34.989	42.009	42.025	0.035
	1.3780	1.6535	0.709		6180	9580				1.3780	1.3775	1.6539	1.6545	
35	35	42	20.0	K35X42X20H	30.4	48.5	8100	12000	0.0437	35.000	34.989	42.009	42.025	0.037
	1.3780	1.6535	0.787		6830	10900				1.3780	1.3775	1.6539	1.6545	
35	35	42	30.0	K35X42X30FH	40.5	70.0	8100	12000	0.0479	35.000	34.989	42.009	42.025	0.061
	1.3780	1.6535	1.181		9100	15740				1.3780	1.3775	1.6539	1.6545	
35	35	45	20.0	K35X45X20FH	36.5	49.9	8400	13000	0.0421	35.000	34.989	45.009	45.025	0.059
	1.3780	1.7717	0.787		8210	11220				1.3780	1.3775	1.7720	1.7726	
35	35	45	30.0	K35X45X30F	51.2	74.5	8400	13000	0.0465	35.000	34.989	45.009	45.025	0.100
	1.3780	1.7717	1.181		11510	16750				1.3780	1.3775	1.7720	1.7726	
35	35	45	35.0	K35X45X35H	62.1	95.5	8400	13000	0.0494	35.000	34.989	45.009	45.025	0.085
	1.3780	1.7717	1.378		13960	21470				1.3780	1.3775	1.7720	1.7726	
35	35	45	41.0	K35X45X41	70.8	113	8400	13000	0.0515	35.000	34.989	45.009	45.025	0.120
	1.3780	1.7717	1.614		15920	25400				1.3780	1.3775	1.7720	1.7726	

Shaft Dia.	Dimensions mm/in.			Assembly Designation	Load Ratings		Limiting Speed			Mounting Dimensions mm/in.				Wt. kg/lbs.	
	-0.2 - .008 -0.55 - .022				kN/lbf.		Grease	Oil	C <sub>g</sub>	Max.	Min.	Min.	Max.		
	mm	F <sub>w</sub>	E <sub>w</sub>		B <sub>c</sub>	C	C <sub>0</sub>	RPM		S	H				
	35	45	49.0	K35X45X49H	82.5	138	8400	13000	0.0541	35.000	34.989	45.009	45.025	0.143	
	1.3780	1.7717	1.929		18550	31020				1.3780	1.3775	1.7720	1.7726		0.315
	35	45	49.0	K35X45X49HZW	71.8	115	8400	13000	0.0518	35.000	34.989	45.009	45.025	0.143	
	1.3780	1.7717	1.929		16140	25850				1.3780	1.3775	1.7720	1.7726		0.315
	35	48	22.8	K35X48X22.8H.ZB2	47.6	57.4	8600	13000	0.0423	35.000	34.989	48.009	48.025	0.100	
	1.3780	1.8898	0.898		10700	12900				1.3780	1.3775	1.8901	1.8907		0.220
	35	50	40.0	K35X50X40F	79.7	102	8700	13000	0.0480	35.000	34.989	50.009	50.025	0.200	
	1.3780	1.9685	1.575		17920	22930				1.3780	1.3775	1.9689	1.9695		0.441
36	36	40	29.0	K36X40X29TN	21.2	45.2	7600	12000	—	36.000	35.989	40.009	40.025	0.029	
	1.4173	1.5748	1.142		4770	10160				1.4173	1.4169	1.5752	1.5758		0.064
	36	42	16.0		K36X42X16	22.8				37.7	7800	12000	0.0425		36.000
1.4173	1.6535	0.630	5130	8480		1.4173	1.4169	1.6539	1.6545	0.060					
36	36	44	27.5	K36X44X27.5H	42.8	69.2	7900	12000	0.0475	36.000	35.989	44.009	44.025	0.064	
	1.4173	1.7323	1.083		9620	15560				1.4173	1.4169	1.7326	1.7333		0.14
	37	42	13.0		K37X42X13H	16.9				29.4	7500	11000	0.0416		37.000
1.4567	1.6535	0.512	3800	6610		1.4567	1.4563	1.6539	1.6545	0.037					
37	42	17.0	K37X42X17H	21.9		41.0	7500	11000	0.0451	37.000				36.989	42.009
1.4567	1.6535	0.669		4920	9220	1.4567				1.4563	1.6539	1.6545	0.055		
37	37	42	27.0	K37X42X27F	32.1	66.9	7500	11000	0.0510	37.000	36.989	42.009	42.025	0.039	
	1.4567	1.6535	1.063		7220	15040				1.4567	1.4563	1.6539	1.6545		0.086
	37	44	19.0		K37X44X19H	29.7				48.0	7600	12000	0.0447		37.000
1.4567	1.7323	0.748	6680	10790		1.4567	1.4563	1.7326	1.7333	0.086					
38	38	41	9.0	K38X41X9TN	5.93	11.0	7100	11000	—	38.000	37.989	41.009	41.025	0.004	
	1.4961	1.6142	0.354		1330	2470				1.4961	1.4956	1.6145	1.6152		0.009
	38	43	17.0		K38X43X17F	21.8				41.0	7300	11000	0.0457		38.000
1.4961	1.6929	0.669	4900	9220		1.4961	1.4956	1.6933	1.6939	0.071					
38	38	43	17.0	K38X43X17H	21.8	41.0	7300	11000	0.0457	38.000	37.989	43.009	43.025	0.032	
	1.4961	1.6929	0.669		4900	9220				1.4961	1.4956	1.6933	1.6939		0.071
	38	43	27.0		K38X43X27	31.9				67.0	7300	11000	0.0516		38.000
1.4961	1.6929	1.063	7170	15060		1.4961	1.4956	1.6933	1.6939	0.090					
38	38	46	19.8	K38X46X20	33.3	51.0	7500	12000	0.0450	38.000	37.989	46.009	46.025	0.055	
	1.4961	1.8110	0.780		7490	11470				1.4961	1.4956	1.8114	1.8120		0.121
	38	46	19.8		K38X46X20H	33.3				51.0	7500	12000	0.0450		38.000
1.4961	1.8110	0.780	7490	11470		1.4961	1.4956	1.8114	1.8120	0.121					
38	38	46	32.0	K38X46X32FV1	53.7	94.6	7500	12000	0.0525	38.000	37.989	46.009	46.025	0.080	
	1.4961	1.8110	1.260		12070	21270				1.4961	1.4956	1.8114	1.8120		0.176
	38	46	32.0		K38X46X32H	55.2				98.1	7500	12000	0.0530		38.000
1.4961	1.8110	1.260	12410	22050		1.4961	1.4956	1.8114	1.8120	0.198					
38	38	50	25.0	K38X50X25	53.0	70.8	7800	12000	0.0464	38.000	37.989	50.009	50.025	0.100	
	1.4961	1.9685	0.984		11910	15920				1.4961	1.4956	1.9689	1.9695		0.220
	38	50	33.0		K38X50X33H	68.3				98.2	7800	12000	0.0504		38.000
1.4961	1.9685	1.299	15350	22080		1.4961	1.4956	1.9689	1.9695	0.278					
38	38	50	40.0	K38X50X40FCH1	76.2	113	7800	12000	0.0521	38.000	37.989	50.009	50.025	0.170	
	1.4961	1.9685	1.575		17130	25400				1.4961	1.4956	1.9689	1.9695		0.375
	40	45	13.0		K40X45X13H	17.6				31.7	6900	11000	0.0438		40.000
1.5748	1.7717	0.512	3960	7130		1.5748	1.5744	1.7720	1.7726	0.049					
40	45	17.0	K40X45X17CH	19.2		35.3	6900	11000	0.0450	40.000				39.989	45.009
1.5748	1.7717	0.669		4320	7940	1.5748				1.5744	1.7720	1.7726	0.060		
40	40	45	17.0	K40X45X17H	23.8	47.0	6900	11000	0.0484	40.000	39.989	45.009	45.025	0.030	
	1.5748	1.7717	0.669		5350	10570				1.5748	1.5744	1.7720	1.7726		0.066
	40	45	18.0		K40X45X18H	25.1				50.4	6900	11000	0.0492		40.000
1.5748	1.7717	0.709	5640	11330		1.5748	1.5744	1.7720	1.7726	0.068					
40	40	45	21.0	K40X45X21CH	23.3	45.2	6900	11000	0.0479	40.000	39.989	45.009	45.025	0.033	
	1.5748	1.7717	0.827		5240	10160				1.5748	1.5744	1.7720	1.7726		0.073
	40	45	27.0		K40X45X27H	32.7				70.2	6900	11000	0.0534		40.000
1.5748	1.7717	1.063	7350	15780		1.5748	1.5744	1.7720	1.7726	0.088					
40	40	45	27.0	K40X45X27TN	33.3	72.1	6900	11000	0.0538	40.000	39.989	45.009	45.025	0.030	
	1.5748	1.7717	1.063		7490	16210				1.5748	1.5744	1.7720	1.7726		0.066

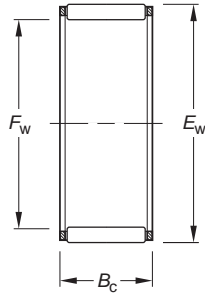
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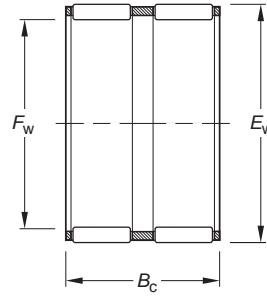
# NEEDLE ROLLER BEARINGS

## SINGLE-ROW, DOUBLE-ROW ASSEMBLIES — *continued*

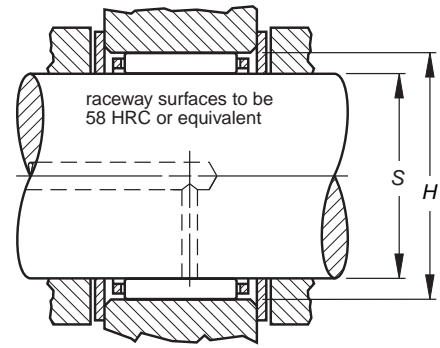
### METRIC SERIES



K



K.ZW



Shaft Dia.	Dimensions mm/in.			Assembly Designation	Load Ratings		Limiting Speed			Mounting Dimensions mm/in.				Wt. kg/lbs.
	-0.2 -0.08 -0.55 -0.22				kN/lbf.		Grease Oil		Max. Min. Min. Max.					
	mm	Fw	Ew		Bc	C	Co	RPM		Ca	S		H	
	40	45	29.0	K40X45X29H	34.7	75.9	6900	11000	0.0545	40.000	39.989	45.009	45.025	0.050
	1.5748	1.7717	1.142		7800	17060								
	40	46	17.0	K40X46X17	25.2	44.0	7000	11000	0.0464	40.000	39.989	46.009	46.025	0.033
	1.5748	1.8110	0.669		5670	9890								
	40	47	18.0	K40X47X18	28.0	45.6	7000	11000	0.0456	40.000	39.989	47.009	47.025	0.041
	1.5748	1.8504	0.709		6290	10250								
	40	47	20.0	K40X47X20	31.1	52.1	7000	11000	0.0472	40.000	39.989	47.009	47.025	0.042
	1.5748	1.8504	0.787		6990	11710								
	40	48	20.0	K40X48X20FV1	35.5	56.3	7100	11000	0.0472	40.000	39.989	48.009	48.025	0.052
	1.5748	1.8898	0.787		7980	12660								
	40	48	20.0	K40X48X20H	35.5	56.3	7100	11000	0.0472	40.000	39.989	48.009	48.025	0.050
	1.5748	1.8898	0.787		7980	12660								
	40	48	35.0	K40X48X35H.ZB2	57.3	104	7100	11000	0.0550	40.000	39.989	48.009	48.025	0.098
	1.5748	1.8898	1.378		12880	23380								
	40	50	27.0	K40X50X27H	53.0	81.0	7200	11000	0.0502	40.000	39.989	50.009	50.025	0.084
	1.5748	1.9685	1.063		11910	18210								
	40	55	45.0	K40X55X45H	103	146	7500	12000	0.0554	40.000	39.989	55.010	55.029	0.221
	1.5748	2.1654	1.772		23160	32820								
	40	56	26.0	K40X56X26H	63.7	75.7	7600	12000	0.0467	40.000	39.989	56.010	56.029	0.138
	1.5748	2.2047	1.024		14320	17020								
41	41	48	31.0	K41X48X31HZW	38.0	68.1	6800	11000	0.0510	41.000	40.989	48.009	48.025	0.067
	1.6142	1.8898	1.220		8540	15310				1.6142	1.6137	1.8901	1.8907	0.148
42	42	47	13.0	K42X47X13H	18.7	34.9	6500	10000	0.0459	42.000	41.989	47.009	47.025	0.027
	1.6535	1.8504	0.512		4200	7850								
	42	47	17.0	K42X47X17H	22.8	45.2	6500	10000	0.0490	42.000	41.989	47.009	47.025	0.028
	1.6535	1.8504	0.669		5130	10160								
	42	47	27.0	K42X47X27FH	33.8	74.7	6500	10000	0.0555	42.000	41.989	47.009	47.025	0.041
	1.6535	1.8504	1.063		7600	16790								
	42	47	27.0	K42X47X27H	33.8	74.7	6500	10000	0.0555	42.000	41.989	47.009	47.025	0.041
	1.6535	1.8504	1.063		7600	16790								
	42	48	24.0	K42X48X24F	33.1	63.9	6600	10000	0.0519	42.000	41.989	48.009	48.025	0.046
	1.6535	1.8898	0.945		7440	14370								
	42	50	13.0	K42X50X13H	20.9	28.9	6700	10000	0.0409	42.000	41.989	50.009	50.025	0.035
	1.6535	1.9685	0.512		4700	6500								
	42	50	20.0	K42X50X20H	35.2	56.6	6700	10000	0.0483	42.000	41.989	50.009	50.025	0.054
	1.6535	1.9685	0.787		7910	12720								
	42	50	30.0	K42X50X30H.ZB2	51.3	91.9	6700	10000	0.0545	42.000	41.989	50.009	50.025	0.080
	1.6535	1.9685	1.181		11530	20660								
	42	54	30.7	K42X54X30.7H	62.7	90.1	7000	11000	0.0514	42.000	41.989	54.010	54.029	0.140
	1.6535	2.1260	1.209		14100	20260								
43	43	48	17.0	K43X48X17FH	23.0	45.8	6400	9800	0.0496	43.000	42.989	48.009	48.025	0.036
	1.6929	1.8898	0.669		5170	10300								
	43	48	27.0	K43X48X27H	34.8	78.0	6400	9800	0.0567	43.000	42.989	48.009	48.025	0.050
	1.6929	1.8898	1.063		7820	17540								
44	44	50	22.0	K44X50X22	31.6	60.6	6400	9900	0.0523	44.000	43.989	50.009	50.025	0.046
	1.7323	1.9685	0.866		7100	13620				1.7323	1.7319	1.9689	1.9695	0.101

Shaft Dia.	Dimensions mm/in.			Assembly Designation	Load Ratings		Limiting Speed		C <sub>g</sub>	Mounting Dimensions mm/in.				Wt. kg/lbs.
	-0.2 - .008 -0.55 - .022				kN/lbf.		Grease	Oil		Max.	Min.	Min.	Max.	
	mm	F <sub>w</sub>	E <sub>w</sub>		B <sub>c</sub>	C	C <sub>0</sub>	RPM		S	H			
	44	50	22.0	K44X50X22H	31.6	60.6	6400	9900	0.0523	44.000	43.989	50.009	50.025	0.046
	1.7323	1.9685	0.866		7100	13620				1.7323	1.7319	1.9689	1.9695	
	44	50	30.5	K44X50X30,5HZW	35.5	70.5	6400	9900	0.0543	44.000	43.989	50.009	50.025	0.068
	1.7323	1.9685	1.201		7980	15850				1.7323	1.7319	1.9689	1.9695	
45	45	50	13.0	K45X50X13H	18.4	35.1	6100	9400	0.0474	45.000	44.989	50.009	50.025	0.022
	1.7717	1.9685	0.512		4140	7890				1.7717	1.7712	1.9689	1.9695	
	45	50	15.0	K45X50X15FVB	19.4	37.3	6100	9400	0.0482	45.000	44.989	50.009	50.025	0.028
	1.7717	1.9685	0.591		4360	8390				1.7717	1.7712	1.9689	1.9695	
	45	50	17.0	K45X50X17H	24.9	51.8	6100	9400	0.0523	45.000	44.989	50.009	50.025	0.030
	1.7717	1.9685	0.669		5600	11650				1.7717	1.7712	1.9689	1.9695	
	45	50	20.0	K45X50X20F	27.0	57.4	6100	9400	0.0536	45.000	44.989	50.009	50.025	0.040
	1.7717	1.9685	0.787		6070	12900				1.7717	1.7712	1.9689	1.9695	
	45	50	21.0	K45X50X21CH	24.6	50.4	6100	9400	0.0519	45.000	44.989	50.009	50.025	0.036
	1.7717	1.9685	0.827		5530	11330				1.7717	1.7712	1.9689	1.9695	
	45	50	27.0	K45X50X27FH.ZB2	34.2	77.4	6100	9400	0.0577	45.000	44.989	50.009	50.025	0.043
	1.7717	1.9685	1.063		7690	17400				1.7717	1.7712	1.9689	1.9695	
	45	50	27.0	K45X50X27TN	31.8	70.7	6100	9400	—	45.000	44.989	50.009	50.025	0.048
	1.7717	1.9685	1.063		7150	15890				1.7717	1.7712	1.9689	1.9695	
	45	52	18.0	K45X52X18H	30.1	52.0	6200	9500	0.0497	45.000	44.989	52.010	52.029	0.045
	1.7717	2.0472	0.709		6770	11690				1.7717	1.7712	2.0476	2.0484	
	45	52	21.0	K45X52X21F	35.0	63.2	6200	9500	0.0521	45.000	44.989	52.010	52.029	0.055
	1.7717	2.0472	0.827		7870	14210				1.7717	1.7712	2.0476	2.0484	
	45	53	19.8	K45X53X20FH.ZB2	36.0	59.5	6200	9600	0.0504	45.000	44.989	53.010	53.029	0.060
	1.7717	2.0866	0.780		8090	13380				1.7717	1.7712	2.0870	2.0878	
	45	53	20.0	K45X53X20H	36.0	59.5	6200	9600	0.0504	45.000	44.989	53.010	53.029	0.054
	1.7717	2.0866	0.787		8090	13380				1.7717	1.7712	2.0870	2.0878	
	45	53	24.8	K45X53X25H	45.9	81.5	6200	9600	0.0545	45.000	44.989	53.010	53.029	0.072
	1.7717	2.0866	0.976		10320	18320				1.7717	1.7712	2.0870	2.0878	
	45	53	25.0	K45X53X25F	42.5	73.7	6200	9600	0.0531	45.000	44.989	53.010	53.029	0.075
	1.7717	2.0866	0.984		9550	16570				1.7717	1.7712	2.0870	2.0878	
	45	53	28.0	K45X53X28H	49.3	89.2	6200	9600	0.0557	45.000	44.989	53.010	53.029	0.078
	1.7717	2.0866	1.102		11080	20050				1.7717	1.7712	2.0870	2.0878	
	45	55	20.0	K45X55X20H	42.0	62.2	6400	9800	0.0494	45.000	44.989	55.010	55.029	0.074
	1.7717	2.1654	0.787		9440	13980				1.7717	1.7712	2.1657	2.1665	
	45	59	18.0	K45X59X18H	47.8	58.9	6600	10000	0.0467	45.000	44.989	59.010	59.029	0.107
	1.7717	2.3228	0.709		10750	13240				1.7717	1.7712	2.3232	2.3240	
	45	59	18.0	K45X59X18TN	45.7	55.4	6600	10000	—	45.000	44.989	59.010	59.029	0.097
	1.7717	2.3228	0.709		10270	12450				1.7717	1.7712	2.3232	2.3240	
	45	59	36.0	K45X59X36H	82.4	118	6600	10000	0.0555	45.000	44.989	59.010	59.029	0.181
	1.7717	2.3228	1.417		18520	26530				1.7717	1.7712	2.3232	2.3240	
	45	60	30.0	K45X60X30H	75.5	101	6600	10000	0.0530	45.000	44.989	60.010	60.029	0.171
	1.7717	2.3622	1.181		16970	22710				1.7717	1.7712	2.3626	2.3633	
	45	60	45.0	K45X60X45H	108	160	6600	10000	0.0594	45.000	44.989	60.010	60.029	0.280
	1.7717	2.3622	1.772		24280	35970				1.7717	1.7712	2.3626	2.3633	
46	46	53	36.0	K46X53X36HZW	48.6	96.7	6100	9300	0.0585	46.000	45.989	53.010	53.029	0.100
	1.8110	2.0866	1.417		10930	21740				1.8110	1.8106	2.0870	2.0878	0.220
47	47	52	15.0	K47X52X15FH	20.1	39.8	5800	8900	0.0499	47.000	46.989	52.010	52.029	0.030
	1.8504	2.0472	0.591		4520	8950				1.8504	1.8500	2.0476	2.0484	
	47	52	17.0	K47X52X17H	24.2	50.4	5800	8900	0.0529	47.000	46.989	52.010	52.029	0.032
	1.8504	2.0472	0.669		5440	11330				1.8504	1.8500	2.0476	2.0484	
	47	52	26.8	K47X52X27FH	35.4	82.4	5800	8900	0.0598	47.000	46.989	52.010	52.029	0.045
	1.8504	2.0472	1.055		7960	18520				1.8504	1.8500	2.0476	2.0484	
	47	52	27.0	K47X52X27H	36.6	85.9	5800	8900	0.0604	47.000	46.989	52.010	52.029	0.045
	1.8504	2.0472	1.063		8230	19310				1.8504	1.8500	2.0476	2.0484	
	47	55	28.0	K47X55X28FV1	48.9	89.5	6000	9200	0.0568	47.000	46.989	55.010	55.029	0.092
	1.8504	2.1654	1.102		10990	20120				1.8504	1.8500	2.1657	2.1665	
48	48	53	17.0	K48X53X17H	25.7	54.9	5700	8700	0.0546	48.000	47.989	53.010	53.029	0.032
	1.8898	2.0866	0.669		5780	12340				1.8898	1.8893	2.0870	2.0878	0.071

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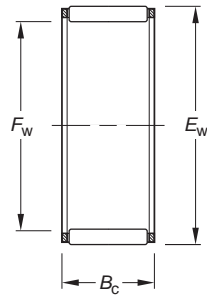




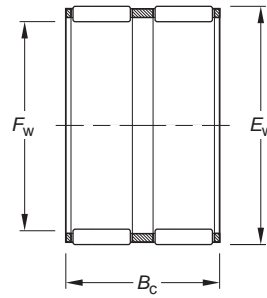
# NEEDLE ROLLER BEARINGS

## SINGLE-ROW, DOUBLE-ROW ASSEMBLIES — *continued*

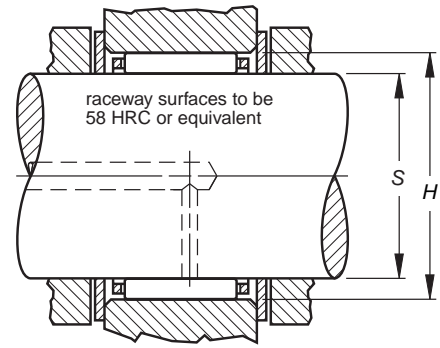
### METRIC SERIES



K



K.ZW



Shaft Dia.	Dimensions mm/in.			Assembly Designation	Load Ratings		Limiting Speed			Mounting Dimensions mm/in.				Wt. kg/lbs.
	-0.2 -0.08 -0.55 -0.22				C	Co	Grease	Oil	Co	Max.	Min.	Min.	Max.	
mm	Fw	Ew	Bc		C	Co	RPM		Cg	S		H		
48	48	54	19.0	K48X54X19H.ZB2	30.9	61.2	5700	8800	0.0545	48.000	47.989	54.010	54.029	0.042
	1.8898	2.1260	0.748		6950	13760								
49	49	55	32.0	K49X55X32HZW	40.2	86.4	5600	8600	0.0599	49.000	48.989	55.010	55.029	0.080
	1.9291	2.1654	1.260		9040	19420								
49	49	65	38.0	K49X65X38H	100	142	6100	9300	0.0593	49.000	48.989	65.010	65.029	0.244
	1.9291	2.5591	1.496		22480	31920								
50	50	55	17.0	K50X55X17H	25.5	55.0	5400	8400	0.0557	50.000	49.989	55.010	55.029	0.032
	1.9685	2.1654	0.669		5730	12360								
50	50	55	20.0	K50X55X20H	30.2	68.5	5400	8400	0.0588	50.000	49.989	55.010	55.029	0.038
	1.9685	2.1654	0.787		6790	15400								
50	50	55	30.0	K50X55X30	38.2	92.4	5400	8400	0.0633	50.000	49.989	55.010	55.029	0.057
	1.9685	2.1654	1.181		8590	20770								
50	50	55	30.0	K50X55X30FV1	38.2	92.4	5400	8400	0.0633	50.000	49.989	55.010	55.029	0.057
	1.9685	2.1654	1.181		8590	20770								
50	50	56	23.0	K50X56X23	35.5	74.1	5500	8500	0.0582	50.000	49.989	56.010	56.029	0.051
	1.9685	2.2047	0.906		7980	16660								
50	50	57	18.0	K50X57X18FH	31.3	56.4	5500	8500	0.0531	50.000	49.989	57.010	57.029	0.050
	1.9685	2.2441	0.709		7040	12680								
50	50	58	20.0	K50X58X20H	38.8	67.8	5600	8600	0.0545	50.000	49.989	58.010	58.029	0.065
	1.9685	2.2835	0.787		8720	15240								
50	50	58	25.0	K50X58X25H	46.5	85.6	5600	8600	0.0577	50.000	49.989	58.010	58.029	0.081
	1.9685	2.2835	0.984		10450	19240								
50	50	58	35.0	K50X58X35H	64.9	131	5600	8600	0.0642	50.000	49.989	58.010	58.029	0.105
	1.9685	2.2835	1.378		14590	29450								
50	50	62	30.0	K50X62X30H.ZB2	64.6	98.1	5800	8900	0.0565	50.000	49.989	62.010	62.029	0.136
	1.9685	2.4409	1.181		14520	22050								
50	50	66	30.0	K50X66X30H	80.9	109	5900	9100	0.0559	50.000	49.989	66.010	66.029	0.192
	1.9685	2.5984	1.181		18190	24500								
50	50	70	32.0	K50X70X32H	103	129	6100	9300	0.0569	50.000	49.989	70.010	70.029	0.224
	1.9685	2.7559	1.260		23160	29000								
52	52	57	12.0	K52X57X12	18.4	36.7	5200	8000	0.0512	52.000	51.987	57.010	57.029	0.022
	2.0472	2.2441	0.472		4140	8250								
52	52	57	17.0	K52X57X17FCH	21.4	44.3	5200	8000	0.0537	52.000	51.987	57.010	57.029	0.035
	2.0472	2.2441	0.669		4810	9960								
52	52	57	17.0	K52X57X17H	21.4	44.3	5200	8000	0.0537	52.000	51.987	57.010	57.029	0.035
	2.0472	2.2441	0.669		4810	9960								
52	52	60	24.0	K52X60X24	47.1	88.3	5400	8200	0.0592	52.000	51.987	60.010	60.029	0.078
	2.0472	2.3622	0.945		10600	19900								
55	55	60	17.0	K55X60X17	26.0	58.3	4900	7600	0.0590	55.000	54.987	60.010	60.029	0.037
	2.1654	2.3622	0.669		5850	13100								
55	55	60	20.0	K55X60X20H	30.7	72.4	4900	7600	0.0622	55.000	54.987	60.010	60.029	0.042
	2.1654	2.3622	0.787		6900	16300								
55	55	60	27.0	K55X60X27H	40.1	102	4900	7600	0.0677	55.000	54.987	60.010	60.029	0.055
	2.1654	2.3622	1.063		9010	22900								
55	55	60	30.0	K55X60X30	40.6	103	4900	7600	0.0680	55.000	54.987	60.010	60.029	0.066
	2.1654	2.3622	1.181		9130	23200								



Shaft Dia.	Dimensions mm/in.			Assembly Designation	Load Ratings		Limiting Speed		C <sub>g</sub>	Mounting Dimensions mm/in.				Wt. kg/lbs.
	-0.2 - .008 -0.55 - .022				kN/lbf.		Grease	Oil		Max.	Min.	Min.	Max.	
	mm	F <sub>w</sub>	E <sub>w</sub>		B <sub>c</sub>	C	C <sub>0</sub>	RPM		C <sub>g</sub>	S		H	
	55	60	30.0	K55X60X30FH	40.6	103	4900	7600	0.0680	55.000	54.987	60.010	60.029	0.068
	2.1654	2.3622	1.181		9130	23200				2.1654	2.1648	2.3626	2.3633	
	55	61	26.0	K55X61X26H	44.3	102	5000	7600	0.0657	55.000	54.987	61.010	61.029	0.063
	2.1654	2.4016	1.024		9960	22900				2.1654	2.1648	2.4020	2.4027	
	55	62	18.0	K55X62X18H	33.2	62.8	5000	7700	0.0569	55.000	54.987	62.010	62.029	0.055
	2.1654	2.4409	0.709		7460	14100				2.1654	2.1648	2.4413	2.4421	
	55	63	15.0	K55X63X15F	30.5	51.5	5000	7800	0.0531	55.000	54.987	63.010	63.029	0.054
	2.1654	2.4803	0.591		6860	11600				2.1654	2.1648	2.4807	2.4815	
	55	63	20.0	K55X63X20	40.3	73.5	5000	7800	0.0580	55.000	54.987	63.010	63.029	0.072
	2.1654	2.4803	0.787		9060	16500				2.1654	2.1648	2.4807	2.4815	
	55	63	25.0	K55X63X25	49.8	96.5	5000	7800	0.0621	55.000	54.987	63.010	63.029	0.080
	2.1654	2.4803	0.984		11200	21700				2.1654	2.1648	2.4807	2.4815	
	55	63	32.0	K55X63X32	62.3	129	5000	7800	0.0667	55.000	54.987	63.010	63.029	0.108
	2.1654	2.4803	1.260		14000	29000				2.1654	2.1648	2.4807	2.4815	
58	58	63	17.0	K58X63X17F	27.0	62.6	4700	7200	0.0615	58.000	57.987	63.010	63.029	0.037
	2.2835	2.4803	0.669		6070	14100				2.2835	2.2830	2.4807	2.4815	
	58	64	19.0	K58X64X19H	32.9	70.6	4700	7200	0.0615	58.000	57.987	64.010	64.029	0.037
	2.2835	2.5197	0.748		7400	15900				2.2835	2.2830	2.5201	2.5208	
	58	65	18.0	K58X65X18H	34.3	67.1	4700	7300	0.0593	58.000	57.987	65.010	65.029	0.058
	2.2835	2.5591	0.709		7710	15100				2.2835	2.2830	2.5594	2.5602	
60	60	65	20.0	K60X65X20H	31.9	78.1	4500	6900	0.0660	60.000	59.987	65.010	65.029	0.046
	2.3622	2.5591	0.787		7170	17600				2.3622	2.3617	2.5594	2.5602	
	60	65	26.8	K60X65X27FH	39.5	103	4500	6900	0.0707	60.000	59.987	65.010	65.029	0.059
	2.3622	2.5591	1.055		8880	23200				2.3622	2.3617	2.5594	2.5602	
	60	65	29.8	K60X65X30FH	42.9	114	4500	6900	0.0726	60.000	59.987	65.010	65.029	0.085
	2.3622	2.5591	1.173		9640	25600				2.3622	2.3617	2.5594	2.5602	
	60	65	30.0	K60X65X30	42.9	114	4500	6900	0.0726	60.000	59.987	65.010	65.029	0.070
	2.3622	2.5591	1.181		9640	25600				2.3622	2.3617	2.5594	2.5602	
	60	68	17.0	K60X68X17F	34.2	61.4	4600	7100	0.0577	60.000	59.987	68.010	68.029	0.066
	2.3622	2.6772	0.669		7690	13800				2.3622	2.3617	2.6776	2.6783	
	60	68	20.0	K60X68X20H	41.8	79.2	4600	7100	0.0614	60.000	59.987	68.010	68.029	0.066
	2.3622	2.6772	0.787		9400	17800				2.3622	2.3617	2.6776	2.6783	
	60	68	23.0	K60X68X23F	49.0	97.2	4600	7100	0.0646	60.000	59.987	68.010	68.029	0.089
	2.3622	2.6772	0.906		11000	21900				2.3622	2.3617	2.6776	2.6783	
	60	68	23.0	K60X68X23FH	49.0	97.2	4600	7100	0.0646	60.000	59.987	68.010	68.029	0.089
	2.3622	2.6772	0.906		11000	21900				2.3622	2.3617	2.6776	2.6783	
	60	68	23.0	K60X68X23H	49.0	97.2	4600	7100	0.0646	60.000	59.987	68.010	68.029	0.089
	2.3622	2.6772	0.906		11000	21900				2.3622	2.3617	2.6776	2.6783	
	60	68	25.0	K60X68X25	51.6	104	4600	7100	0.0657	60.000	59.987	68.010	68.029	0.091
	2.3622	2.6772	0.984		11600	23400				2.3622	2.3617	2.6776	2.6783	
	60	68	30.0	K60X68X30ZW	46.4	90.1	4600	7100	0.0634	60.000	59.987	68.010	68.029	0.119
	2.3622	2.6772	1.181		10400	20300				2.3622	2.3617	2.6776	2.6783	
63	63	71	20.0	K63X71X20	41.4	79.4	4400	6700	0.0628	63.000	62.987	71.010	71.029	0.070
	2.4803	2.7953	0.787		9310	17800				2.4803	2.4798	2.7957	2.7964	
64	64	70	16.0	K64X70X16	26.4	55.1	4200	6500	0.0605	64.000	63.987	70.010	70.029	0.049
	2.5197	2.7559	0.630		5930	12400				2.5197	2.5192	2.7563	2.7570	
65	65	70	20.0	K65X70X20CH	28.6	69.2	4100	6400	0.0665	65.000	64.987	70.010	70.029	0.050
	2.5591	2.7559	0.787		6430	15600				2.5591	2.5585	2.7563	2.7570	
	65	70	20.0	K65X70X20F	31.5	78.9	4100	6400	0.0687	65.000	64.987	70.010	70.029	0.050
	2.5591	2.7559	0.787		7080	17700				2.5591	2.5585	2.7563	2.7570	
	65	70	20.0	K65X70X20H	31.5	78.9	4100	6400	0.0687	65.000	64.987	70.010	70.029	0.050
	2.5591	2.7559	0.787		7080	17700				2.5591	2.5585	2.7563	2.7570	
	65	70	30.0	K65X70X30	44.4	123	4100	6400	0.0766	65.000	64.987	70.010	70.029	0.075
	2.5591	2.7559	1.181		9980	27700				2.5591	2.5585	2.7563	2.7570	
	65	73	23.0	K65X73X23H	48.2	97.7	4200	6500	0.0671	65.000	64.987	73.010	73.029	0.091
	2.5591	2.8740	0.906		10800	22000				2.5591	2.5585	2.8744	2.8752	
	65	73	30.0	K65X73X30H	60.1	129	4200	6500	0.0719	65.000	64.987	73.010	73.029	0.116
	2.5591	2.8740	1.181		13500	29100				2.5591	2.5585	2.8744	2.8752	

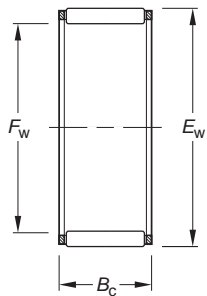
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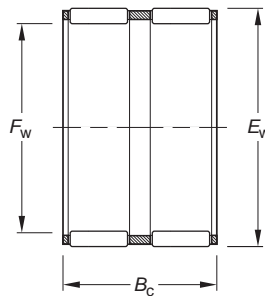
# NEEDLE ROLLER BEARINGS

## SINGLE-ROW, DOUBLE-ROW ASSEMBLIES — continued

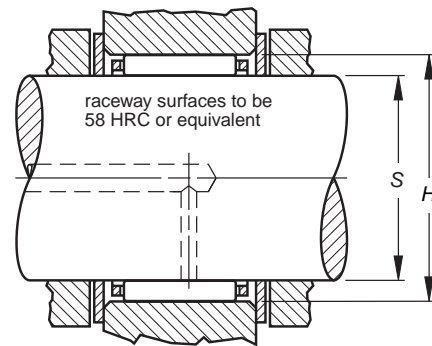
### METRIC SERIES



K



K.ZW



Shaft Dia.	Dimensions mm/in.			Assembly Designation	Load Ratings		Limiting Speed			Mounting Dimensions mm/in.				Wt. kg/lbs.
	-0.2 -0.08 -0.55 -0.22				C	Co	Grease	Oil	Co	Max.	Min.	Min.	Max.	
mm	Fw	Ew	Bc				RPM		S	H				
68	68	74	20.0	K68X74X20FH	37.5	88.1	4000	6100	0.0699	68.000	67.987	74.010	74.029	0.062
	2.6772	2.9134	0.787		8430	19800				2.6772	2.6767	2.9138	2.9145	
68	68	74	28.0	K68X74X28CH	44.8	110	4000	6100	0.0739	68.000	67.987	74.010	74.029	0.082
	2.6772	2.9134	1.102		10100	24700				2.6772	2.6767	2.9138	2.9145	
68	68	74	30.0	K68X74X30H	47.6	119	4000	6100	0.0754	68.000	67.987	74.010	74.029	0.098
	2.6772	2.9134	1.181		10700	26800				2.6772	2.6767	2.9138	2.9145	
68	68	74	35.0	K68X74X35HZW	45.1	111	4000	6100	0.0740	68.000	67.987	74.010	74.029	0.120
	2.6772	2.9134	1.378		10100	25000				2.6772	2.6767	2.9138	2.9145	
68	68	76	20.0	K68X76X20	43.8	87.8	4000	6200	0.0667	68.000	67.987	76.010	76.029	0.086
	2.6772	2.9921	0.787		9850	19700				2.6772	2.6767	2.9925	2.9933	
68	68	82	38.5	K68X82X38,5H	117	209	4200	6400	0.0761	68.000	67.987	82.012	82.034	0.320
	2.6772	3.2283	1.516		26300	47000				2.6772	2.6767	3.2288	3.2297	
70	70	76	20.0	K70X76X20	36.1	84.7	3900	5900	0.0702	70.000	69.987	76.010	76.029	0.065
	2.7559	2.9921	0.787		8120	19000				2.7559	2.7554	2.9925	2.9933	
70	70	76	30.0	K70X76X30	51.6	134.0	3900	5900	0.0786	70.000	69.987	76.010	76.029	0.097
	2.7559	2.9921	1.181		11600	30100				2.7559	2.7554	2.9925	2.9933	
70	70	78	20.0	K70X78X20H	43.6	87.9	3900	6000	0.0676	70.000	69.987	78.010	78.029	0.090
	2.7559	3.0709	0.787		9800	19800				2.7559	2.7554	3.0713	3.0720	
70	70	78	23.0	K70X78X23F	49.8	104.0	3900	6000	0.0705	70.000	69.987	78.010	78.029	0.115
	2.7559	3.0709	0.906		11200	23400				2.7559	2.7554	3.0713	3.0720	
70	70	78	24.8	K70X78X25F	49.8	104.0	3900	6000	0.0705	70.000	69.987	78.010	78.029	0.115
	2.7559	3.0709	0.976		11200	23400				2.7559	2.7554	3.0713	3.0720	
70	70	78	30.0	K70X78X30H	62.2	139.0	3900	6000	0.0757	70.000	69.987	78.010	78.029	0.140
	2.7559	3.0709	1.181		14000	31200				2.7559	2.7554	3.0713	3.0720	
70	70	78	46.0	K70X78X46ZW	78.4	187.0	3900	6000	0.0815	70.000	69.987	78.010	78.029	0.188
	2.7559	3.0709	1.811		17600	42000				2.7559	2.7554	3.0713	3.0720	
70	70	85	40.0	K70X85X40F	118	203	4100	6300	0.0758	70.000	69.987	85.012	85.034	0.338
	2.7559	3.3465	1.575		26500	45600				2.7559	2.7554	3.3469	3.3478	
70	70	88	30.0	K70X88X30H.ZB2	115	175	4100	6400	0.0714	70.000	69.987	88.012	88.034	0.205
	2.7559	3.4646	1.181		25900	39300				2.7559	2.7554	3.4650	3.4659	
72	72	80	20.0	K72X80X20	44.4	90.7	3800	5800	0.0690	72.000	71.987	80.010	80.029	0.084
	2.8346	3.1496	0.787		9980	20400				2.8346	2.8341	3.1500	3.1507	
73	73	79	20.0	K73X79X20	37.0	88.7	3700	5700	0.0723	73.000	72.987	79.010	79.029	0.068
	2.8740	3.1102	0.787		8320	19900				2.8740	2.8735	3.1106	3.1114	
75	75	81	20.0	K75X81X20F	37.4	90.7	3600	5500	0.0737	75.000	74.987	81.012	81.034	0.075
	2.9528	3.1890	0.787		8410	20400				2.9528	2.9522	3.1894	3.1903	
75	75	83	23.0	K75X83X23	52.5	114.0	3600	5600	0.0744	75.000	74.987	83.012	83.034	0.104
	2.9528	3.2677	0.906		11800	25600				2.9528	2.9522	3.2682	3.2691	
75	75	83	30.0	K75X83X30	60.9	138	3600	5600	0.0780	75.000	74.987	83.012	83.034	0.141
	2.9528	3.2677	1.181		13700	31000				2.9528	2.9522	3.2682	3.2691	
75	75	83	30.0	K75X83X30FH	60.9	138	3600	5600	0.0780	75.000	74.987	83.012	83.034	0.141
	2.9528	3.2677	1.181		13700	31000				2.9528	2.9522	3.2682	3.2691	
80	80	86	20.0	K80X86X20H	38.6	96.7	3400	5200	0.0771	80.000	79.987	86.012	86.034	0.072
	3.1496	3.3858	0.787		8680	21700				3.1496	3.1491	3.3863	3.3872	
80	80	88	25.0	K80X88X25FV1	54.0	121	3400	5200	0.0778	80.000	79.987	88.012	88.034	0.134
	3.1496	3.4646	0.984		12100	27200				3.1496	3.1491	3.4650	3.4659	

Shaft Dia.	Dimensions mm/in.			Assembly Designation	Load Ratings kN/lbf.		Limiting Speed		C <sub>g</sub>	Mounting Dimensions mm/in.				Wt. kg/lbs.
	-0.2 - .008 -0.55 - .022				C	C <sub>0</sub>	Grease	Oil		Max.	Min.	Min.	Max.	
mm	F <sub>w</sub>	E <sub>w</sub>	B <sub>c</sub>				RPM		S	H				
80	80	88	30.0	K80X88X30	67.5	161	3400	5200	0.0835	80.000	79.987	88.012	88.034	0.153
	3.1496	3.4646	1.181		15200	36200				3.1496	3.1491	3.4650	3.4659	
85	85	92	20.0	K85X92X20H	39.9	91.7	3200	4900	0.0763	84.988	84.973	92.012	92.034	0.085
	3.3465	3.6220	0.787		8970	20600				3.3460	3.3454	3.6225	3.6234	
85	85	93	25.0	K85X93X25F						84.988	84.973	93.012	93.034	0.000
	3.3465	3.6614	0.984							3.3460	3.3454	3.6619	3.6628	
85	85	93	30.0	K85X93X30H	69.4	170	3200	4900	0.0870	84.988	84.973	93.012	93.034	0.166
	3.3465	3.6614	1.181		15600	38200				3.3460	3.3454	3.6619	3.6628	
90	90	97	20.0	K90X97X20	46.3	114	3000	4600	0.0827	89.988	89.973	97.012	97.034	0.095
	3.5433	3.8189	0.787		10400	25600				3.5428	3.5422	3.8194	3.8202	
90	90	98	25.0	K90X98X25F	54.8	128	3000	4600	0.0832	89.988	89.973	98.012	98.034	0.134
	3.5433	3.8583	0.984		12300	28800				3.5428	3.5422	3.8587	3.8596	
90	90	98	30.0	K90X98X30	63.6	155	3000	4600	0.0873	89.988	89.973	98.012	98.034	0.168
	3.5433	3.8583	1.181		14300	34800				3.5428	3.5422	3.8587	3.8596	
95	95	103	20.0	K95X103X20	49.3	114	2800	4400	0.0829	94.988	94.973	103.012	103.034	0.130
	3.7402	4.0551	0.787		11100	25600				3.7397	3.7391	4.0556	4.0565	
95	95	103	30.0	K95X103X30F	71.0	183	2800	4400	0.0932	94.988	94.973	103.012	103.034	0.180
	3.7402	4.0551	1.181		16000	41100				3.7397	3.7391	4.0556	4.0565	
100	100	108	30.0	K100X108X30	72.4	191	2700	4200	0.0965	99.988	99.973	108.012	108.034	0.210
	3.9370	4.2520	1.181		16300	42900				3.9365	3.9359	4.2524	4.2533	
110	110	118	24.0	K110X118X24	64.0	168	2400	3800	0.0977	109.988	109.973	118.012	118.034	0.165
	4.3307	4.6457	0.945		14400	37800				4.3302	4.3296	4.6461	4.6470	
110	110	118	30.0	K110X118X30H	75.3	207	2400	3800	0.1029	109.988	109.973	118.012	118.034	0.200
	4.3307	4.6457	1.181		16900	46500				4.3302	4.3296	4.6461	4.6470	





## NEEDLE ROLLER AND CAGE RADIAL ASSEMBLIES FOR CONNECTING ROD APPLICATIONS – METRIC SERIES

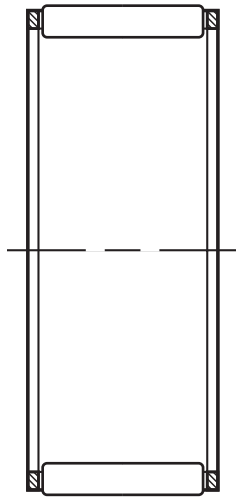
Connecting rods have two bearing positions: the crank pin or big end and the wrist pin or small end.

In the crank pin position there may be severe operating conditions due to centrifugal forces, internal forces, accelerations and high rotational speeds, requiring the use of special needle roller and cage radial assemblies.

Similarly, in the wrist pin position the reciprocating inertia loads and high oscillating speeds dictate the use of special cage designs.

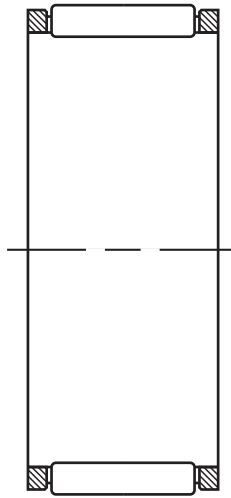
### Types Of Metric Series Needle Roller and Cage Radial Assemblies.

Needle roller and cage assembly for crank pin applications.



K.BE

Needle roller and cage assembly for wrist pin applications.



K.SE

#### Suffixes

<b>BE</b>	steel cage, heat treated, for crank pin position
<b>SE</b>	steel cage, heat treated, for wrist pin position

C



## CONSTRUCTION

### METRIC SERIES NEEDLE ROLLER AND CAGE RADIAL ASSEMBLIES FOR CRANK PIN POSITIONS

Needle roller and cage assemblies for use in crank pin positions have cages with a large outside cylindrical surface to ensure optimum radial guidance in the connecting rod bore. Due to the inherent low weight and strength of the heat-treated cages, the needle roller and cage assemblies are well-suited for high engine speed applications. When necessary, silver plating and copper plating can be applied for optimum performance during operation at high speeds.

### METRIC SERIES NEEDLE ROLLER AND CAGE RADIAL ASSEMBLIES FOR WRIST PIN POSITIONS

Reciprocating inertia loads and oscillating speeds require the cages used in the wrist pin positions to be heat treated and to guide on the wrist pin.

These cages are available in a variety of widths to allow the selection of a needle roller and cage assembly with the length of needle rollers to match the connecting rod width.

### SIZE SELECTION

In most instances selection of a suitable size of a needle roller and cage assembly for typical connecting rod positions may be based on the cylinder displacement of the engine which in turn, dictates the crank pin and wrist pin diameters.

Suggestions based on engine displacements are listed in the following table.

TABLE 1 –  
CRANK PIN AND WRIST PIN DIAMETERS, DETERMINED BY THE CYLINDER DISPLACEMENT OF THE ENGINE.

		CYLINDER DISPLACEMENT IN CM <sup>3</sup>						
Cylinder	>		40	60	100	150	200	300
Displacement	≤	40	60	100	150	200	300	

		DIAMETER IN MM						
Crank pin		12/14	15/16/18	18/20	18/20/22	24/25/28	28/30	35/40
Wrist pin		10/11	12/13	14/15	15/16	18	20	20





## CONNECTING ROD GUIDANCE ARRANGEMENTS

End guidance of a connecting rod can be provided either at the crank pin or at the wrist pin end. Connecting rod guidance is achieved at the crank pin end using a small clearance between the crank webs. Guidance at the wrist pin end is controlled by a small clearance between the piston bosses.

### CRANK PIN END GUIDANCE

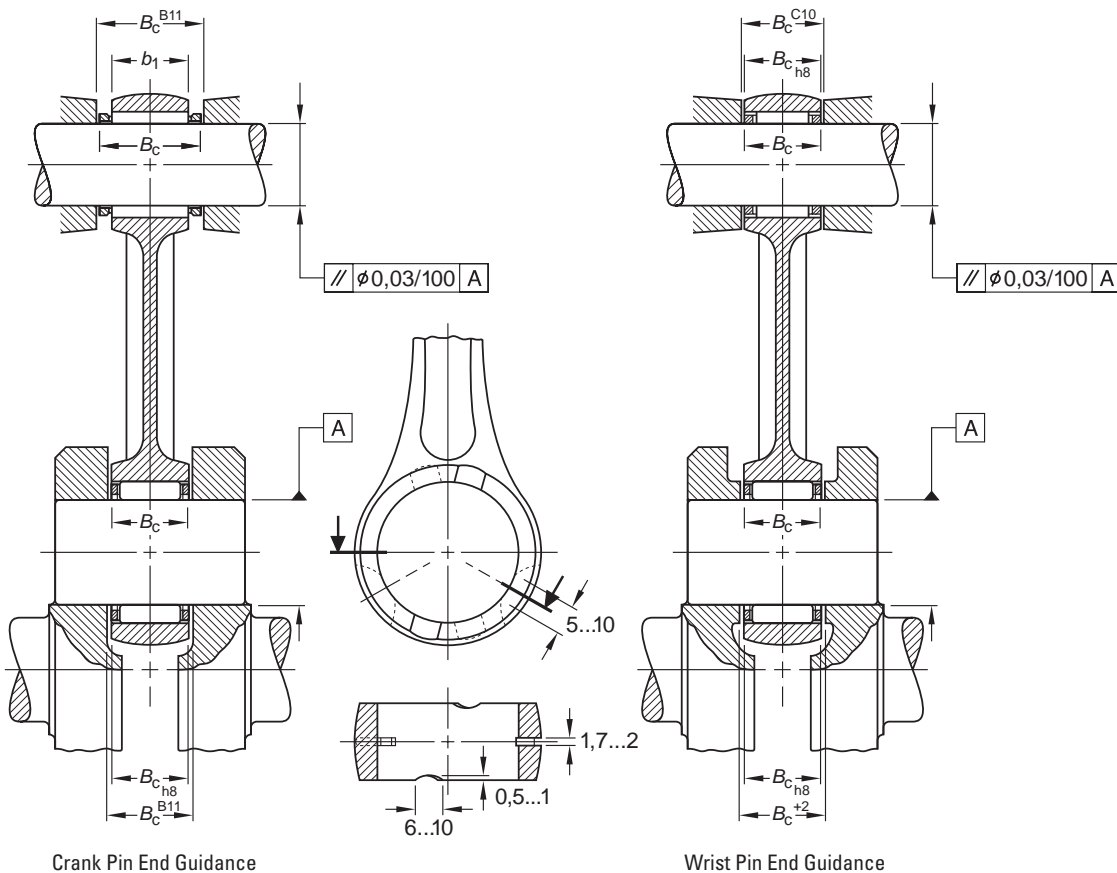
With crank pin end guidance care must be taken that an adequate amount of lubricant is supplied to the crank pin bearing and the surfaces which guide the connecting rod. For this purpose, grooves in the connecting rod end faces or slots in the connecting rod bore aligned with the incoming lubrication path should be provided. Occasionally, bronze or hardened steel washers may be used for end guidance of the connecting rod.

At the wrist pin end, the needle roller and cage assembly is located axially between the piston bosses. It may be both economical and effective to machine the connecting rod at the wrist pin end and at the crank pin end to the same width. It is suggested that at the wrist pin end the needle roller length does not overhang the connecting rod width. Otherwise, the load rating of the needle roller and cage assembly will be reduced.

### WRIST PIN END GUIDANCE

Wrist pin end will get the most effective axial guidance between the piston bosses. Grooves in the bottom of the piston bosses and a chamfer of small angle on each side of the upper portion of the connecting rod small end, can improve the oil flow to the needle roller and cage assembly and its guiding surfaces.

The length of the needle roller and cage assembly and the connecting rod width at the crank pin end should be identical to ensure best possible radial piloting of cage in the bore of the connecting rod. The crank webs are recessed to allow proper axial alignment of the connecting rod. As a rule, it is not necessary to have additional supply of lubricant. Only in engines with sparse lubrication should consideration be given to provide lubricating slots in the connecting rod bores as with crank pin end guidance.



### Suitable Materials and Heat Treatment

Connecting rod crank pin end and wrist pin end bores serve as raceways:

a case hardening steel such as 15 CrNi 6, 17 MnCr 5 or AISI 8620.

Crank pins:

e.g., case hardening steel 15 Cr 3, AISI 8620, AISI 1018 or through-hardening steel 100 Cr 6, AISI 52100.

Wrist pins:

e.g., case hardening steel Ck 15, 15 Cr 3 or through-hardening steel 100 Cr 6, AISI 52100.

The effective case depth (50 HRC) of the raceways should be 0.5 mm minimum, the surface hardness should be 60 HRC or 700 HV minimum.

After hardening, the connecting rods must be stress relieved.

The connecting rod raceway bores as well as the crank pins and the wrist pins must be precision ground or preferably honed to a surface finish  $R_a$  not exceeding 0.16  $\mu\text{m}$ .

### FORM TOLERANCES

The form tolerances for crank pins, wrist pins and connecting rod bores are listed in Table 2.

TABLE 2 – FORM TOLERANCES

		Dimension in mm				
Nominal pin diameter	>	10	14	18	25	30
	≤	14	18	25	30	40
		Tolerances in $\mu\text{m}$				
Parallelism*	wrist pin & crank pin	1	1	2	2	3
	rod bore	2	3	3	4	4
Circularity (DIN ISO 1101)	wrist pin & crank pin	1	1	1.5	1.5	2
	rod bore	1.5	2	2	2.5	2.5

\* The parallelism values are valid for the needle roller length  $L_w$ .

It is suggested that the parallelism of the wrist pin axis and the crank pin axis be within a tolerance zone of 0.03 mm diameter over a distance of 100 mm.

## RADIAL CLEARANCE

### METRIC SERIES CRANK PIN BEARINGS

The high speeds of modern production engines dictate the need for crank pin bearings with a relatively large radial clearance. As an approximation, the minimum clearance can be taken as the crank pin diameter/1000. The maximum radial clearance would be a result of the sorting plan shown in Table 3.

As shown in the example of the matching scheme, the suggested mounting diameters for the crank pin position are G6 for the connecting rod bore diameters and h5 for the crank pin diameters. Axial location of the cage is shown on the crank pin end guidance arrangement.

Racing and sport engines operate at yet even higher speeds than production engines, requiring 50 percent larger radial clearances in the crank pin bearings. The larger radial clearances should also be used in bores of split connecting rods to avoid the danger of distortion resulting from the unavoidable connecting rod deformation occurring in operation. Consult your Timken representative for advice on such applications.

### METRIC SERIES WRIST PIN BEARINGS

The radial clearance in wrist pin bearings should be held as small as possible. The minimum clearance should be aimed at 2 mm with the maximum clearance resulting from the proposed sorting plan in Table 3. The maximum clearance should be held as close as possible to 12 mm for all wrist pin bearings based on sorting wrist pins made to a tolerance h5, small end bore diameter tolerance of K6 and needle roller grades as shown in Table 3.



**TIMKEN® TORRINGTON® METRIC SERIES NEEDLE ROLLER AND CAGE RADIAL ASSEMBLIES FOR CONNECTING ROD APPLICATIONS**

TABLE 3 – RADIAL CLEARANCE

**Matching Scheme For A Crank Pin Bearing Arrangement**

*(three diameter ranges are specified for the connecting rod and crank pin)*

Example: Crank pin diameter 20 mm, tolerance h5  
 Connecting rod bore diameter 26 mm, tolerance G6  
 Needle roller and cage assembly K20x26x12BE  
 Radial clearance 20 . . . 29 µm

		Connecting Rod Crank Pin End Bore Diameter 26 <sup>+20</sup> / <sub>+7</sub> Tolerances and Radial Clearances In µm											
		+12 +7 Needle Roller Tolerance		Radial Clearance		+16 +12 Needle Roller Tolerance		Radial Clearance		+20 +16 Needle Roller Tolerance		Radial Clearance	
Crank Pin Diameter	0	-7		21...29		-4	-5	20...29		-2	-3	20...29	
	-3	-9				-6	-7			-4	-5		
	-3	-5		20...28		-3		21...28		-1		21...28	
	-6	-7				-5				-3			
20 <sup>0</sup> / <sub>-9</sub>	-6	-4		21...29		-1	-2	20...29		0		22...29	
	-9	-6				-3	-4			-2			

**Matching Scheme For A Wrist Pin Bearing Arrangement**

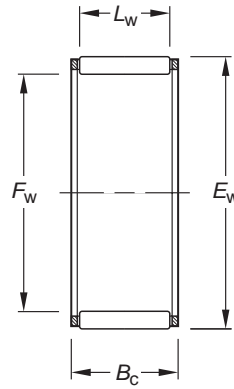
*(three diameter ranges are specified for the connecting rod and wrist pin)*

Example: Wrist pin diameter 16 mm, tolerance h5  
 Connecting rod bore diameter 20 mm, tolerance K6  
 Needle roller and cage assembly K16x20x20SE  
 Radial clearance 2 . . . 12 µm

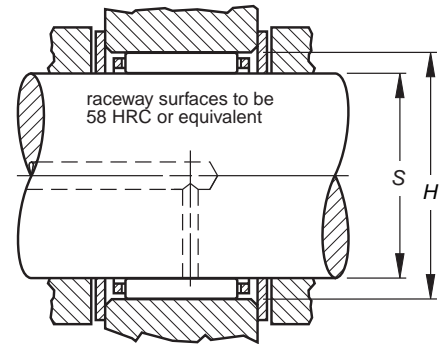
		Wrist Pin End Bore Diameter 20 <sup>+2</sup> / <sub>-11</sub> Tolerances and Radial Clearances In µm											
		-6 -11 Needle roller Tolerance		Radial Clearance		-2 -6 Needle Roller Tolerance		Radial Clearance		+2 -2 Needle Roller Tolerance		Radial Clearance	
Wrist Pin Diameter	0					-4	-5	2...11		-2	-3	2...11	
	-3					-6	-7			-4	-5		
	-3	-5		2...10		-3	-4	3...12		-1	-2	3...12	
	-6	-7				-5	-6			-3	-4		
16 <sup>0</sup> / <sub>-8</sub>	-6	-4	-5	3...12		-1	-2	2...10		0		4...10	
	-8	-6	-7			-3	-4			-2			



**ASSEMBLIES FOR CRANK PIN  
END APPLICATIONS**  
**METRIC SERIES**



K.BE



Shaft Dia.	Dimensions mm/in. -0.2 - .008 -0.55 - .022				Assembly Designation	Load Ratings kN/lbf.			Mounting Dimensions mm/in. (non-high performance engines)				Wt. kg/lbs.
	mm	F <sub>w</sub>	E <sub>w</sub>	B <sub>c</sub>		L <sub>w</sub>	C	C <sub>0</sub>	C <sub>g</sub>	S	H	Max.	
12	12	12	16	10	K12X16X10BE	6.21	6.70	n/a	12.000	11.992	16.006	16.017	0.004
	0.4724	0.4724	0.6299	0.394		1400	1510		0.4724	0.4721	0.6302	0.6306	
12	12	17	10	7.8	K12X17X10BE	7.32	7.21	n/a	12.000	11.992	17.006	17.017	0.005
	0.4724	0.6693	0.394	0.307		1650	1620		0.4724	0.4721	0.6695	0.6700	
14	14	18	10	7.8	K14X18X10BE	6.89	7.98	n/a	14.000	13.992	18.006	18.017	0.005
	0.5512	0.7087	0.394	0.307		1550	1790		0.5512	0.5509	0.7089	0.7093	
14	14	18	10	7.8	WK14X18X10BE	6.89	7.98	0.0204	14.000	13.992	18.006	18.017	0.005
	0.5512	0.7087	0.394	0.307		1550	1790		0.5512	0.5509	0.7089	0.7093	
14	14	20	10	7.8	K14X20X10BE	8.90	8.61	0.0198	14.000	13.992	20.007	20.020	0.007
	0.5512	0.7874	0.394	0.307		2000	1940		0.5512	0.5509	0.7877	0.7882	
14	14	20	12	9.5	K14X20X12BE	10.50	10.60	0.0209	14.000	13.992	20.007	20.020	0.009
	0.5512	0.7874	0.472	0.374		2360	2380		0.5512	0.5509	0.7877	0.7882	
14	14	20	12	9.5	WK14X20X12BE	10.50	10.60	0.0209	14.000	13.992	20.007	20.020	0.009
	0.5512	0.7874	0.472	0.374		2360	2380		0.5512	0.5509	0.7877	0.7882	
15	15	22	12	9.0	K15,2X22,2X12BE	10.80	10.30	0.0211	15.200	15.192	22.207	22.220	0.012
	0.5984	0.8740	0.472	0.354		2430	2320		0.5984	0.5981	0.8743	0.8748	
16	16	21	10	7.8	K16X21X10BE	8.17	8.90	0.0215	16.000	15.992	21.007	21.020	0.007
	0.6299	0.8268	0.394	0.307		1840	2000		0.6299	0.6296	0.8270	0.8276	
16	16	21	10	7.8	WK16X21X10BE	8.17	8.90	0.0215	16.000	15.992	21.007	21.020	0.007
	0.6299	0.8268	0.394	0.307		1840	2000		0.6299	0.6296	0.8270	0.8276	
16	16	22	12	9.5	K16X22X12BE	11.20	11.90	0.0227	16.000	15.992	22.007	22.020	0.011
	0.6299	0.8661	0.472	0.374		2520	2680		0.6299	0.6296	0.8664	0.8669	
18	18	24	12	9.5	K18X24X12BE	11.80	13.10	0.0243	18.000	17.992	24.007	24.020	0.011
	0.7087	0.9449	0.472	0.374		2650	2940		0.7087	0.7083	0.9452	0.9457	
18	18	24	13	9.8	K18X24X13BE	12.10	13.50	0.0245	18.000	17.992	24.007	24.020	0.013
	0.7087	0.9449	0.512	0.386		2720	3030		0.7087	0.7083	0.9452	0.9457	
18	18	24	13	10.5	WK18X24X13BE	12.80	14.60	0.0250	18.000	17.992	24.007	24.020	0.011
	0.7087	0.9449	0.512	0.413		2880	3280		0.7087	0.7083	0.9452	0.9457	
18	18	24	15	11.8	K18X24X15BE	13.30	15.20	0.0253	18.000	17.992	24.007	24.020	0.014
	0.7087	0.9449	0.591	0.465		2990	3420		0.7087	0.7083	0.9452	0.9457	
19	19	25	15	12.5	K19X25X15BE	14.70	17.60	0.0268	19.000	18.991	25.007	25.020	0.014
	0.7480	0.9843	0.591	0.492		3300	3960		0.7480	0.7477	0.9845	0.9850	
20	20	26	12	9.8	K20X26X12BE	13.30	15.80	0.0267	20.000	19.991	26.007	26.020	0.013
	0.7874	1.0236	0.472	0.386		2990	3550		0.7874	0.7870	1.0239	1.0244	
20	20	26	17	13.8	K20X26X17BE	14.90	18.20	0.0276	20.000	19.991	26.007	26.020	0.017
	0.7874	1.0236	0.669	0.543		3350	4090		0.7874	0.7870	1.0239	1.0244	
21	21	27	13	10.5	K21,1X27,1X13BE	14.10	17.20	0.0278	21.100	21.091	27.107	27.120	0.016
	0.8307	1.0669	0.512	0.413		3170	3870		0.8307	0.8304	1.0672	1.0677	
22	22	28	13	9.8	K22X28X13BE	13.90	17.10	0.0283	22.000	21.991	28.007	28.020	0.015
	0.8661	1.1024	0.512	0.386		3120	3840		0.8661	0.8658	1.1026	1.1031	
22	22	29	15.6	12.8	WK22X29X15,6BE	18.50	22.30	0.0296	22.000	21.991	29.007	29.020	0.021
	0.8661	1.1417	0.614	0.504		4160	5010		0.8661	0.8658	1.1420	1.1425	
22	22	29	16	12.8	K22X29X16BE	18.50	22.30	0.0296	22.000	21.991	29.007	29.020	0.021
	0.8661	1.1417	0.630	0.504		4160	5010		0.8661	0.8658	1.1420	1.1425	

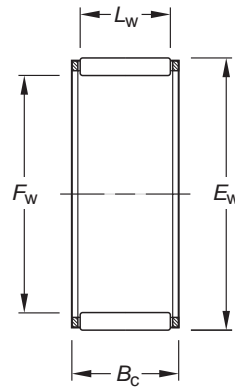
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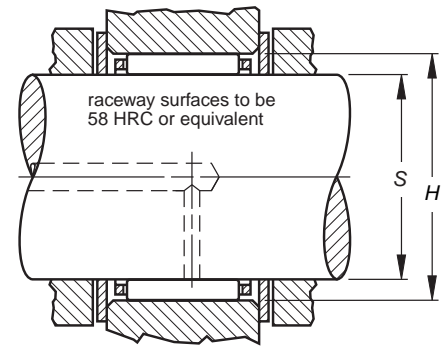
## ASSEMBLIES FOR CRANK PIN END APPLICATIONS

continued

### METRIC SERIES

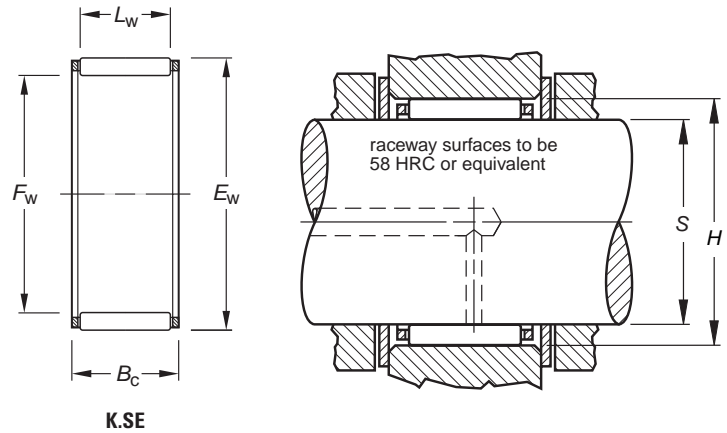


K.BE



Shaft Dia.	Dimensions mm/in.				Assembly Designation	Load Ratings kN/lbf.			Mounting Dimensions mm/in. (non-high performance engines)				Wt. kg/lbs.
	F <sub>w</sub>	E <sub>w</sub>	B <sub>c</sub>	L <sub>w</sub>		C	C <sub>0</sub>	C <sub>g</sub>	Max.	Min.	Min.	Max.	
mm									S	H			
24	24	30	13	9.8	K24X30X13BE	14.40	18.40	0.0298	24.000	23.991	30.007	30.020	0.016
	0.9449	1.1811	0.512	0.386		3240	4140		0.9449	0.9445	1.1814	1.1819	0.035
24	24	30	15	11.8	K24X30X15BE	15.30	19.70	0.0304	24.000	23.991	30.007	30.020	0.018
	0.9449	1.1811	0.591	0.465		3440	4430		0.9449	0.9445	1.1814	1.1819	0.040
24	24	30	17	13.8	K24X30X17BE	19.00	26.30	0.0326	24.000	23.991	30.007	30.020	0.021
	0.9449	1.1811	0.669	0.543		4270	5910		0.9449	0.9445	1.1814	1.1819	0.04
25	25	31	19.8	17.8	WK25X31X20BE	23.30	34.50	0.0355	25.000	24.991	31.009	31.025	0.024
	0.9843	1.2205	0.780	0.701		5240	7760		0.9843	0.9839	1.2208	1.2215	0.053
25	25	32	16	12.8	K25X32X16BE	19.20	24.30	0.0319	25.000	24.991	32.009	32.025	0.022
	0.9843	1.2598	0.630	0.504		4320	5460		0.9843	0.9839	1.2602	1.2608	0.049
25	25	32	24	19.8	K25X32X24BE	27.50	38.50	0.0358	25.000	24.991	32.009	32.025	0.035
	0.9843	1.2598	0.945	0.780		6180	8660		0.9843	0.9839	1.2602	1.2608	0.077
30	30	37	16	12.8	K30X37X16BE	21.60	29.80	0.0363	30.000	29.991	37.009	37.025	0.029
	1.1811	1.4567	0.630	0.504		4860	6700		1.1811	1.1807	1.4570	1.4577	0.064
35	35	42	20	16.8	K35X42X20BE	29.70	47.00	0.0434	35.000	34.989	42.009	42.025	0.039
	1.3780	1.6535	0.787	0.661		6680	10600		1.3780	1.3775	1.6539	1.6545	0.086

**ASSEMBLIES FOR WRIST PIN  
END APPLICATIONS  
METRIC SERIES**



**K.SE**

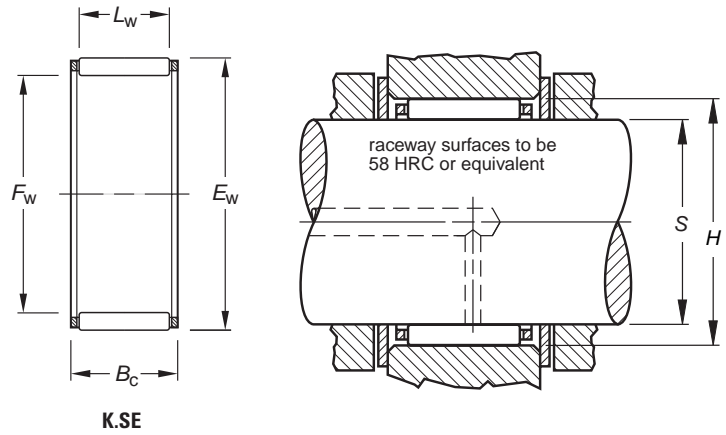
Shaft Dia.	Dimensions mm/in. -0.2 -.008 -0.55 -.022				Assembly Designation	Load Ratings kN/lbf.			Mounting Dimensions mm/in. (non-high performance engines)				Wt. kg/lbs.
	F <sub>w</sub>	E <sub>w</sub>	B <sub>c</sub>	L <sub>w</sub>		C	C <sub>0</sub>	C <sub>g</sub>	Max. S	Min. H	Min.	Max.	
mm													
9	9	12	11.5	8.4	K9X12X11,5SE	4.23	4.53	0.0296	9.000	8.994	12.006	12.017	0.003
	0.3543	0.4724	0.453	0.331		951	1020		0.3543	0.3541	0.4727	0.4731	
9	9	13	12.5	9.8	K9X13X12,5SE	5.58	5.41	0.0306	9.000	8.994	13.006	13.017	0.005
	0.3543	0.5118	0.492	0.386		1250	1220		0.3543	0.3541	0.5120	0.5125	
10	10	13	14.5	11.8	K10X13X14,5SE	5.93	7.20	0.0152	10.000	9.994	13.006	13.017	0.004
	0.3937	0.5118	0.571	0.465		1330	1620		0.3937	0.3935	0.5120	0.5125	
10	10	14	10.0	7.0	K10X14X10SE	4.62	4.36	0.0155	10.000	9.994	14.006	14.017	0.004
	0.3937	0.5512	0.394	0.276		1040	980		0.3937	0.3935	0.5514	0.5519	
12	12	15	13.0	9.8	K12X15X13SE	6.00	7.72	0.0179	12.000	11.992	15.006	15.017	0.004
	0.4724	0.5906	0.512	0.386		1350	1740		0.4724	0.4721	0.5908	0.5912	
12	12	15	15.0	11.8	K12X15X15SE	6.97	9.36	0.0153	12.000	11.992	15.006	15.017	0.005
	0.4724	0.5906	0.591	0.465		1570	2100		0.4724	0.4721	0.5908	0.5912	
12	12	15	17.5	12.8	K12X15X17,5SE	7.45	10.2	0.0196	12.000	11.992	15.006	15.017	0.006
	0.4724	0.5906	0.689	0.504		1670	2290		0.4724	0.4721	0.5908	0.5912	
12	12	16	13.0	9.8	K12X16X13SE	6.03	6.38	0.0206	12.000	11.992	16.006	16.017	0.006
	0.4724	0.6299	0.512	0.386		1360	1430		0.4724	0.4721	0.6302	0.6306	
12	12	17	13.0	9.8	K12X17X13SE	7.61	7.54	0.0210	12.000	11.992	17.006	17.017	0.007
	0.4724	0.6693	0.512	0.386		1710	1700		0.4724	0.4721	0.6695	0.6700	
12	12	17	15.0	12.5	K12X17X15SE	9.30	9.75	0.0181	12.000	11.992	17.006	17.017	0.007
	0.4724	0.6693	0.591	0.492		2090	2190		0.4724	0.4721	0.6695	0.6700	
13	13	16	14.0	9.8	K13X16X14SE	5.62	7.23	0.0184	13.000	12.992	16.006	16.017	0.005
	0.5118	0.6299	0.551	0.386		1260	1630		0.5118	0.5115	0.6302	0.6306	
13	13	17	17.7	13.8	K13X17X17,7SE	9.80	12.3	0.0196	13.000	12.992	17.006	17.017	0.008
	0.5118	0.6693	0.697	0.543		2200	2770		0.5118	0.5115	0.6695	0.6700	
13	13	18	15.0	12.5	K13X18X15SE	9.28	9.88	0.0200	13.000	12.992	18.006	18.017	0.008
	0.5118	0.7087	0.591	0.492		2090	2220		0.5118	0.5115	0.7089	0.7093	
14	14	18	13.0	9.8	K14X18X13SE	7.39	8.69	0.0220	14.000	13.992	18.006	18.017	0.007
	0.5512	0.7087	0.512	0.386		1660	1950		0.5512	0.5509	0.7089	0.7093	
14	14	18	17.0	11.8	K14X18X17SE	8.59	10.5	0.0203	14.000	13.992	18.006	18.017	0.00
	0.5512	0.7087	0.669	0.465		1930	2360		0.5512	0.5509	0.7089	0.7093	
14	14	18	21.0	14.8	K14X18X21SE	10.3	13.3	0.0208	14.000	13.992	18.006	18.017	0.011
	0.5512	0.7087	0.827	0.583		2320	2990		0.5512	0.5509	0.7089	0.7093	
15	15	19	17.0	11.8	K15X19X17SE	9.05	11.5	0.0218	15.000	14.992	19.007	19.020	0.009
	0.5906	0.7480	0.669	0.465		2030	2590		0.5906	0.5902	0.7483	0.7488	
15	15	19	19.5	15.8	K15X19X19,5SE	10.8	14.3	0.0231	15.000	14.992	19.007	19.020	0.010
	0.5906	0.7480	0.768	0.622		2430	3210		0.5906	0.5902	0.7483	0.7488	
15	15	19	20.0	15.8	K15X19X20SE	10.8	14.3	0.0229	15.000	14.992	19.007	19.020	0.010
	0.5906	0.7480	0.787	0.622		2430	3210		0.5906	0.5902	0.7483	0.7488	
16	16	20	20.0	15.8	K16X20X20SE	12.0	16.9	0.0242	16.000	15.992	20.007	20.020	0.011
	0.6299	0.7874	0.787	0.622		2700	3800		0.6299	0.6296	0.7877	0.7882	
16	16	20	22.0	15.8	K16X20X22SE	12.0	16.9	0.0242	16.000	15.992	20.007	20.020	0.013
	0.6299	0.7874	0.866	0.622		2700	3800		0.6299	0.6296	0.7877	0.7882	
16	16	20	23.0	15.8	K16X20X23SE	10.7	14.5	0.0259	16.000	15.992	20.007	20.020	0.013
	0.6299	0.7874	0.906	0.622		2410	3260		0.6299	0.6296	0.7877	0.7882	

Continued on next page.



# NEEDLE ROLLER BEARINGS

## ASSEMBLIES FOR WRIST PIN END APPLICATIONS — *continued* METRIC SERIES



Shaft Dia.	Dimensions mm/in. -0.2 -.008 -0.55 -.022				Assembly Designation	Load Ratings kN/lbf.			Mounting Dimensions mm/in. (non-high performance engines)				Wt. kg/lbs.
	F <sub>w</sub>	E <sub>w</sub>	B <sub>c</sub>	L <sub>w</sub>		C	C <sub>0</sub>	C <sub>g</sub>	Max.	Min.	Min.	Max.	
mm	F <sub>w</sub>	E <sub>w</sub>	B <sub>c</sub>	L <sub>w</sub>		C	C <sub>0</sub>	C <sub>g</sub>	S	H			
18	18	22	22.0	17.8	K18X22X22SE	14.4	22.0	0.0259	18.000	17.992	22.007	22.020	0.016
	0.7087	0.8661	0.866	0.701		3240	4950		0.7087	0.7083	0.8664	0.8669	0.035
18	18	23	20.0	15.8	K18X23X20SE	13.6	17.6	0.0249	18.000	17.992	23.007	23.020	0.015
	0.7087	0.9055	0.787	0.622		3060	3960		0.7087	0.7083	0.9058	0.9063	0.033
18	18	23	23.0	17.8	K18X23X23SE	15.9	21.6	0.0291	18.000	17.992	23.007	23.020	0.018
	0.7087	0.9055	0.906	0.701		3570	4860		0.7087	0.7083	0.9058	0.9063	0.040
19	19	24	25.5	17.8	K19X24X25.5SE	16.7	23.4	0.0268	19.000	18.991	24.007	24.020	0.022
	0.7480	0.9449	1.004	0.701		3750	5260		0.7480	0.7477	0.9452	0.9457	0.049
20	20	24	23.0	17.8	K20X24X23SE	14.8	23.7	0.0282	20.000	19.991	24.007	24.020	0.017
	0.7874	0.9449	0.906	0.701		3330	5330		0.7874	0.7870	0.9452	0.9457	0.037
20	20	25	22.0	16.8	K20X25X22SE	15.9	22.2	0.0294	20.000	19.991	25.007	25.020	0.020
	0.7874	0.9843	0.866	0.661		3570	4990		0.7874	0.7870	0.9845	0.9850	0.044
20	20	25	23.0	17.8	K20X25X23SE	17.5	25.2	0.0310	20.000	19.991	25.007	25.020	0.025
	0.7874	0.9843	0.906	0.701		3930	5670		0.7874	0.7870	0.9845	0.9850	0.055

## NEEDLE ROLLER AND CAGE RADIAL ASSEMBLIES

### INCH SERIES

Timken® Torrington® inch series needle roller and cage radial assemblies are available in a variety of sizes and designs. This catalog includes the most popular standard designs.

#### REFERENCE STANDARDS:

- **ANSI/ABMA 18.2** – Needle roller bearings – Radial, inch design.

Before selecting specific inch series, needle roller and cage radial assemblies, the engineering section of this catalog should be reviewed.

### Types Of Inch Series Needle Roller And Cage Radial Assemblies



WJ



WJC

There are two primary constructions of inch series needle roller and cage assemblies. The WJ assemblies generally employ larger diameter needle rollers whereas the WJC assemblies normally employ smaller diameter needle rollers.

### CONSTRUCTION

Needle roller and cage radial assemblies have a steel cage which provides both inward and outward retention for the needle rollers. The designs provide maximum cage strength consistent with the inherent high load ratings of needle roller bearings.

Accurate guidance of the needle rollers by the cage bars allows for operation at high speeds. Needle roller and cage assemblies have either one or two rows of needle rollers.

Also available (on request) are needle roller and cage assemblies using molded, one piece glass reinforced engineered polymer cages. These operate well at temperatures up to 250° F (120° C) over extended periods. However, care should be exercised when bearings are lubricated with oils containing additives as service life may be reduced if the operating temperature exceeds 212° F (100° C). At such high temperatures oil can deteriorate with time and it is suggested that oil change intervals are observed.

Needle rollers with relieved ends used in these assemblies are made of high carbon chrome steel, through-hardened, ground and lapped to close tolerances for diameter and roundness. See the engineering section of this catalog for further discussion of relieved end rollers.

### DIMENSIONAL ACCURACY

The nominal inch assemblies, WJ and WJC, contain needle rollers manufactured to only one diameter grade. Within any one assembly, the needle rollers have a total diameter tolerance of .0001 inch.

The limit to precision of the radial clearance of mounted needle roller and cage assemblies is the capability of the user to hold close tolerances on the inner and outer raceways.

The tolerance of the overall width of these assemblies is given on the tabular pages of this section.

### MOUNTING DIMENSIONS

The cage and needle roller assembly normally uses the shaft and housing as the inner and outer raceways. In order to realize full bearing load rating and life, the shaft and housing must have the correct geometric and metallurgical characteristics.

The tables of dimensions for these assemblies list the suggested diameters for the shaft when used as the inner raceway. These are consistent with ISO h5 shaft raceway tolerances. Additional design details for shafts used as inner raceways can be found in the engineering section of this catalog.

Since the housing normally serves as the outer raceway, it should be of sufficient cross section to maintain adequate roundness and running clearance under load. The tables of dimensions also list the suggested diameters for the housings when used as outer raceways. These are consistent with ISO G6



## NEEDLE ROLLER BEARINGS

housing bore tolerances. Additional design details for housings used as outer raceways can be found in the engineering section of this catalog.

The suggested mounting diameter tolerances for these needle roller and cage assemblies will provide correct running clearance for most applications.

The needle roller and cage assembly must be axially located by shoulders or other suitable means. End locating surfaces should be hardened to minimize wear. For satisfactory operation, minimum axial clearance should be 0.008 inch. When using type WJ assembly, fillets adjacent to the assembly must not exceed 0.03 inch radius. When it is necessary to use fillets adjacent to WJC assembly, please consult your Timken representative for suggestions.

C

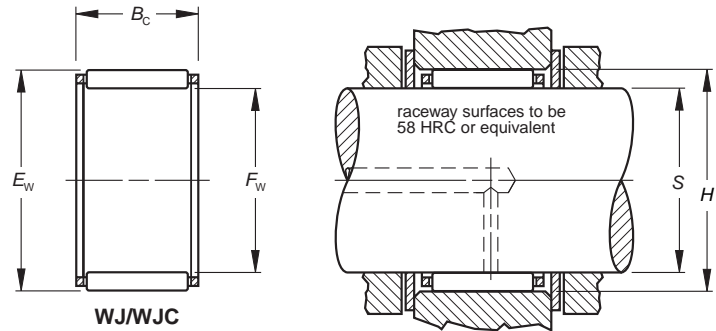
### LUBRICATION

Oil is the preferred lubricant for most applications. In critical applications involving high speeds, ample oil flow must be provided. Where assemblies are subjected to high centrifugal forces, such as in epicyclic gearing, or inertia forces, as in the small end of a connecting rod, the contact pressure between the cage and the raceway guiding surface becomes critical. The allowable contact pressure depends on a combination of the induced force and the rubbing velocity between the cage and the raceway and the rate of lubricant flow. Consult your Timken representative when cages will be subjected to high induced forces.

### SPECIAL DESIGNS

Needle roller and cage assemblies made to special dimensions or configurations, such as those that are split to assemble around a one-piece crankshaft, can be made available on special order where quantities permit. Special plated cages to enhance life under conditions of high induced forces can also be made available.

**SINGLE-ROW ASSEMBLIES**  
**INCH SERIES**



Shaft Dia.	Dimensions mm/in.			Assembly Designation	Load Ratings kN/lbf.		Limiting Speed		C <sub>g</sub>	Max.	Min.	Min.	Max.	Wt. kg/lbs.
	-0.2 -.008 -0.55 -.022				C	C <sub>0</sub>	Grease	Oil						
in.	F <sub>w</sub>	E <sub>w</sub>	B <sub>c</sub>		C	C <sub>0</sub>	RPM			S		H		
3/8	9.525 0.3750	12.700 0.5000	9.53 0.375	WJC-060806	3.87 870	4.00 900	24000	37000	0.0170	9.525 0.3750	9.520 0.3748	12.705 0.5002	12.715 0.5006	0.003 0.006
1/2	12.700 0.5000	15.875 0.6250	12.70 0.500	WJC-081008	6.23 1 400	8.01 1 800	23000	35000	0.0227	12.700 0.5000	12.692 0.4997	15.880 0.6252	15.890 0.6256	0.005 0.010
9/16	14.288 0.5625	17.463 0.6875	12.70 0.500	WJC-091108	6.81 1 530	9.25 2 080	22000	34000	0.0247	14.288 0.5625	14.280 0.5622	17.468 0.6877	17.478 0.6881	0.006 0.013
5/8	15.875 0.6250	19.050 0.7500	12.70 0.500	WJC-101208	7.03 1 580	9.96 2 240	18000	27000	0.0264	15.875 0.6250	15.867 0.6247	19.058 0.7503	19.070 0.7508	0.006 0.013
	15.875 0.6250	22.225 0.8750	15.88 0.625	WJ-101410	15.6 3 510	17.8 3 990	19000	29000	0.0280	15.875 0.6250	15.867 0.6247	22.233 0.8753	22.245 0.8758	0.012 0.027
3/4	15.875 0.6250	22.225 0.8750	22.23 0.875	WJ-101414	21.3 4 780	26.4 5 940	19000	29000	0.0309	15.875 0.6250	15.867 0.6247	22.233 0.8753	22.245 0.8758	0.017 0.038
	19.050 0.7500	25.400 1.0000	25.40 1.000	WJ-121616	26.8 6 020	37.2 8 370	16000	24000	0.0362	19.050 0.7500	19.040 0.7496	25.408 1.0003	25.420 1.0008	0.023 0.051
13/16	20.638 0.8125	26.988 1.0625	22.23 0.875	WJ-131714	25.1 5 650	35.0 7 880	14000	22000	0.0368	20.638 0.8125	20.627 0.8121	26.995 1.0628	27.008 1.0633	0.021 0.046
7/8	22.225 0.8750	28.575 1.1250	25.40 1.000	WJ-141816	29.2 6 570	43.5 9 770	13000	20000	0.0401	22.225 0.8750	22.215 0.8746	28.583 1.1253	28.595 1.1258	0.026 0.058
1	25.400 1.0000	33.338 1.3125	19.05 0.750	WJ-162112	28.1 6 320	37.1 8 340	12000	18000	0.0397	25.400 1.0000	25.390 0.9996	33.348 1.3129	33.363 1.3135	0.029 0.063
	25.400 1.0000	33.338 1.3125	25.40 1.000	WJ-162116	36.8 8 270	52.5 11 800	12000	18000	0.0432	25.400 1.0000	25.390 0.9996	33.348 1.3129	33.363 1.3135	0.038 0.084
	25.400 1.0000	33.338 1.3125	31.75 1.250	WJ-162120	44.5 10 000	67.2 15 100	12000	18000	0.0460	25.400 1.0000	25.390 0.9996	33.348 1.3129	33.363 1.3135	0.048 0.105
1 1/8	28.575 1.1250	38.100 1.5000	25.40 1.000	WJ-182416	42.4 9 520	57.8 13 000	10000	16000	0.0455	28.575 1.1250	28.565 1.1246	38.110 1.5004	38.125 1.5010	0.041 0.090
	28.575 1.1250	38.100 1.5000	31.75 1.250	WJ-182420	52 11 700	74.7 16 800	10000	16000	0.0485	28.575 1.1250	28.565 1.1246	38.110 1.5004	38.125 1.5010	0.065 0.143
1 1/4	31.750 1.2500	41.275 1.6250	19.05 0.750	WJ-202612	33.4 7 520	43.7 9 830	9300	14000	0.0443	31.750 1.2500	31.740 1.2496	41.285 1.6254	41.300 1.6260	0.043 0.094
	31.750 1.2500	41.275 1.6250	25.40 1.000	WJ-202616	44.1 9 910	62.3 14 000	9300	14000	0.0484	31.750 1.2500	31.740 1.2496	41.285 1.6254	41.300 1.6260	0.061 0.134
	31.750 1.2500	41.275 1.6250	31.75 1.250	WJ-202620	53.8 12 100	81.0 18 200	9300	14000	0.0517	31.750 1.2500	31.740 1.2496	41.285 1.6254	41.300 1.6260	0.071 0.156
	31.750 1.2500	41.275 1.6250	38.10 1.500	WJ-202624	63.6 14 300	99.6 22 400	9300	14000	0.0544	31.750 1.2500	31.740 1.2496	41.285 1.6254	41.300 1.6260	0.085 0.188
1 3/8	34.925 1.3750	44.450 1.7500	25.40 1.000	WJ-222816	45.8 10 300	67.2 15 100	8300	13000	0.0513	34.925 1.3750	34.915 1.3746	44.460 1.7504	44.475 1.7510	0.067 0.147
	34.925 1.3750	44.450 1.7500	31.75 1.250	WJ-222820	56.0 12 600	87.2 19 600	8300	13000	0.0547	34.925 1.3750	34.915 1.3746	44.460 1.7504	44.475 1.7510	0.077 0.170
1 1/2	38.100 1.5000	47.625 1.8750	25.40 1.000	WJ-243016	47.2 10 600	71.6 16 100	7600	12000	0.0541	38.100 1.5000	38.090 1.4996	47.635 1.8754	47.650 1.8760	0.078 0.172
	38.100 1.5000	47.625 1.8750	31.75 1.250	WJ-243020	57.8 13 000	93.0 20 900	7600	12000	0.0577	38.100 1.5000	38.090 1.4996	47.635 1.8754	47.650 1.8760	0.083 0.184
	38.100 1.5000	47.625 1.8750	38.10 1.500	WJ-243024	68.1 15 300	114.8 25 800	7600	12000	0.0608	38.100 1.5000	38.090 1.4996	47.635 1.8754	47.650 1.8760	0.100 0.220

Load Ratings are based on a minimum raceway hardness of 58 HRC or equivalent.

Minimum axial clearance should be .02 mm, .008 in.

Continued on next page.



# NEEDLE ROLLER BEARINGS

Shaft Dia.	Dimensions mm/in.			Assembly Designation	Load Ratings kN/bf.		Limiting Speed			Max.	Min.	Min.	Max.	Wt. kg/lbs.
	F <sub>w</sub>	E <sub>w</sub>	B <sub>c</sub>		C	C <sub>0</sub>	Grease	Oil	C <sub>g</sub>					
in.							RPM							
	<b>38.100</b>	<b>47.625</b>	<b>44.45</b>	<b>WJ-243028</b>	<b>77.4</b>	<b>135.7</b>	<b>7600</b>	<b>12000</b>	<b>0.0634</b>	<b>38.100</b>	<b>38.090</b>	<b>47.635</b>	<b>47.650</b>	<b>0.13</b>
	1.5000	1.8750	1.750		17 400	30 500				1.5000	1.4996	1.8754	1.8760	0.295
1 3/4	<b>44.450</b>	<b>53.975</b>	<b>19.05</b>	<b>WJ-283412</b>	<b>39.5</b>	<b>59.6</b>	<b>6400</b>	<b>9900</b>	<b>0.0552</b>	<b>44.450</b>	<b>44.440</b>	<b>53.985</b>	<b>54.003</b>	<b>0.058</b>
	1.7500	2.1250	0.750		8 870	13 400				1.7500	1.7496	2.1254	2.1261	0.127
	<b>44.450</b>	<b>53.975</b>	<b>25.40</b>	<b>WJ-283416</b>	<b>52.0</b>	<b>85.0</b>	<b>6400</b>	<b>9900</b>	<b>0.0603</b>	<b>44.450</b>	<b>44.440</b>	<b>53.985</b>	<b>54.003</b>	<b>0.084</b>
	1.7500	2.1250	1.000		11 700	19 100				1.7500	1.7496	2.1254	2.1261	0.185
	<b>44.450</b>	<b>53.975</b>	<b>38.10</b>	<b>WJ-283424</b>	<b>74.7</b>	<b>136</b>	<b>6400</b>	<b>9900</b>	<b>0.0677</b>	<b>44.450</b>	<b>44.440</b>	<b>53.985</b>	<b>54.003</b>	<b>0.115</b>
	1.7500	2.1250	1.500		16 800	30 600				1.7500	1.7496	2.1254	2.1261	0.253
2	<b>50.800</b>	<b>60.325</b>	<b>19.05</b>	<b>WJ-323812</b>	<b>42.8</b>	<b>69</b>	<b>5600</b>	<b>8600</b>	<b>0.0606</b>	<b>50.800</b>	<b>50.787</b>	<b>60.335</b>	<b>60.353</b>	<b>0.065</b>
	2.0000	2.3750	0.750		9 610	15 500				2.0000	1.9995	2.3754	2.3761	0.143
	<b>50.800</b>	<b>60.325</b>	<b>25.40</b>	<b>WJ-323816</b>	<b>56.5</b>	<b>98</b>	<b>5600</b>	<b>8600</b>	<b>0.0662</b>	<b>50.800</b>	<b>50.787</b>	<b>60.335</b>	<b>60.353</b>	<b>0.105</b>
	2.0000	2.3750	1.000		12 700	22 100				2.0000	1.9995	2.3754	2.3761	0.231
	<b>50.800</b>	<b>60.325</b>	<b>31.75</b>	<b>WJ-323820</b>	<b>69.0</b>	<b>127</b>	<b>5600</b>	<b>8600</b>	<b>0.0707</b>	<b>50.800</b>	<b>50.787</b>	<b>60.335</b>	<b>60.353</b>	<b>0.10</b>
	2.0000	2.3750	1.250		15 500	28 700				2.0000	1.9995	2.3754	2.3761	0.238
	<b>50.800</b>	<b>60.325</b>	<b>38.10</b>	<b>WJ-323824</b>	<b>81.0</b>	<b>157</b>	<b>5600</b>	<b>8600</b>	<b>0.0744</b>	<b>50.800</b>	<b>50.787</b>	<b>60.335</b>	<b>60.353</b>	<b>0.130</b>
	2.0000	2.3750	1.500		18 200	35 300				2.0000	1.9995	2.3754	2.3761	0.286
2 1/16	<b>52.388</b>	<b>61.913</b>	<b>25.40</b>	<b>WJ-333916</b>	<b>57.8</b>	<b>102</b>	<b>5400</b>	<b>8300</b>	<b>0.0678</b>	<b>52.388</b>	<b>52.375</b>	<b>61.923</b>	<b>61.940</b>	<b>0.099</b>
	2.0625	2.4375	1.000		13 000	23 100				2.0625	2.0620	2.4379	2.4386	0.218
2 1/8	<b>53.975</b>	<b>63.500</b>	<b>25.40</b>	<b>WJ-344016</b>	<b>52.5</b>	<b>92.08</b>	<b>5200</b>	<b>8000</b>	<b>0.0668</b>	<b>53.975</b>	<b>53.962</b>	<b>63.510</b>	<b>63.528</b>	<b>0.089</b>
	2.1250	2.5000	1.000		11 800	20 700				2.1250	2.1245	2.5004	2.5011	0.196
	<b>53.975</b>	<b>63.500</b>	<b>38.10</b>	<b>WJ-344024</b>	<b>78.3</b>	<b>153</b>	<b>5200</b>	<b>8000</b>	<b>0.0759</b>	<b>53.975</b>	<b>53.962</b>	<b>63.510</b>	<b>63.528</b>	<b>0.137</b>
	2.1250	2.5000	1.500		17 600	34 500				2.1250	2.1245	2.5004	2.5011	0.302
2 3/16	<b>55.563</b>	<b>65.088</b>	<b>19.05</b>	<b>WJ-354112</b>	<b>44.5</b>	<b>75.17</b>	<b>5000</b>	<b>7800</b>	<b>0.0644</b>	<b>55.563</b>	<b>55.550</b>	<b>65.098</b>	<b>65.115</b>	<b>0.070</b>
	2.1875	2.5625	.750		10 000	16 900				2.1875	2.1870	2.5629	2.5636	0.155
	<b>55.563</b>	<b>65.088</b>	<b>25.40</b>	<b>WJ-354116</b>	<b>57.8</b>	<b>107</b>	<b>5000</b>	<b>7800</b>	<b>0.0704</b>	<b>55.563</b>	<b>55.550</b>	<b>65.098</b>	<b>65.115</b>	<b>0.094</b>
	2.1875	2.5625	1.000		13 000	24 100				2.1875	2.1870	2.5629	2.5636	0.207
2 1/4	<b>57.150</b>	<b>66.675</b>	<b>25.40</b>	<b>WJ-364216</b>	<b>53.8</b>	<b>96.08</b>	<b>4900</b>	<b>7500</b>	<b>0.0693</b>	<b>57.150</b>	<b>57.137</b>	<b>66.685</b>	<b>66.703</b>	<b>0.096</b>
	2.2500	2.6250	1.000		12 100	21 600				2.2500	2.2495	2.6254	2.6261	0.212
	<b>57.150</b>	<b>66.675</b>	<b>31.75</b>	<b>WJ-364220</b>	<b>67.6</b>	<b>128</b>	<b>4900</b>	<b>7500</b>	<b>0.0745</b>	<b>57.150</b>	<b>57.137</b>	<b>66.685</b>	<b>66.703</b>	<b>0.120</b>
	2.2500	2.6250	1.250		15 200	28 900				2.2500	2.2495	2.6254	2.6261	0.265
2 3/8	<b>60.325</b>	<b>69.850</b>	<b>38.10</b>	<b>WJ-384424</b>	<b>81.4</b>	<b>167</b>	<b>4600</b>	<b>7100</b>	<b>0.0815</b>	<b>60.325</b>	<b>60.312</b>	<b>69.860</b>	<b>69.878</b>	<b>0.151</b>
	2.3750	2.7500	1.500		18 300	37 600				2.3750	2.3745	2.7504	2.7511	0.334
2 1/2	<b>63.500</b>	<b>73.025</b>	<b>25.40</b>	<b>WJ-404616</b>	<b>55.6</b>	<b>104</b>	<b>4400</b>	<b>6700</b>	<b>0.0741</b>	<b>63.500</b>	<b>63.487</b>	<b>73.035</b>	<b>73.053</b>	<b>0.106</b>
	2.5000	2.8750	1.000		12 500	23 400				2.5000	2.4995	2.8754	2.8761	0.234
	<b>63.500</b>	<b>73.025</b>	<b>31.75</b>	<b>WJ-404620</b>	<b>69.8</b>	<b>139</b>	<b>4400</b>	<b>6700</b>	<b>0.0797</b>	<b>63.500</b>	<b>63.487</b>	<b>73.035</b>	<b>73.053</b>	<b>0.132</b>
	2.5000	2.8750	1.250		15 700	31 400				2.5000	2.4995	2.8754	2.8761	0.292
	<b>63.500</b>	<b>73.025</b>	<b>38.10</b>	<b>WJ-404624</b>	<b>83.2</b>	<b>173</b>	<b>4400</b>	<b>6700</b>	<b>0.0842</b>	<b>63.500</b>	<b>63.487</b>	<b>73.035</b>	<b>73.053</b>	<b>0.179</b>
	2.5000	2.8750	1.500		18 700	39 100				2.5000	2.4995	2.8754	2.8761	0.395
2 3/4	<b>69.850</b>	<b>79.375</b>	<b>25.40</b>	<b>WJ-445016</b>	<b>57.8</b>	<b>112.54</b>	<b>4000</b>	<b>6100</b>	<b>0.0788</b>	<b>69.850</b>	<b>69.837</b>	<b>79.385</b>	<b>79.403</b>	<b>0.116</b>
	2.7500	3.1250	1.000		13 000	25 300				2.7500	2.7495	3.1254	3.1261	0.256
3	<b>76.200</b>	<b>85.725</b>	<b>25.40</b>	<b>WJ-485416</b>	<b>59.6</b>	<b>120.55</b>	<b>3600</b>	<b>5600</b>	<b>0.0833</b>	<b>76.200</b>	<b>76.187</b>	<b>85.738</b>	<b>85.761</b>	<b>0.126</b>
	3.0000	3.3750	1.000		13 400	27 100				3.0000	2.9995	3.3755	3.3764	0.278
	<b>76.200</b>	<b>85.725</b>	<b>38.10</b>	<b>WJ-485424</b>	<b>85.4</b>	<b>191.72</b>	<b>3600</b>	<b>5600</b>	<b>0.0935</b>	<b>76.200</b>	<b>76.187</b>	<b>85.738</b>	<b>85.761</b>	<b>0.189</b>
	3.0000	3.3750	1.500		19 200	43 100				3.0000	2.9995	3.3755	3.3764	0.416
3 1/4	<b>82.550</b>	<b>92.075</b>	<b>25.40</b>	<b>WJ-525816</b>	<b>61.4</b>	<b>128.55</b>	<b>3300</b>	<b>5100</b>	<b>0.0878</b>	<b>82.550</b>	<b>82.535</b>	<b>92.088</b>	<b>92.111</b>	<b>0.136</b>
	3.2500	3.6250	1.000		13 800	28 900				3.2500	3.2494	3.6255	3.6264	0.299
	<b>82.550</b>	<b>92.075</b>	<b>38.10</b>	<b>WJ-525824</b>	<b>88.1</b>	<b>204.62</b>	<b>3300</b>	<b>5100</b>	<b>0.0985</b>	<b>82.550</b>	<b>82.535</b>	<b>92.088</b>	<b>92.111</b>	<b>0.220</b>
	3.2500	3.6250	1.500		19 800	46 000				3.2500	3.2494	3.6255	3.6264	0.486
3 1/2	<b>88.900</b>	<b>98.425</b>	<b>25.40</b>	<b>WJ-566216</b>	<b>63.2</b>	<b>136.56</b>	<b>3100</b>	<b>4700</b>	<b>0.0922</b>	<b>88.900</b>	<b>88.885</b>	<b>98.438</b>	<b>98.461</b>	<b>0.146</b>
	3.5000	3.8750	1.000		14 200	30 700				3.5000	3.4994	3.8755	3.8764	0.321
	<b>88.900</b>	<b>101.600</b>	<b>25.40</b>	<b>WJ-566416</b>	<b>79.6</b>	<b>150.35</b>	<b>3100</b>	<b>4800</b>	<b>0.0903</b>	<b>88.900</b>	<b>88.885</b>	<b>101.613</b>	<b>101.636</b>	<b>0.197</b>
	3.5000	4.0000	1.000		17 900	33 800				3.5000	3.4994	4.0005	4.0014	0.435
	<b>88.900</b>	<b>101.600</b>	<b>38.10</b>	<b>WJ-566424</b>	<b>113</b>	<b>237.53</b>	<b>3100</b>	<b>4800</b>	<b>0.1011</b>	<b>88.900</b>	<b>88.885</b>	<b>101.613</b>	<b>101.636</b>	<b>0.296</b>
	3.5000	4.0000	1.500		25 600	53 400				3.5000	3.4994	4.0005	4.0014	0.653
4	<b>101.600</b>	<b>114.300</b>	<b>25.40</b>	<b>WJ-647216</b>	<b>83.6</b>	<b>166.59</b>	<b>2700</b>	<b>4200</b>	<b>0.0983</b>	<b>101.600</b>	<b>101.585</b>	<b>114.313</b>	<b>114.336</b>	<b>0.224</b>
	4.0000	4.5000	1.000		18 800	37 450				4.0000	3.9994	4.5005	4.5014	0.493
	<b>101.600</b>	<b>114.300</b>	<b>38.10</b>	<b>WJ-647224</b>	<b>119</b>	<b>263.33</b>	<b>2700</b>	<b>4200</b>	<b>0.1102</b>	<b>101.600</b>	<b>101.585</b>	<b>114.313</b>	<b>114.336</b>	<b>0.335</b>
	4.0000	4.5000	1.500		26 800	59 200				4.0000	3.9994	4.5005	4.5014	0.739
5	<b>127.000</b>	<b>152.400</b>	<b>38.10</b>	<b>WJ-809624</b>	<b>211</b>	<b>365.20</b>	<b>2200</b>	<b>3400</b>	<b>0.1196</b>	<b>127.000</b>	<b>126.982</b>	<b>152.415</b>	<b>152.438</b>	<b>1.018</b>
	5.0000	6.0000	1.500		47 600	82 100				5.0000	4.9993	6.0006	6.0015	2.244

Load Ratings are based on a minimum raceway hardness of 58 HRC or equivalent.

Minimum axial clearance should be .02 mm, .008 in.



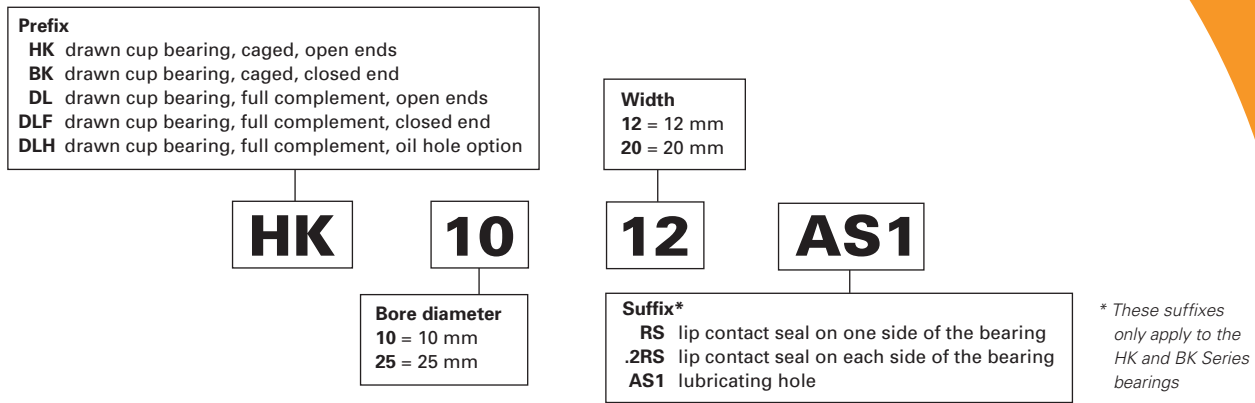
## DRAWN CUP NEEDLE ROLLER BEARINGS

**Overview:** Drawn cup needle roller bearings support radial loads and reduce friction between rotating components, with a drawn outer shell serving as a raceway for the rollers. The low cross section of the drawn cup bearing provides high load-carrying capability with minimum required space. Drawn cup bearings are easily installed with a press fit in the housing.

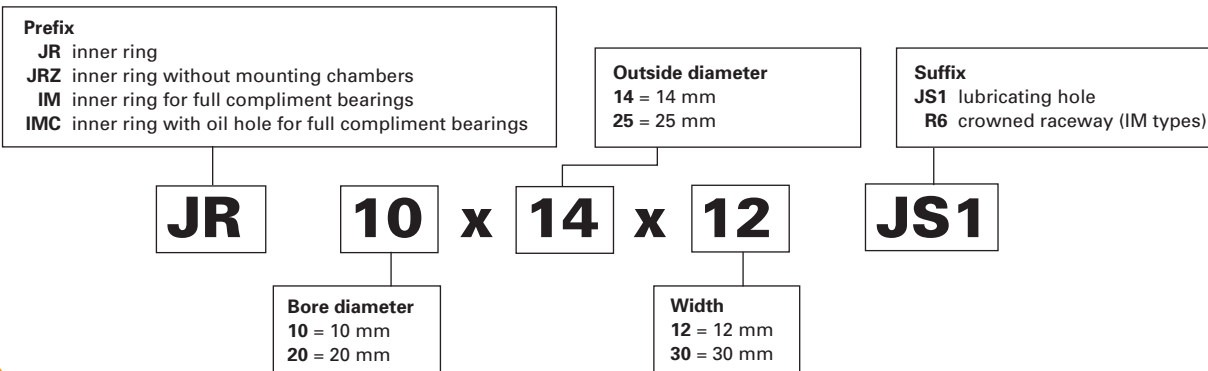
- **Sizes:** 3 mm - 60 mm bore (1/8 in. - 5 1/2 in. bore).
- **Markets:** Transmissions, transfer cases, engines, valve trains, steering and braking systems, axle supports, outboard engines, power tools, copiers, fax machines, paper-moving equipment and appliances.
- **Features:** Available in two basic designs: full complement and caged.
- **Benefits:** Full complement handles high radial load-carrying capability at a low cost. Caged provides high speed and maximum lubricant retention capability.



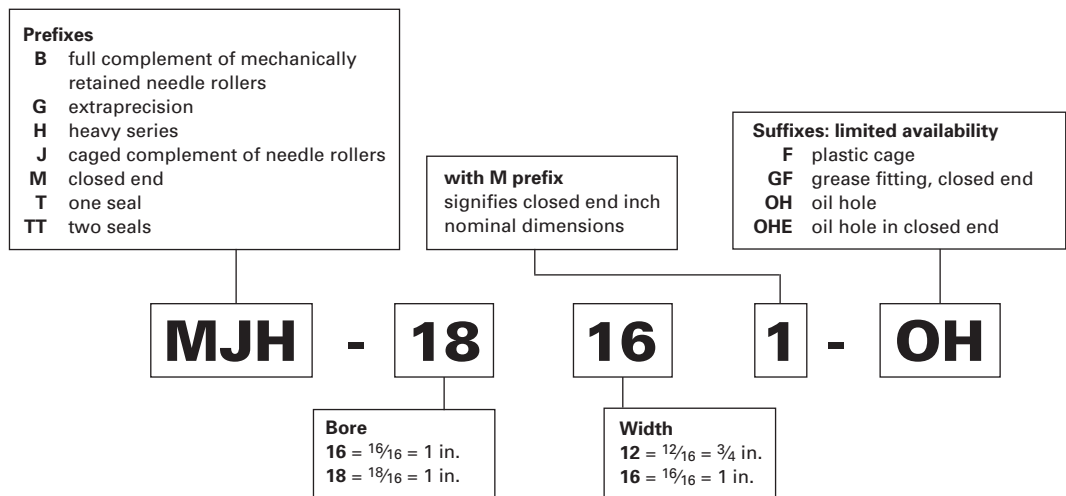
## Drawn Cup Needle Roller Bearings – Metric Nominal Dimensions



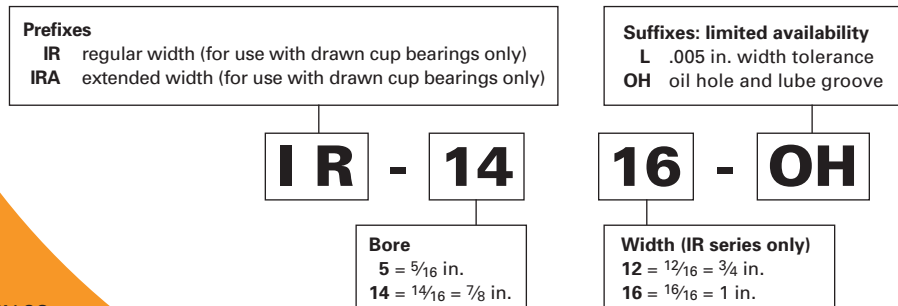
## Inner Rings – Metric Nominal Dimensions



## Drawn Cup Needle Roller Bearings – Inch Nominal Dimensions



## Inner Rings (with 4-digit number) Inch Nominal Dimensions



# ***Drawn Cup Bearings***

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Full Complement Bearings, Caged Bearings – Open Ends, Closed One End – Inch Series .....	C66
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Inner Rings for Inch Series Drawn Cup Bearings .....	C92





## DRAWN CUP NEEDLE ROLLER BEARINGS

### METRIC SERIES

When a rolling bearing is needed for a compact and economic design and where it is not practical to harden and grind the housing bore, or where the housing materials are of low rigidity such as cast iron, aluminum or even plastics, drawn cup needle roller bearings should be considered.

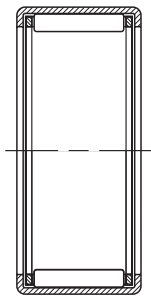
### REFERENCE STANDARDS ARE:

- **ISO 3245** – Rolling bearings – Needle roller bearings, drawn cup, without inner ring, boundary dimensions and tolerances.
- **ANSI/ABMA 18.1** – Needle roller bearings – Radial, metric design.
- **DIN 618** – Needle roller bearings with cage – Drawn cups with open end, drawn cup with closed end.

Before selecting specific drawn cup needle roller bearings, the engineering section of this catalog should be reviewed.

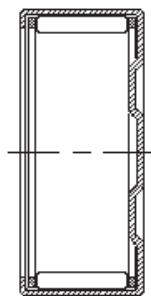
### Types Of Metric Series Drawn Cup Needle Roller Bearings

Drawn cup needle roller bearing, open ends



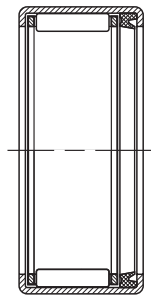
HK

Drawn cup needle roller bearing, closed end

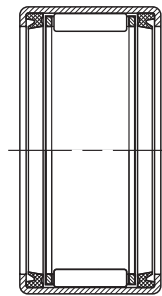


BK

Drawn cup needle roller bearings, open ends, sealed



HKRS



HK.2RS

#### Suffixes

AS1	lubricating hole
RS	one seal
.2RS	two seals

## CONSTRUCTION

The prefix letters in metric series drawn cup bearing designations denote whether the bearings are made with a full complement of needle rollers or caged needle rollers. The use of a full complement of needle rollers is indicated by the prefix code letters DL or DLF and for use of caged needle rollers by the prefix code letters HK or BK.

The outer ring, in the form of a cup, is accurately drawn and no subsequent machining is performed. Drawn cup needle roller bearings of series HK and DL have open ends. The HK Series are also available with one seal, HKRS, and with two seals, HK.2RS. The stamped lip of a drawn cup needle roller bearing of series HKRS with one seal is at the seal end.

Drawn cup needle roller bearings of series BK and DLF are closed at one end. They are used for shaft end mounting. The open end is not sealed.

The one-piece steel cage used in HK Series drawn cup bearings is designed to provide rigidity and minimize wear. This cage design separates the needle roller guiding and retention functions.

Drawn cup needle roller bearings are manufactured with two needle roller and cage assemblies. They have a lubricating hole in the outer ring. Metric series drawn cup bearings with one needle roller and cage assembly may be made available on request with a lubricating hole, indicated by suffix AS1.

### SEALED BEARINGS

The HK Series drawn cup bearings are offered with integral seals. The tables of dimensions on page C50 indicates those sizes available with lip contact seals. The seal lip design achieves a light and constant contact with the inner raceway throughout the range

of mounted bearing clearances thereby ensuring positive sealing and low frictional drag.

Sealed drawn cup bearings are intended to retain grease or non-pressurized oil within a bearing while also preventing contaminants entering the raceway area.

Details of shaft design for sealed bearings are given in the engineering section of this catalog.

The standard lip contact seals are compatible with common lubricating oils and petroleum based fuels, but they are adversely affected by certain fire-resistant hydraulic fluids and most common solvents. Sealed drawn cup bearings are normally filled with a high quality lithium soap base general purpose grease. The seal material and grease properties limit the bearing operating temperature between -30° C and +100° C.

If the operating temperature must be outside of the range for the seals mentioned here, or if the seals are exposed to unusual fluids please consult your Timken automotive representative.

## BEARING MOUNTING FITS AND INTERNAL CLEARANCE

Drawn cup bearings are manufactured to a degree of precision that will satisfy the radial clearance requirements of most applications. The total radial clearance for an installed drawn cup bearing results from the build up of manufacturing tolerances of the housing bore, the inner raceway diameter and the bearing, as well as the minimum radial clearance required for the application.

For metric series drawn cup bearings requiring close control of radial internal clearance, the suggested housing bore tolerance is N6 and h5 tolerance for the inner raceway diameter. When such exacting close control of radial internal clearance is not required, the user may select N7 housing bore and h6 inner raceway diameter tolerances.

## TOLERANCES FOR HOUSING MATERIALS OF LOW RIGIDITY

Metric series drawn cup bearings used in housings made from materials of low rigidity or steel housings of small section, the suggested housing bore tolerance is R6 (R7). To maintain normal radial internal clearance the inner raceway diameter tolerance should be h5 (h6).

## OUTER RING ROTATION

For metric series drawn cup bearing applications where the outer ring rotates with respect to the load, it is suggested that both the housing bore and the inner raceway diameter be reduced using R6 (R7) and f5 (f6) tolerance practice respectively.

## OSCILLATING MOTION

Metric series drawn cup bearing applications involving oscillating motion may require reduced radial internal clearances. This reduction may be accomplished by increasing the inner raceway diameter using j6 tolerance.

## INNER RINGS

When it becomes impractical to meet the shaft raceway design requirements (hardness, case depth, surface finish etc.) outlined in the engineering section, standard inner rings may be used with metric series drawn cup bearings. It is suggested that when metric series inner rings are used with metric series drawn cup bearings, they should be mounted with a loose transition fit on the shaft using g6 (g5) shaft diameter tolerance. The inner ring should be end-clamped against a shoulder. If a tight transition fit must be used, [shaft diameter tolerance h6 (h5)], to keep the inner ring from rotating relative to the shaft, the inner ring outside diameter, as mounted, must not exceed the raceway diameter required by the drawn cup bearing for the particular application. In case the outside diameter of the inner ring, when mounted on the shaft, exceeds the required raceway diameter for the matching drawn cup bearing, it should be ground to proper diameter while mounted on the shaft.

## LOAD RATING FACTORS

### DYNAMIC LOADS

Drawn cup needle roller bearings can accommodate only radial loads.

$$P = F_r$$

P = The maximum dynamic radial load that may be applied to a drawn cup bearing based on the dynamic load rating, C given in the tabular pages. This load should be  $\leq C/3$ .

### STATIC LOADS

$$f_0 = \frac{C_0}{P_0}$$

$f_0$  – static load safety factor

$C_0$  – basic static load rating (kN)

$P_0$  – maximum applied static load (kN)

To ensure satisfactory operation of drawn cup needle roller bearings under all types of conditions the static load safety factor  $f_0$  should be  $\geq 3$ .

### ADJUSTED RATING LIFE

When application data includes details of operating temperature, oil viscosity, operating speed and the applied load meets the  $\leq C/3$  condition adjusted rating life may be evaluated using the information given in the engineering section of this catalog.



## INSPECTION OF DRAWN CUP NEEDLE ROLLER BEARINGS

Although the bearing cup is accurately drawn from strip steel, because of its fairly thin section it may go out of round during heat treatment. When the bearing is pressed into a true round housing or ring gage, of correct size and wall thickness, it becomes round and is sized properly. For this reason, it is incorrect to inspect an unmounted drawn cup bearing by measuring the outside diameter. The correct method for inspecting the bearing size is to:

1. press the bearing into a ring gage of proper size
2. plug the bearing bore with the appropriate "go" and "no go" gages or measure it with a tapered arbor (lathe mandrel)

The "go" gage size is the minimum needle roller complement bore diameter. The "no go" gage size is larger than the maximum needle roller complement bore diameter by 0.002 mm.

TABLE 1 – HK SERIES BEARINGS

Nominal Bore Diameter mm	Ring Gage *	Dimensions – mm Needle Roller Complement Bore Diameter	
		Min.	Max.
<b>F<sub>ws min</sub></b>			
3	6.484	3.006	3.024
4	7.984	4.010	4.028
5	8.984	5.010	5.028
6	9.984	6.010	6.028
7	10.980	7.013	7.031
8	11.980	8.013	8.031
9	12.980	9.013	9.031
10	13.980	10.013	10.031
12	15.980	12.016	12.034
12	17.980	12.016	12.034
13	18.976	13.016	13.034
14	19.976	14.016	14.034
15	20.976	15.016	15.034
16	21.976	16.016	16.034
17	22.976	17.016	17.034
18	23.976	18.016	18.034
20	25.976	20.020	20.041
22	27.976	22.020	22.041
25	31.972	25.020	25.041
28	34.972	28.020	28.041
30	36.972	30.020	30.041
35	41.972	35.025	35.050
40	46.972	40.025	40.050
45	51.967	45.025	45.050
50	57.967	50.025	50.050
60	67.967	60.030	60.060

\*The ring gage sizes are in accordance with ISO N6 lower limit.

## INSTALLATION PROCEDURES

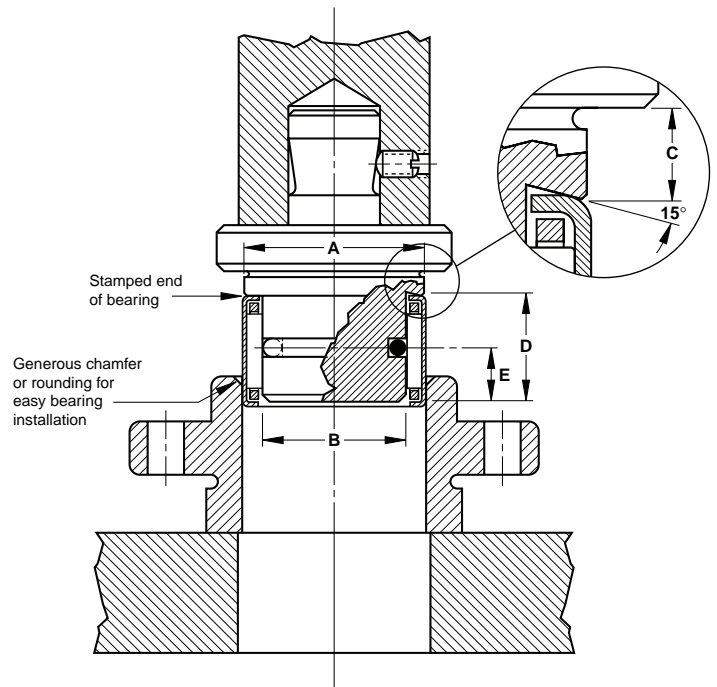
### GENERAL INSTALLATION REQUIREMENTS

- A drawn cup bearing must be pressed into its housing.
- An installation tool, similar to the one illustrated, must be used in conjunction with a standard press.
- The bearing must not be hammered into its housing even in conjunction with the proper assembly mandrel.
- The bearing must not be pressed tightly against a shoulder in the housing.
- If it is necessary to use a shouldered housing, the depth of the housing bore must be sufficient to ensure that the housing shoulder fillet, as well as the shoulder face, clears the bearing.
- The installation tool must be coaxial with the housing bore.

### INSTALLATION OF OPEN END BEARINGS

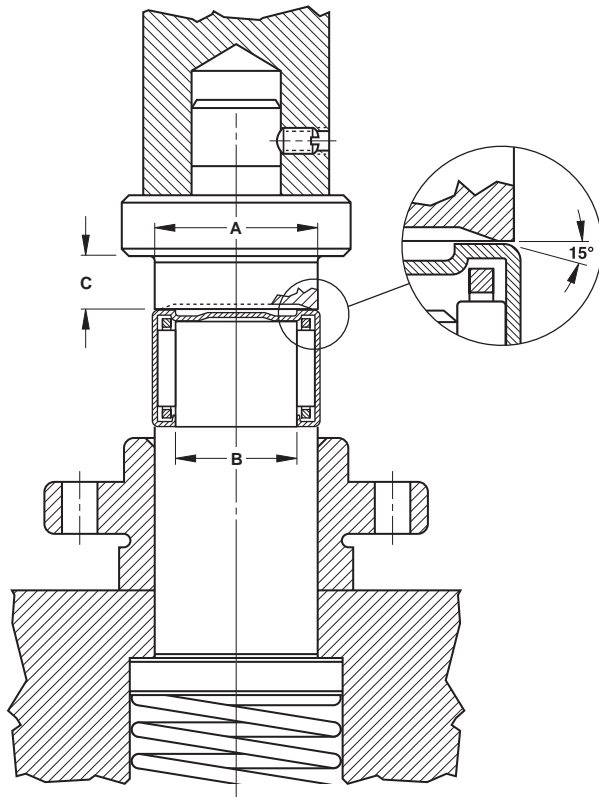
It is advisable to utilize a positive stop on the press tool to locate the bearing properly in the housing. The assembly tool should have a leader or a pilot, as shown, to aid in starting the bearing true in the housing. The "O" ring shown on the drawing may be used to assist in holding the bearing on the installation tool. The bearing should be installed with the marked end (the end with the identification markings) against the angled shoulder of the pressing tool.

- A – 0.4 mm less than housing bore
- B – 0.08 mm less than shaft diameter
- C – distance bearing will be inset into housing, minimum of 0.2 mm
- D – pilot length should be length of bearing less 0.8 mm
- E – approximately  $\frac{1}{2} D$



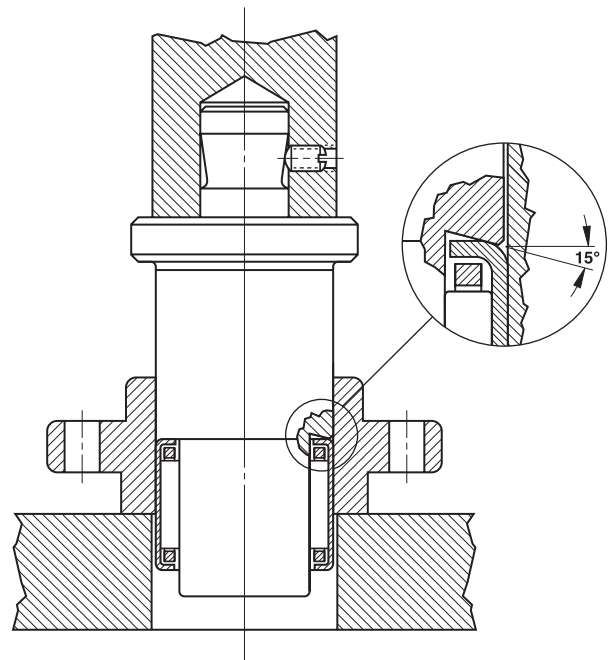
### INSTALLATION OF CLOSED END BEARINGS

Bearing can be piloted from below for installation.



### EXTRACTION FROM A STRAIGHT HOUSING

Bearing can be extracted by pushing it through the housing. After extraction, the drawn cup bearing should not be reused.

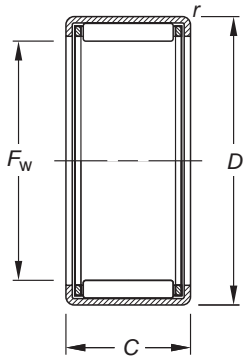




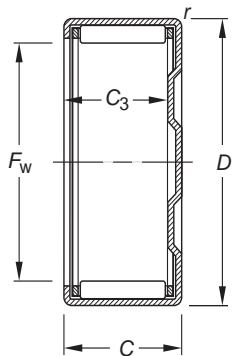


# NEEDLE ROLLER BEARINGS

## OPEN ENDS, CLOSED ONE END METRIC SERIES



HK



BK

Shaft Dia.	Dimensions mm/in.					Bearing Designation	Load Ratings kN/lbf.		Limiting Speed Approx.		C <sub>9</sub>	
	mm	F <sub>w</sub>	D	C	C <sub>3 min</sub>		r <sub>s min</sub>	Dynamic	Static	Grease		Oil
3	3	3	7	6	—	0.3	HK0306	1.6	1.14	30000	46000	0.0065
	0.1181	0.2559	0.236	—	0.012	—	360	256	—	—	—	—
4	4	4	8	8	—	0.4	HK0408	1.88	1.32	25000	39000	0.0083
	0.1575	0.315	0.315	—	0.016	—	423	297	—	—	—	—
5	5	5	9	9	7.4	0.4	BK0509	2.52	2.07	23000	36000	0.01
	0.1969	0.3543	0.354	0.291	0.016	—	567	465	—	—	—	—
	5	5	9	9	—	0.4	HK0509	2.52	2.07	23000	36000	0.01
	0.1969	0.3543	0.354	—	0.016	—	567	465	—	—	—	—
6	6	6	10	8	—	0.4	HK0608	2.34	1.95	22000	33000	0.0105
	0.2362	0.3937	0.315	—	0.016	—	526	438	—	—	—	—
	6	6	10	9	7.4	0.4	BK0609	3.14	2.85	22000	33000	0.0116
	0.2362	0.3937	0.354	0.291	0.016	—	706	641	—	—	—	—
	6	6	10	9	—	0.4	HK0609	3.15	2.94	22000	33000	0.0116
	0.2362	0.3937	0.354	—	0.016	—	708	661	—	—	—	—
7	7	7	11	9	7.4	0.4	BK0709	3.23	3.05	21000	32000	0.0125
	0.2756	0.4331	0.354	0.291	0.016	—	726	686	—	—	—	—
	7	7	11	9	—	0.4	HK0709	3.22	3.12	21000	32000	0.0125
	0.2756	0.4331	0.354	—	0.016	—	724	701	—	—	—	—
8	8	8	12	8	6.4	0.4	BK0808	2.9	2.73	20000	31000	0.0128
	0.315	0.4724	0.315	0.252	0.016	—	652	614	—	—	—	—
	8	8	12	8	—	0.4	HK0808	2.9	2.73	20000	31000	0.0128
	0.315	0.4724	0.315	—	0.016	—	652	614	—	—	—	—
	8	8	12	10	8.4	0.4	BK0810	3.93	4.14	20000	31000	0.0184
	0.315	0.4724	0.394	0.331	0.016	—	883	931	—	—	—	—
	8	8	12	10	—	0.4	HK0810	3.95	4.07	20000	31000	0.0186
	0.315	0.4724	0.394	—	0.016	—	888	915	—	—	—	—
9	9	9	13	10	8.4	0.4	BK0910	4.57	5.07	19000	30000	0.0206
	0.3543	0.5118	0.394	0.331	0.016	—	1030	1140	—	—	—	—
	9	9	13	10	—	0.4	HK0910	4.57	5.07	19000	30000	0.0206
	0.3543	0.5118	0.394	—	0.016	—	1030	1140	—	—	—	—
	9	9	13	12	10.4	0.4	BK0912	5.65	6.65	19000	30000	0.022
	0.3543	0.5118	0.472	0.409	0.016	—	1270	1490	—	—	—	—
	9	9	13	12	—	0.4	HK0912	5.65	6.65	19000	30000	0.022
	0.3543	0.5118	0.472	—	0.016	—	1270	1490	—	—	—	—
10	10	10	14	10	8.4	0.4	BK1010	4.78	5.51	19000	29000	0.0219
	0.3937	0.5512	0.394	0.331	0.016	—	1070	1240	—	—	—	—
	10	10	14	10	—	0.4	HK1010	4.78	5.51	19000	29000	0.0219
	0.3937	0.5512	0.394	—	0.016	—	1070	1240	—	—	—	—
	10	10	14	12	10.4	0.4	BK1012	5.9	7.23	19000	29000	0.0239
	0.3937	0.5512	0.472	0.409	0.016	—	1330	1630	—	—	—	—
	10	10	14	12	—	0.4	HK1012	5.9	7.23	19000	29000	0.0235
	0.3937	0.5512	0.472	—	0.016	—	1330	1630	—	—	—	—
	10	10	14	15	—	0.4	HK1015	7.49	9.81	19000	29000	0.0253
	0.3937	0.5512	0.591	—	0.016	—	1680	2210	—	—	—	—
12	12	12	16	10	8.4	0.4	BK1210	4.96	6.08	18000	28000	0.0243
	0.4724	0.6299	0.394	0.331	0.016	—	1120	1370	—	—	—	—
	12	12	16	10	—	0.4	HK1210	4.96	6.08	18000	28000	0.0243
	0.4724	0.6299	0.394	—	0.016	—	1120	1370	—	—	—	—
	12	12	18	12	9.3	1	BK1212	6.61	7.29	14000	22000	0.0245
	0.4724	0.7087	0.472	0.366	0.039	—	1490	1640	—	—	—	—
	12	12	18	12	—	1	HK1212	6.61	7.29	14000	22000	0.0245
	0.4724	0.7087	0.472	—	0.039	—	1490	1640	—	—	—	—
13	13	13	19	12	9.3	1	BK1312	6.92	7.89	14000	22000	0.0258
	0.5118	0.748	0.472	0.366	0.039	—	1560	1770	—	—	—	—
	13	13	19	12	—	1	HK1312	6.92	7.89	14000	22000	0.0258
	0.5118	0.748	0.472	—	0.039	—	1560	1770	—	—	—	—
14	14	14	20	12	9.3	1	BK1412	7.21	8.5	14000	21000	0.0271
	0.5512	0.7874	0.472	0.366	0.039	—	1620	1910	—	—	—	—



Wt. kg/lbs.	Mounting Dimensions mm/in.					Plug Gage		Matching Inner Ring	Shaft Dia. mm
	Max.	Min.	Min.	Max.	Ring Gage	Go	No-Go		
	S		H			C <sub>g</sub>			
0.001 0.002	3 0.1181	2.996 0.118	6.487 0.2554	6.495 0.2557	6.484 0.2553	3.006 0.1183	3.026 0.1191		3
0.002 0.004	4 0.1575	3.995 0.1573	7.984 0.3143	7.993 0.3147	7.984 0.3143	4.01 0.1579	4.03 0.1587		4
0.002 0.004	5 0.1969	4.995 0.1967	8.984 0.3537	8.993 0.3541	8.984 0.3537	5.01 0.1972	5.03 0.198		5
0.002 0.004	5 0.1969	4.995 0.1967	8.984 0.3537	8.993 0.3541	8.984 0.3537	5.01 0.1972	5.03 0.198		5
0.002 0.004	6 0.2362	5.995 0.236	9.984 0.3931	9.993 0.3934	9.984 0.3931	6.01 0.2366	6.03 0.2374		6
0.003 0.007	6 0.2362	5.995 0.236	9.984 0.3931	9.993 0.3934	9.984 0.3931	6.01 0.2366	6.03 0.2374		6
0.002 0.004	6 0.2362	5.995 0.236	9.984 0.3931	9.993 0.3934	9.984 0.3931	6.01 0.2366	6.03 0.2374		6
0.003 0.007	7 0.2756	6.994 0.2754	10.98 0.4323	10.991 0.4327	10.98 0.4323	7.013 0.2761	7.033 0.2769		7
0.003 0.007	7 0.2756	6.994 0.2754	10.98 0.4323	10.991 0.4327	10.98 0.4323	7.013 0.2761	7.033 0.2769		7
0.003 0.007	8 0.315	7.994 0.3147	11.98 0.4717	11.991 0.4721	11.98 0.4717	8.013 0.3155	8.033 0.3163		8
0.003 0.007	8 0.315	7.994 0.3147	11.98 0.4717	11.991 0.4721	11.98 0.4717	8.013 0.3155	8.033 0.3163		8
0.004 0.009	8 0.315	7.994 0.3147	11.98 0.4717	11.991 0.4721	11.98 0.4717	8.013 0.3155	8.033 0.3163	0.0241	JR5x8x12
0.004 0.009	8 0.315	7.994 0.3147	11.98 0.4717	11.991 0.4721	11.98 0.4717	8.013 0.3155	8.033 0.3163	0.0244	JR5x8x12
0.004 0.009	9 0.3543	8.994 0.3541	12.98 0.511	12.991 0.5115	12.98 0.511	9.013 0.3548	9.033 0.3556	0.027	JR6x9x12
0.004 0.009	9 0.3543	8.994 0.3541	12.98 0.511	12.991 0.5115	12.98 0.511	9.013 0.3548	9.033 0.3556	0.027	JR6x9x12
0.005 0.011	9 0.3543	8.994 0.3541	12.98 0.511	12.991 0.5115	12.98 0.511	9.013 0.3548	9.033 0.3556	0.0289	JR6x9x12
0.005 0.011	9 0.3543	8.994 0.3541	12.98 0.511	12.991 0.5115	12.98 0.511	9.013 0.3548	9.033 0.3556	0.0289	JR6x9x12
0.004 0.009	10 0.3937	9.994 0.3935	13.98 0.5504	13.991 0.5508	13.98 0.5504	10.013 0.3942	10.033 0.395	0.0287	JR7x10x10.5
0.004 0.009	10 0.3937	9.994 0.3935	13.98 0.5504	13.991 0.5508	13.98 0.5504	10.013 0.3942	10.033 0.395	0.0287	JR7x10x10.5
0.005 0.011	10 0.3937	9.994 0.3935	13.98 0.5504	13.991 0.5508	13.98 0.5504	10.013 0.3942	10.033 0.395	0.0314	JR7x10x12
0.005 0.011	10 0.3937	9.994 0.3935	13.98 0.5504	13.991 0.5508	13.98 0.5504	10.013 0.3942	10.033 0.395	0.0308	JR7x10x12
0.007 0.015	10 0.3937	9.994 0.3935	13.98 0.5504	13.991 0.5508	13.98 0.5504	10.013 0.3942	10.033 0.395	0.0332	JR7x10x16
0.006 0.013	12 0.4724	11.992 0.4721	15.98 0.6291	15.991 0.6296	17.98 0.7079	12.016 0.4731	12.036 0.4739	0.0319	JR8x12x10.5
0.006 0.013	12 0.4724	11.992 0.4721	15.98 0.6291	15.991 0.6296	17.98 0.7079	12.016 0.4731	12.036 0.4739	0.0319	JR8x12x10.5
0.012 0.026	12 0.4724	11.992 0.4721	17.98 0.7079	17.991 0.7083	17.98 0.7079	12.016 0.4731	12.036 0.4739	0.0321	JR8x12x12.5
0.01 0.022	12 0.4724	11.992 0.4721	17.98 0.7079	17.991 0.7083	17.98 0.7079	12.016 0.4731	12.036 0.4739	0.0321	JR8x12x12.5
0.012 0.026	13 0.5118	12.992 0.5115	18.976 0.7471	18.989 0.7476	18.976 0.7471	13.016 0.5124	13.036 0.5132	0.0338	JR10x13x12.5
0.01 0.022	13 0.5118	12.992 0.5115	18.976 0.7471	18.989 0.7476	18.976 0.7471	13.016 0.5124	13.036 0.5132	0.0338	JR10x13x12.5
0.014 0.031	14 0.5512	13.992 0.5509	19.976 0.7865	19.989 0.787	19.976 0.7865	14.016 0.5518	14.036 0.5526	0.0356	JR10x14x12

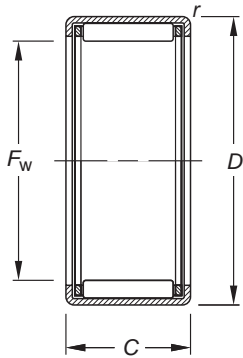
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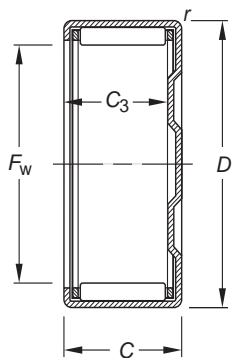
# NEEDLE ROLLER BEARINGS

## OPEN ENDS, CLOSED ONE END METRIC SERIES

continued



HK



BK

Shaft Dia.	Dimensions mm/in.					Bearing Designation	Load Ratings kN/lbf.		Limiting Speed Approx.		C <sub>9</sub>
	mm	F <sub>w</sub>	D	C	C <sub>3 min</sub>		r <sub>s min</sub>	Dynamic	Static	Grease	
	14	20	12	—	1	HK1412	7.21	8.5	14000	21000	0.0271
	0.5512	0.7874	0.472		0.039		1620	1910			
15	15	21	12	9.3	1	BK1512	7.16	8.57	14000	21000	0.0284
	0.5906	0.8268	0.472	0.366	0.039		1610	1930			
	15	21	12	—	1	HK1512	7.49	9.11	14000	21000	0.0284
	0.5906	0.8268	0.472		0.039		1680	2050			
	15	21	16	13.3	1	BK1516	10.7	14.4	14000	21000	0.0318
	0.5906	0.8268	0.63	0.524	0.039		2410	3240			
	15	21	16	—	1	HK1516	10.7	14.4	14000	21000	0.0318
	0.5906	0.8268	0.63		0.039		2410	3240			
	15	21	22	19.3	1	BK1522	13.5	19.4	14000	21000	0.0288
	0.5906	0.8268	0.866	0.76	0.039		3030	4360			
	15	21	22	—	1	HK1522	13.5	19.4	14000	21000	0.0288
	0.5906	0.8268	0.866		0.039		3030	4360			
16	16	22	12	9.3	1	BK1612	7.76	9.72	14000	21000	0.0297
	0.6299	0.8661	0.472	0.366	0.039		1740	2190			
	16	22	12	—	1	HK1612	7.76	7.72	14000	21000	0.0297
	0.6299	0.8661	0.472		0.039		1740	1740			
	16	22	16	13.3	1	BK1616	11.1	15.3	14000	21000	0.0332
	0.6299	0.8661	0.63	0.524	0.039		2500	3440			
	16	22	16	—	1	HK1616	11.1	15.3	14000	21000	0.0332
	0.6299	0.8661	0.63		0.039		2500	3440			
	16	22	22	19.3	1	BK1622	13.4	19.5	14000	21000	0.0297
	0.6299	0.8661	0.866	0.76	0.039		3010	4380			
	16	22	22	—	1	HK1622	13.4	19.5	14000	21000	0.0297
	0.6299	0.8661	0.866		0.039		3010	4380			
17	17	23	12	9.3	1	BK1712	8.12	10.4	13000	20000	0.0236
	0.6693	0.9055	0.472	0.366	0.039		1830	2340			
	17	23	12	—	1	HK1712	8.12	10.4	13000	20000	0.0236
	0.6693	0.9055	0.472		0.039		1830	2340			
18	18	24	12	—	1	HK1812	8.41	11.11	12000	18000	0.0246
	0.7087	0.9449	0.472		0.039		1890	2500			
	18	24	16	13.3	1	BK1816	11.6	16.8	12000	18000	0.0357
	0.7087	0.9449	0.63	0.524	0.039		2610	3780			
	18	24	16	—	1	HK1816	11.6	16.8	12000	18000	0.0357
	0.7087	0.9449	0.63		0.039		2610	3780			
20	20	26	12	9.3	1	BK2012	8.97	12.5	11000	16000	0.0347
	0.7874	1.0236	0.472	0.366	0.039		2020	2810			
	20	26	12	—	1	HK2012	8.97	12.5	11000	16000	0.0347
	0.7874	1.0236	0.472		0.039		2020	2810			
	20	26	16	13.3	1	BK2016	12.4	18.9	11000	16000	0.0385
	0.7874	1.0236	0.63	0.524	0.039		2790	4250			
	20	26	16	—	1	HK2016	12.4	18.9	11000	16000	0.0385
	0.7874	1.0236	0.63		0.039		2790	4250			
	20	26	20	17.3	1	BK2020	15.5	25.3	11000	16000	0.0414
	0.7874	1.0236	0.787	0.681	0.039		3480	5690			
	20	26	20	—	1	HK2020	15.9	26.2	11000	16000	0.0414
	0.7874	1.0236	0.787		0.039		3570	5890			
	20	26	30	27.3	1	BK2030	21.2	37.8	11000	16000	0.0385
	0.7874	1.0236	1.181	1.075	0.039		4770	8500			
	20	26	30	—	1	HK2030	21.2	37.8	11000	16000	0.0385
	0.7874	1.0236	1.181		0.039		4770	8500			
22	22	28	12	9.3	1	BK2212	9.81	14.5	9600	15000	0.0375
	0.8661	1.1024	0.472	0.366	0.039		2210	3260			
	22	28	12	—	1	HK2212	9.81	14.5	9600	15000	0.0382
	0.8661	1.1024	0.472		0.039		2210	3260			
	22	28	16	13.3	1	BK2216	13.1	20.9	9600	15000	0.0412
	0.8661	1.1024	0.63	0.524	0.039		2940	4700			

Wt. kg/lbs	Mounting Dimensions mm/in.						Plug Gage		Matching Inner Ring	Shaft Dia.  mm
	Max.	Min.	Min.	Max.	Ring Gage	Go	No-Go	C <sub>g</sub>		
	S		H							
<b>0.011</b> 0.024	<b>14</b> 0.5512	<b>13.992</b> 0.5509	<b>19.976</b> 0.7865	<b>19.989</b> 0.787	<b>19.976</b> 0.7865	<b>14.016</b> 0.5518	<b>14.036</b> 0.5526	<b>0.0356</b>	JR10x14x12	
<b>0.015</b> 0.033	<b>15</b> 0.5906	<b>14.992</b> 0.5902	<b>20.976</b> 0.8258	<b>20.989</b> 0.8263	<b>20.976</b> 0.8258	<b>15.016</b> 0.5912	<b>15.036</b> 0.592	<b>0.0373</b>	JR12x15x12.5	<b>15</b>
<b>0.011</b> 0.024	<b>15</b> 0.5906	<b>14.992</b> 0.5902	<b>20.976</b> 0.8258	<b>20.989</b> 0.8263	<b>20.976</b> 0.8258	<b>15.016</b> 0.5912	<b>15.036</b> 0.592	<b>0.0373</b>	JR12x15x12.5	
<b>0.019</b> 0.042	<b>15</b> 0.5906	<b>14.992</b> 0.5902	<b>20.976</b> 0.8258	<b>20.989</b> 0.8263	<b>20.976</b> 0.8258	<b>15.016</b> 0.5912	<b>15.036</b> 0.592	<b>0.0417</b>	JR12x15x16.5	
<b>0.016</b> 0.035	<b>15</b> 0.5906	<b>14.992</b> 0.5902	<b>20.976</b> 0.8258	<b>20.989</b> 0.8263	<b>20.976</b> 0.8258	<b>15.016</b> 0.5912	<b>15.036</b> 0.592	<b>0.0417</b>	JR12x15x16.5	
<b>0.025</b> 0.055	<b>15</b> 0.5906	<b>14.992</b> 0.5902	<b>20.976</b> 0.8258	<b>20.989</b> 0.8263	<b>20.976</b> 0.8258	<b>15.016</b> 0.5912	<b>15.036</b> 0.592	<b>0.0378</b>	JR12x15x22.5	
<b>0.024</b> 0.053	<b>15</b> 0.5906	<b>14.992</b> 0.5902	<b>20.976</b> 0.8258	<b>20.989</b> 0.8263	<b>20.976</b> 0.8258	<b>15.016</b> 0.5912	<b>15.036</b> 0.592	<b>0.0378</b>	JR12x15x22.5	
<b>0.016</b> 0.035	<b>16</b> 0.6299	<b>15.992</b> 0.6296	<b>21.976</b> 0.8652	<b>21.989</b> 0.8657	<b>21.976</b> 0.8652	<b>16.016</b> 0.6306	<b>16.036</b> 0.6313	<b>0.039</b>	JR12x16x12	<b>16</b>
<b>0.012</b> 0.026	<b>16</b> 0.6299	<b>15.992</b> 0.6296	<b>21.976</b> 0.8652	<b>21.989</b> 0.8657	<b>21.976</b> 0.8652	<b>16.016</b> 0.6306	<b>16.036</b> 0.6313	<b>0.039</b>	JR12x16x12	
<b>0.02</b> 0.044	<b>16</b> 0.6299	<b>15.992</b> 0.6296	<b>21.976</b> 0.8652	<b>21.989</b> 0.8657	<b>21.976</b> 0.8652	<b>16.016</b> 0.6306	<b>16.036</b> 0.6313	<b>0.0436</b>	JR12x16x16	
<b>0.018</b> 0.04	<b>16</b> 0.6299	<b>15.992</b> 0.6296	<b>21.976</b> 0.8652	<b>21.989</b> 0.8657	<b>21.976</b> 0.8652	<b>16.016</b> 0.6306	<b>16.036</b> 0.6313	<b>0.0436</b>	JR12x16x16	
<b>0.028</b> 0.062	<b>16</b> 0.6299	<b>15.992</b> 0.6296	<b>21.976</b> 0.8652	<b>21.989</b> 0.8657	<b>21.976</b> 0.8652	<b>16.016</b> 0.6306	<b>16.036</b> 0.6313	<b>0.039</b>	JR12x16x22	
<b>0.022</b> 0.049	<b>16</b> 0.6299	<b>15.992</b> 0.6296	<b>21.976</b> 0.8652	<b>21.989</b> 0.8657	<b>21.976</b> 0.8652	<b>16.016</b> 0.6306	<b>16.036</b> 0.6313	<b>0.039</b>	JR12x16x22	
<b>0.018</b> 0.04	<b>17</b> 0.6693	<b>16.992</b> 0.669	<b>22.976</b> 0.9046	<b>22.989</b> 0.9051	<b>22.976</b> 0.9046	<b>17.016</b> 0.6699	<b>17.036</b> 0.6707			<b>17</b>
<b>0.013</b> 0.029	<b>17</b> 0.6693	<b>16.992</b> 0.669	<b>22.976</b> 0.9046	<b>22.989</b> 0.9051	<b>22.976</b> 0.9046	<b>17.016</b> 0.6699	<b>17.036</b> 0.6707			
<b>0.015</b> 0.033	<b>18</b> 0.7087	<b>17.992</b> 0.7083	<b>23.976</b> 0.9439	<b>23.989</b> 0.9444	<b>23.976</b> 0.9439	<b>18.016</b> 0.7093	<b>18.036</b> 0.7101			<b>18</b>
<b>0.022</b> 0.049	<b>18</b> 0.7087	<b>17.992</b> 0.7083	<b>23.976</b> 0.9439	<b>23.989</b> 0.9444	<b>23.976</b> 0.9439	<b>18.016</b> 0.7093	<b>18.036</b> 0.7101	<b>0.0468</b>	JR15x18x16.5	
<b>0.018</b> 0.04	<b>18</b> 0.7087	<b>17.992</b> 0.7083	<b>23.976</b> 0.9439	<b>23.989</b> 0.9444	<b>23.976</b> 0.9439	<b>18.016</b> 0.7093	<b>18.036</b> 0.7101	<b>0.0468</b>	JR15x18x16.5	
<b>0.017</b> 0.037	<b>20</b> 0.7874	<b>19.991</b> 0.787	<b>25.976</b> 1.0227	<b>25.989</b> 1.0232	<b>25.976</b> 1.0227	<b>20.02</b> 0.7882	<b>20.043</b> 0.7891	<b>0.0455</b>	JR15x20x12	<b>20</b>
<b>0.016</b> 0.035	<b>20</b> 0.7874	<b>19.991</b> 0.787	<b>25.976</b> 1.0227	<b>25.989</b> 1.0232	<b>25.976</b> 1.0227	<b>20.02</b> 0.7882	<b>20.043</b> 0.7891	<b>0.0455</b>	JR15x20x12	
<b>0.022</b> 0.049	<b>20</b> 0.7874	<b>19.991</b> 0.787	<b>25.976</b> 1.0227	<b>25.989</b> 1.0232	<b>25.976</b> 1.0227	<b>20.02</b> 0.7882	<b>20.043</b> 0.7891	<b>0.0505</b>	JR17x20x16.5	
<b>0.022</b> 0.049	<b>20</b> 0.7874	<b>19.991</b> 0.787	<b>25.976</b> 1.0227	<b>25.989</b> 1.0232	<b>25.976</b> 1.0227	<b>20.02</b> 0.7882	<b>20.043</b> 0.7891	<b>0.0505</b>	JR17x20x16.5	
<b>0.027</b> 0.06	<b>20</b> 0.7874	<b>19.991</b> 0.787	<b>25.976</b> 1.0227	<b>25.989</b> 1.0232	<b>25.976</b> 1.0227	<b>20.02</b> 0.7882	<b>20.043</b> 0.7891	<b>0.0543</b>	JR17x20x20.5	
<b>0.025</b> 0.055	<b>20</b> 0.7874	<b>19.991</b> 0.787	<b>25.976</b> 1.0227	<b>25.989</b> 1.0232	<b>25.976</b> 1.0227	<b>20.02</b> 0.7882	<b>20.043</b> 0.7891	<b>0.0543</b>	JR17x20x20.5	
<b>0.043</b> 0.095	<b>20</b> 0.7874	<b>19.991</b> 0.787	<b>25.976</b> 1.0227	<b>25.989</b> 1.0232	<b>25.976</b> 1.0227	<b>20.02</b> 0.7882	<b>20.043</b> 0.7891	<b>0.0505</b>	JR17x20x30.5	
<b>0.041</b> 0.09	<b>20</b> 0.7874	<b>19.991</b> 0.787	<b>25.976</b> 1.0227	<b>25.989</b> 1.0232	<b>25.976</b> 1.0227	<b>20.02</b> 0.7882	<b>20.043</b> 0.7891	<b>0.0505</b>	JR17x20x30.5	
<b>0.02</b> 0.044	<b>22</b> 0.8661	<b>21.991</b> 0.8658	<b>27.976</b> 1.1014	<b>27.989</b> 1.1019	<b>27.976</b> 1.1014	<b>22.02</b> 0.8669	<b>22.043</b> 0.8678	<b>0.0492</b>	JR17x22x13	<b>22</b>
<b>0.015</b> 0.033	<b>22</b> 0.8661	<b>21.991</b> 0.8658	<b>27.976</b> 1.1014	<b>27.989</b> 1.1019	<b>27.976</b> 1.1014	<b>22.02</b> 0.8669	<b>22.043</b> 0.8678	<b>0.0501</b>	JR17x22x13	
<b>0.027</b> 0.06	<b>22</b> 0.8661	<b>21.991</b> 0.8658	<b>27.976</b> 1.1014	<b>27.989</b> 1.1019	<b>27.976</b> 1.1014	<b>22.02</b> 0.8669	<b>22.043</b> 0.8678	<b>0.0541</b>	JR17x22x16	

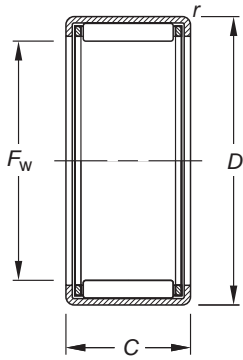
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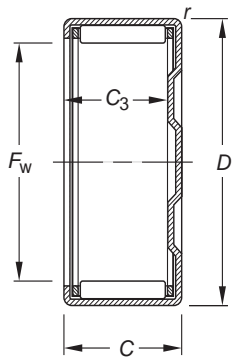
# NEEDLE ROLLER BEARINGS

## OPEN ENDS, CLOSED ONE END METRIC SERIES

continued



HK



BK

Shaft Dia.	Dimensions mm/in.					Bearing Designation	Load Ratings kN/lbf.		Limiting Speed Approx.		C <sub>9</sub>
	mm	F <sub>w</sub>	D	C	C <sub>3 min</sub>		r <sub>s min</sub>	Dynamic	Static	Grease	
	22	28	16	—	1	HK2216	13.1	20.9	9600	15000	0.0412
	0.8661	1.1024	0.63	—	0.039		2940	4700			
	22	28	20	17.3	1	BK2220	15.3	25.5	9600	15000	0.0432
	0.8661	1.1024	0.787	0.681	0.039		3440	5730			
	22	28	20	—	1	HK2220	15.3	25.5	9600	15000	0.0432
	0.8661	1.1024	0.787	—	0.039		3440	5730			
25	25	32	12	—	1	HK2512	10.9	14.7	8500	13000	0.0295
	0.9843	1.2598	0.472	—	0.039		2450	3300			
	25	32	16	13.3	1	BK2516	15.6	23.5	8500	13000	0.0434
	0.9843	1.2598	0.63	0.524	0.039		3510	5280			
	25	32	16	—	1	HK2516	15.6	23.5	8500	13000	0.0434
	0.9843	1.2598	0.63	—	0.039		3510	5280			
	25	32	20	17.3	1	BK2520	20.6	33.4	8500	13000	0.0474
	0.9843	1.2598	0.787	0.681	0.039		4630	7510			
	25	32	20	—	1	HK2520	20.6	33.4	8500	13000	0.0474
	0.9843	1.2598	0.787	—	0.039		4630	7510			
	25	32	26	23.3	1	BK2526	25.7	44.4	8500	13000	0.0508
	0.9843	1.2598	1.024	0.917	0.039		5780	9980			
	25	32	26	—	1	HK2526	25.7	44.4	8500	13000	0.0508
	0.9843	1.2598	1.024	—	0.039		5780	9980			
	25	32	38	35.3	1	BK2538	35.3	66.9	8500	13000	0.0474
	0.9843	1.2598	1.496	1.39	0.039		7940	15000			
	25	32	38	—	1	HK2538	35.3	66.9	8500	13000	0.0474
	0.9843	1.2598	1.496	—	0.039		7940	15000			
28	28	35	16	—	1	HK2816	15.9	24.9	7500	12000	0.0462
	1.1024	1.378	0.63	—	0.039		3570	5600			
	28	35	20	17.3	1	BK2820	20.9	35.3	7500	12000	0.0504
	1.1024	1.378	0.787	0.681	0.039		4700	7940			
	28	35	20	—	1	HK2820	20.9	35.3	7500	12000	0.0504
	1.1024	1.378	0.787	—	0.039		4700	7940			
30	30	37	12	9.3	1	BK3012	11.6	16.8	7000	11000	0.033
	1.1811	1.4567	0.472	0.366	0.039		2610	3780			
	30	37	12	—	1	HK3012	12	17.7	7000	11000	0.033
	1.1811	1.4567	0.472	—	0.039		2700	3980			
	30	37	16	—	1	HK3016	16.8	27.3	7000	11000	0.0488
	1.1811	1.4567	0.63	—	0.039		3780	6140			
	30	37	20	17.3	1	BK3020	22.4	39.6	7000	11000	0.0537
	1.1811	1.4567	0.787	0.681	0.039		5040	8900			
	30	37	20	—	1	HK3020	22.4	39.6	7000	11000	0.0537
	1.1811	1.4567	0.787	—	0.039		5040	8900			
	30	37	26	23.3	1	BK3026	27.4	51.2	7000	11000	0.057
	1.1811	1.4567	1.024	0.917	0.039		6160	11500			
	30	37	26	—	1	HK3026	27.4	51.2	7000	11000	0.0571
	1.1811	1.4567	1.024	—	0.039		6160	11500			
	30	37	38	35.3	1	BK3038	38.4	79.2	7000	11000	0.0535
	1.1811	1.4567	1.496	1.39	0.039		8630	17800			
	30	37	38	—	1	HK3038	38.4	79.2	7000	11000	0.0535
	1.1811	1.4567	1.496	—	0.039		8630	17800			
35	35	42	12	—	1	HK3512	13	20.6	5900	9100	0.0365
	1.378	1.6535	0.472	—	0.039		2920	4630			
	35	42	16	—	1	HK3516	17.4	29.9	5900	9100	0.0534
	1.378	1.6535	0.63	—	0.039		3910	6720			
	35	42	20	17.3	1	BK3520	24.5	46.8	5900	9100	0.0597
	1.378	1.6535	0.787	0.681	0.039		5510	10520			
	35	42	20	—	1	HK3520	24.5	46.8	5900	9100	0.0597
	1.378	1.6535	0.787	—	0.039		5510	10500			
40	40	47	12	—	1	HK4012	14.7	25.3	5200	7900	0.0402
	1.5748	1.8504	0.472	—	0.039		3300	5690			

Wt. kg/lbs	Mounting Dimensions mm/in.					Plug Gage		Matching Inner Ring	Shaft Dia. mm
	Max.	Min.	Min.	Max.	Ring Gage	Go	No-Go		
	S		H			C <sub>g</sub>			
<b>0.022</b> 0.049	<b>22</b> 0.8661	<b>21.991</b> 0.8658	<b>27.976</b> 1.1014	<b>27.989</b> 1.1019	<b>27.976</b> 1.1014	<b>22.02</b> 0.8669	<b>22.043</b> 0.8678	<b>0.0541</b>	JR17x22x16
<b>0.028</b> 0.062	<b>22</b> 0.8661	<b>21.991</b> 0.8658	<b>27.976</b> 1.1014	<b>27.989</b> 1.1019	<b>27.976</b> 1.1014	<b>22.02</b> 0.8669	<b>22.043</b> 0.8678	<b>0.0567</b>	JR17x22x23
<b>0.026</b> 0.057	<b>22</b> 0.8661	<b>21.991</b> 0.8658	<b>27.976</b> 1.1014	<b>27.989</b> 1.1019	<b>27.976</b> 1.1014	<b>22.02</b> 0.8669	<b>22.043</b> 0.8678	<b>0.0567</b>	JR17x22x23
<b>0.021</b> 0.046	<b>25</b> 0.9843	<b>24.991</b> 0.9839	<b>31.972</b> 1.2587	<b>31.988</b> 1.2594	<b>31.972</b> 1.2587	<b>25.02</b> 0.985	<b>25.043</b> 0.9859		<b>25</b>
<b>0.031</b> 0.068	<b>25</b> 0.9843	<b>24.991</b> 0.9839	<b>31.972</b> 1.2587	<b>31.988</b> 1.2594	<b>31.972</b> 1.2587	<b>25.02</b> 0.985	<b>25.043</b> 0.9859	<b>0.0569</b>	JR20x25x17
<b>0.028</b> 0.062	<b>25</b> 0.9843	<b>24.991</b> 0.9839	<b>31.972</b> 1.2587	<b>31.988</b> 1.2594	<b>31.972</b> 1.2587	<b>25.02</b> 0.985	<b>25.043</b> 0.9859	<b>0.0569</b>	JR20x25x17
<b>0.043</b> 0.095	<b>25</b> 0.9843	<b>24.991</b> 0.9839	<b>31.972</b> 1.2587	<b>31.988</b> 1.2594	<b>31.972</b> 1.2587	<b>25.02</b> 0.985	<b>25.043</b> 0.9859	<b>0.0622</b>	JR20x25x20.5
<b>0.04</b> 0.088	<b>25</b> 0.9843	<b>24.991</b> 0.9839	<b>31.972</b> 1.2587	<b>31.988</b> 1.2594	<b>31.972</b> 1.2587	<b>25.02</b> 0.985	<b>25.043</b> 0.9859	<b>0.0622</b>	JR20x25x20.5
<b>0.048</b> 0.106	<b>25</b> 0.9843	<b>24.991</b> 0.9839	<b>31.972</b> 1.2587	<b>31.988</b> 1.2594	<b>31.972</b> 1.2587	<b>25.02</b> 0.985	<b>25.043</b> 0.9859	<b>0.0666</b>	JR20x25x26.5
<b>0.046</b> 0.101	<b>25</b> 0.9843	<b>24.991</b> 0.9839	<b>31.972</b> 1.2587	<b>31.988</b> 1.2594	<b>31.972</b> 1.2587	<b>25.02</b> 0.985	<b>25.043</b> 0.9859	<b>0.0666</b>	JR20x25x26.5
<b>0.077</b> 0.17	<b>25</b> 0.9843	<b>24.991</b> 0.9839	<b>31.972</b> 1.2587	<b>31.988</b> 1.2594	<b>31.972</b> 1.2587	<b>25.02</b> 0.985	<b>25.043</b> 0.9859	<b>0.0622</b>	JR20x25x38.5
<b>0.073</b> 0.161	<b>25</b> 0.9843	<b>24.991</b> 0.9839	<b>31.972</b> 1.2587	<b>31.988</b> 1.2594	<b>31.972</b> 1.2587	<b>25.02</b> 0.985	<b>25.043</b> 0.9859	<b>0.0622</b>	JR20x25x38.5
<b>0.032</b> 0.071	<b>28</b> 1.1024	<b>27.991</b> 1.102	<b>34.972</b> 1.3769	<b>34.988</b> 1.3775	<b>34.972</b> 1.3769	<b>28.02</b> 1.1031	<b>28.043</b> 1.1041	<b>0.0606</b>	JR22x28x17
<b>0.047</b> 0.104	<b>28</b> 1.1024	<b>27.991</b> 1.102	<b>34.972</b> 1.3769	<b>34.988</b> 1.3775	<b>34.972</b> 1.3769	<b>28.02</b> 1.1031	<b>28.043</b> 1.1041	<b>0.0661</b>	JR22x28x20.5
<b>0.04</b> 0.088	<b>28</b> 1.1024	<b>27.991</b> 1.102	<b>34.972</b> 1.3769	<b>34.988</b> 1.3775	<b>34.972</b> 1.3769	<b>28.02</b> 1.1031	<b>28.043</b> 1.1041	<b>0.0661</b>	JR22x28x20.5
<b>0.031</b> 0.068	<b>30</b> 1.1811	<b>29.991</b> 1.1807	<b>36.972</b> 1.4556	<b>36.988</b> 1.4562	<b>36.972</b> 1.4556	<b>30.02</b> 1.1819	<b>30.043</b> 1.1828		<b>30</b>
<b>0.042</b> 0.093	<b>30</b> 1.1811	<b>29.991</b> 1.1807	<b>36.972</b> 1.4556	<b>36.988</b> 1.4562	<b>36.972</b> 1.4556	<b>30.02</b> 1.1819	<b>30.043</b> 1.1828		
<b>0.032</b> 0.071	<b>30</b> 1.1811	<b>29.991</b> 1.1807	<b>36.972</b> 1.4556	<b>36.988</b> 1.4562	<b>36.972</b> 1.4556	<b>30.02</b> 1.1819	<b>30.043</b> 1.1828	<b>0.064</b>	JR25x30x17
<b>0.053</b> 0.117	<b>30</b> 1.1811	<b>29.991</b> 1.1807	<b>36.972</b> 1.4556	<b>36.988</b> 1.4562	<b>36.972</b> 1.4556	<b>30.02</b> 1.1819	<b>30.043</b> 1.1828	<b>0.0705</b>	JR25x30x20.5
<b>0.047</b> 0.104	<b>30</b> 1.1811	<b>29.991</b> 1.1807	<b>36.972</b> 1.4556	<b>36.988</b> 1.4562	<b>36.972</b> 1.4556	<b>30.02</b> 1.1819	<b>30.043</b> 1.1828	<b>0.0705</b>	JR25x30x20.5
<b>0.067</b> 0.148	<b>30</b> 1.1811	<b>29.991</b> 1.1807	<b>36.972</b> 1.4556	<b>36.988</b> 1.4562	<b>36.972</b> 1.4556	<b>30.02</b> 1.1819	<b>30.043</b> 1.1828	<b>0.0748</b>	JR25x30x26.5
<b>0.052</b> 0.115	<b>30</b> 1.1811	<b>29.991</b> 1.1807	<b>36.972</b> 1.4556	<b>36.988</b> 1.4562	<b>36.972</b> 1.4556	<b>30.02</b> 1.1819	<b>30.043</b> 1.1828	<b>0.0749</b>	JR25x30x26.5
<b>0.093</b> 0.205	<b>30</b> 1.1811	<b>29.991</b> 1.1807	<b>36.972</b> 1.4556	<b>36.988</b> 1.4562	<b>36.972</b> 1.4556	<b>30.02</b> 1.1819	<b>30.043</b> 1.1828	<b>0.0702</b>	JR25x30x38.5
<b>0.087</b> 0.192	<b>30</b> 1.1811	<b>29.991</b> 1.1807	<b>36.972</b> 1.4556	<b>36.988</b> 1.4562	<b>36.972</b> 1.4556	<b>30.02</b> 1.1819	<b>30.043</b> 1.1828	<b>0.0702</b>	JR25x30x38.5
<b>0.028</b> 0.062	<b>35</b> 1.378	<b>34.989</b> 1.3775	<b>41.972</b> 1.6524	<b>41.988</b> 1.6531	<b>41.972</b> 1.6524	<b>35.025</b> 1.3789	<b>35.052</b> 1.38		<b>35</b>
<b>0.037</b> 0.082	<b>35</b> 1.378	<b>34.989</b> 1.3775	<b>41.972</b> 1.6524	<b>41.988</b> 1.6531	<b>41.972</b> 1.6524	<b>35.025</b> 1.3789	<b>35.052</b> 1.38	<b>0.0701</b>	JR30x35x17
<b>0.065</b> 0.143	<b>35</b> 1.378	<b>34.989</b> 1.3775	<b>41.972</b> 1.6524	<b>41.988</b> 1.6531	<b>41.972</b> 1.6524	<b>35.025</b> 1.3789	<b>35.052</b> 1.38	<b>0.0783</b>	JR30x35x20.5
<b>0.049</b> 0.108	<b>35</b> 1.378	<b>34.989</b> 1.3775	<b>41.972</b> 1.6524	<b>41.988</b> 1.6531	<b>41.972</b> 1.6524	<b>35.025</b> 1.3789	<b>35.052</b> 1.38	<b>0.0783</b>	JR30x35x20.5
<b>0.036</b> 0.079	<b>40</b> 1.5748	<b>39.989</b> 1.5744	<b>46.972</b> 1.8493	<b>46.988</b> 1.8499	<b>46.972</b> 1.8493	<b>40.025</b> 1.5758	<b>40.052</b> 1.5769		<b>40</b>

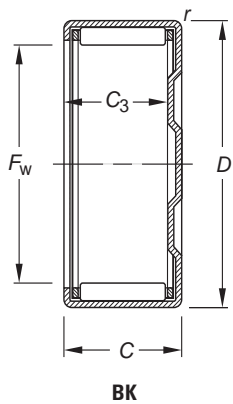
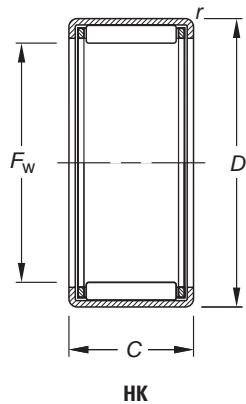
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# NEEDLE ROLLER BEARINGS

## OPEN ENDS, CLOSED ONE END METRIC SERIES

continued



Shaft Dia.	Dimensions mm/in.					Bearing Designation	Load Ratings kN/lbf.		Limiting Speed Approx.		C <sub>g</sub>
	-0.3, -.012						Dynamic	Static	Grease	Oil	
mm	F <sub>w</sub>	D	C	C <sub>3 min</sub>	r <sub>s min</sub>		C	C <sub>0</sub>	RPM		
40	40	47	16	—	1	HK4016	18.9	34.8	5200	7900	0.0589
	1.5748	1.8504	0.63		0.039		4250	7820			
40	40	47	20	17.3	1	BK4020	25.1	50.4	5200	7900	0.0646
	1.5748	1.8504	0.787	0.681	0.039		5640	11300			
40	40	47	20	—	1	HK4020	25.1	50.4	5200	7900	0.0646
	1.5748	1.8504	0.787		0.039		5640	11300			
45	45	52	12	—	1	HK4512	14.1	24.8	4600	7000	N/A
	1.7717	2.0472	0.472		0.039		3170	5580			
45	45	52	16	—	1	HK4516	19.8	38.5	4600	7000	0.0637
	1.7717	2.0472	0.63		0.039		4450	8660			
45	45	52	20	17.3	1	BK4520	26.3	55.4	4600	7000	0.0697
	1.7717	2.0472	0.787	0.681	0.039		5910	12500			
45	45	52	20	—	1	HK4520	27.2	58.2	4600	7000	0.0697
	1.7717	2.0472	0.787		0.039		6110	13100			
50	50	58	20	—	1	HK5020	30.9	62.2	4100	6300	0.0714
	1.9685	2.2835	0.787		0.039		6950	14000			
50	50	58	25	—	1	HK5025	35.5	74.1	4100	6300	0.0764
	1.9685	2.2835	0.984		0.039		7980	16700			
60	60	68	12	—	1	HK6012	17.2	31.2	3400	5200	0.0523
	2.3622	2.6772	0.472		0.039		3870	7010			

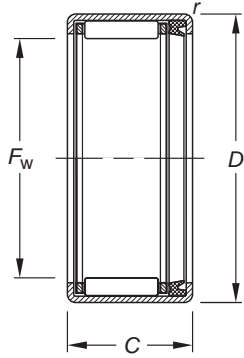
Wt. kg/lbs	Mounting Dimensions mm/in.					Plug Gage		C <sub>g</sub>	Matching Inner Ring	Shaft Dia. mm
	Max.	Min.	Min.	Max.	Ring Gage	Go	No-Go			
	S		H							
<b>0.048</b> 0.106	<b>40</b> 1.5748	<b>39.989</b> 1.5744	<b>46.972</b> 1.8493	<b>46.988</b> 1.8499	<b>46.972</b> 1.8493	<b>40.025</b> 1.5758	<b>40.052</b> 1.5769	<b>0.0773</b>	JR35x40x17	
<b>0.07</b> 0.154	<b>40</b> 1.5748	<b>39.989</b> 1.5744	<b>46.972</b> 1.8493	<b>46.988</b> 1.8499	<b>46.972</b> 1.8493	<b>40.025</b> 1.5758	<b>40.052</b> 1.5769	<b>0.0848</b>	JR35x40x20.5	
<b>0.06</b> 0.132	<b>40</b> 1.5748	<b>39.989</b> 1.5744	<b>46.972</b> 1.8493	<b>46.988</b> 1.8499	<b>46.972</b> 1.8493	<b>40.025</b> 1.5758	<b>40.052</b> 1.5769	<b>0.0848</b>	JR35x40x20.5	
<b>0.036</b> 0.079	<b>45</b> 1.7717	<b>44.989</b> 1.7712	<b>51.967</b> 2.0459	<b>51.986</b> 2.0467	<b>51.967</b> 2.0459	<b>45.025</b> 1.7726	<b>45.052</b> 1.7737	<b>N/A</b>		<b>45</b>
<b>0.048</b> 0.106	<b>45</b> 1.7717	<b>44.989</b> 1.7712	<b>51.967</b> 2.0459	<b>51.986</b> 2.0467	<b>51.967</b> 2.0459	<b>45.025</b> 1.7726	<b>45.052</b> 1.7737	<b>0.0836</b>	JR40x45x17	
<b>0.079</b> 0.174	<b>45</b> 1.7717	<b>44.989</b> 1.7712	<b>51.967</b> 2.0459	<b>51.986</b> 2.0467	<b>51.967</b> 2.0459	<b>45.025</b> 1.7726	<b>45.052</b> 1.7737	<b>0.0914</b>	JR40x45x20.5	
<b>0.057</b> 0.126	<b>45</b> 1.7717	<b>44.989</b> 1.7712	<b>51.967</b> 2.0459	<b>51.986</b> 2.0467	<b>51.967</b> 2.0459	<b>45.025</b> 1.7726	<b>45.052</b> 1.7737	<b>0.0914</b>	JR40x45x20.5	
<b>0.072</b> 0.159	<b>50</b> 1.9685	<b>49.989</b> 1.9681	<b>57.967</b> 2.2822	<b>57.986</b> 2.2829	<b>57.967</b> 2.2822	<b>50.025</b> 1.9695	<b>50.052</b> 1.9706	<b>0.0937</b>	JR45x50x20	
<b>0.092</b> 0.203	<b>50</b> 1.9685	<b>49.989</b> 1.9681	<b>57.967</b> 2.2822	<b>57.986</b> 2.2829	<b>57.967</b> 2.2822	<b>50.025</b> 1.9695	<b>50.052</b> 1.9706	<b>0.1002</b>	JR45x50x25.5	<b>50</b>
<b>0.06</b> 0.132	<b>60</b> 2.3622	<b>59.987</b> 2.3617	<b>67.967</b> 2.6759	<b>67.986</b> 2.6766	<b>67.967</b> 2.6759	<b>60.03</b> 2.3634	<b>60.062</b> 2.3646			



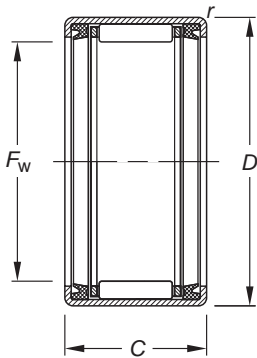


# NEEDLE ROLLER BEARINGS

## SEALED BEARINGS METRIC SERIES



HK RS



HK .2RS

Shaft Dia.	Dimensions mm/in.					Bearing Designation	Load Ratings kN/lbf.		Limiting Speed Approx. Grease RPM	C <sub>9</sub>
	F <sub>w</sub>	D	C	C <sub>3 min</sub>	r <sub>s min</sub>		C	C <sub>0</sub>		
8	8 0.315	12 0.4724	10 0.394	—	0.4 0.016	HK0810RS	2.9 650	2.73 610	20000	N/A
10	10 0.3937	14 0.5512	12 0.472	—	0.4 0.016	HK1012RS	4.78 1070	5.51 1240	19000	N/A
12	12 0.4724	18 0.7087	14 0.551	—	1 0.039	HK1214RS	6.61 1490	7.29 1640	14000	0.0189
	12 0.4724	18 0.7087	16 0.63	—	1	HK1216.2RS	6.87	7.65	14000	0.0189
14	14 0.5512	20 0.7874	14 0.551	11.3 0.445	1 0.039	BK1414RS	7.17 1610	8.41 1890	14000	N/A
	14 0.5512	20 0.7874	14 0.551	—	1 0.039	HK1414RS	7.17 1610	8.41 1890	14000	0.0271
	14 0.5512	20 0.7874	16 0.63	—	1 0.039	HK1416.2RS	7.17 1610	8.41 1890	14000	0.0271
15	15 0.5906	21 0.8268	14 0.551	11.3 0.445	1 0.039	BK1514RS	7.87 1770	9.69 2180	13000	N/A
	15 0.5906	21 0.8268	14 0.551	—	1 0.039	HK1514RS	7.87 1770	9.69 2180	13000	0.0288
	15 0.5906	21 0.8268	16 0.63	—	1 0.039	HK1516.2RS	7.87 1770	9.69 2180	13000	0.0288
16	16 0.6299	22 0.8661	16 0.63	—	1 0.039	HK1614RS	7.82 1760	9.76 2190	12000	0.0297
	16 0.6299	22 0.8661	16 0.63	—	1 0.039	HK1616.2RS	7.82 1760	9.76 2190	12000	0.0297
18	18 0.7087	24 0.9449	14 0.551	—	1 0.039	HK1814RS	8.41 1890	11.1 2500	11000	0.0246
	18 0.7087	24 0.9449	16 0.63	—	1 0.039	HK1816.2RS	8.41 1890	11.1 2500	11000	0.0322
20	20 0.7874	26 1.0236	16 0.63	—	1 0.039	HK2016.2RS	8.97 2020	12.5 2810	9700	0.0347
	20 0.7874	26 1.0236	18 0.709	—	1 0.039	HK2018RS	12.4 2790	18.9 4250	9700	0.0385
	20 0.7874	26 1.0236	20 0.787	—	1 0.039	HK2020.2RS	12.4 2790	18.9 4250	9700	0.0385
22	22 0.8661	28 1.1024	16 0.63	—	1 0.039	HK2216.2RS	9.81 2210	14.5 3260	8800	0.0286
22	22 0.8661	28 1.1024	18 0.709	—	1 0.039	HK2218RS	13.1 2950	20.9 4700	8800	0.0412
	22 0.8661	28 1.1024	20 0.787	—	1 0.039	HK2220.2RS	13.1 2950	20.9 4700	8800	0.0412
25	25 0.9843	32 1.2598	16 0.63	—	1 0.039	HK2516.2RS	11.1 2500	15.1 3390	7800	0.0389
	25 0.9843	32 1.2598	18 0.709	—	1 0.039	HK2518RS	16.2 3640	24.6 5530	7800	0.0439
	25 0.9843	32 1.2598	20 0.787	—	1 0.039	HK2520.2RS	16.2 3640	24.6 5530	7800	0.0439
	25 0.9843	32 1.2598	22 0.866	—	1 0.039	HK2522RS	20.6 4630	33.4 7510	7800	0.0474
	25 0.9843	32 1.2598	24 0.945	—	1 0.039	HK2524.2RS	20.6 4630	33.4 7510	7800	0.0474
28	28 1.1024	35 1.378	20 0.787	—	1 0.039	HK2820.2RS	15.9 3570	24.9 5600	6900	0.0462
30	30 1.1811	37 1.4567	16 0.63	—	1 0.039	HK3016.2RS	11.6 2610	16.8 3780	6500	0.0432
	30 1.1811	37 1.4567	18 0.709	—	1 0.039	HK3018RS	16.8 3780	27.3 6140	6500	0.0488
	30 1.1811	37 1.4567	20 0.787	—	1 0.039	HK3020.2RS	16.8 3780	27.3 6140	6500	0.0488



Wt. kg/lbs	Mounting Dimensions mm/in.					Plug Gage		Matching Inner Ring	Shaft Dia. mm
	Max.	Min.	Min.	Max.	Ring Gage	Go	No-Go		
	S		H					C <sub>g</sub>	
<b>0.004</b> 0.009	<b>8</b> 0.315	<b>7.994</b> 0.3147	<b>11.98</b> 0.4717	<b>11.991</b> 0.4721	<b>11.98</b> 0.4717	<b>8.013</b> 0.3155	<b>8.033</b> 0.3163		<b>8</b>
<b>0.005</b> 0.011	<b>10</b> 0.3937	<b>9.994</b> 0.3935	<b>13.98</b> 0.5504	<b>13.991</b> 0.5508	<b>13.98</b> 0.5504	<b>10.013</b> 0.3942	<b>10.033</b> 0.395		<b>10</b>
<b>0.013</b> 0.029	<b>12</b> 0.4724	<b>11.992</b> 0.4721	<b>17.98</b> 0.7079	<b>17.991</b> 0.7083	<b>17.98</b> 0.7079	<b>12.016</b> 0.4731	<b>12.036</b> 0.4739		<b>12</b>
<b>0.016</b> 0.035	<b>12</b> 0.4724	<b>11.992</b> 0.4721	<b>17.98</b> 0.7079	<b>17.991</b> 0.7083	<b>17.98</b> 0.7079	<b>12.016</b> 0.4731	<b>12.036</b> 0.4739		
<b>0.014</b> 0.031	<b>14</b> 0.5512	<b>13.992</b> 0.5509	<b>19.976</b> 0.7865	<b>19.989</b> 0.787	<b>19.976</b> 0.7865	<b>14.016</b> 0.5518	<b>14.036</b> 0.5526		<b>14</b>
<b>0.015</b> 0.033	<b>14</b> 0.5512	<b>13.992</b> 0.5509	<b>19.976</b> 0.7865	<b>19.989</b> 0.787	<b>19.976</b> 0.7865	<b>14.016</b> 0.5518	<b>14.036</b> 0.5526	<b>0.0356</b>	<b>JR10x14x16</b>
<b>0.014</b> 0.031	<b>14</b> 0.5512	<b>13.992</b> 0.5509	<b>19.976</b> 0.7865	<b>19.989</b> 0.787	<b>19.976</b> 0.7865	<b>14.016</b> 0.5518	<b>14.036</b> 0.5526	<b>0.0356</b>	<b>JR10x14x20</b>
<b>0.017</b> 0.037	<b>15</b> 0.5906	<b>14.992</b> 0.5902	<b>20.976</b> 0.8258	<b>20.989</b> 0.8263	<b>20.976</b> 0.8258	<b>15.016</b> 0.5912	<b>15.036</b> 0.592	<b>0.0378</b>	<b>JR12x15x16.5</b>
<b>0.016</b> 0.035	<b>15</b> 0.5906	<b>14.992</b> 0.5902	<b>20.976</b> 0.8258	<b>20.989</b> 0.8263	<b>20.976</b> 0.8258	<b>15.016</b> 0.5912	<b>15.036</b> 0.592	<b>0.0378</b>	<b>JR12x15x16.5</b>
<b>0.019</b> 0.042	<b>15</b> 0.5906	<b>14.992</b> 0.5902	<b>20.976</b> 0.8258	<b>20.989</b> 0.8263	<b>20.976</b> 0.8258	<b>15.016</b> 0.5912	<b>15.036</b> 0.592	<b>0.0378</b>	<b>JR12x15x16.5</b>
<b>0.014</b> 0.031	<b>16</b> 0.6299	<b>15.992</b> 0.6296	<b>21.976</b> 0.8652	<b>21.989</b> 0.8657	<b>21.976</b> 0.8652	<b>16.016</b> 0.6306	<b>16.036</b> 0.6313	<b>0.039</b>	<b>JR12x16x16</b>
<b>0.015</b> 0.033	<b>16</b> 0.6299	<b>15.992</b> 0.6296	<b>21.976</b> 0.8652	<b>21.989</b> 0.8657	<b>21.976</b> 0.8652	<b>16.016</b> 0.6306	<b>16.036</b> 0.6313	<b>0.039</b>	<b>JR12x16x20</b>
<b>0.018</b> 0.04	<b>18</b> 0.7087	<b>17.992</b> 0.7083	<b>23.976</b> 0.9439	<b>23.989</b> 0.9444	<b>23.976</b> 0.9439	<b>18.016</b> 0.7093	<b>18.036</b> 0.7101		<b>18</b>
<b>0.017</b> 0.037	<b>18</b> 0.7087	<b>17.992</b> 0.7083	<b>23.976</b> 0.9439	<b>23.989</b> 0.9444	<b>23.976</b> 0.9439	<b>18.016</b> 0.7093	<b>18.036</b> 0.7101	<b>0.0422</b>	<b>JR15x18x16.5</b>
<b>0.023</b> 0.051	<b>20</b> 0.7874	<b>19.991</b> 0.787	<b>25.976</b> 1.0227	<b>25.989</b> 1.0232	<b>25.976</b> 1.0227	<b>20.02</b> 0.7882	<b>20.043</b> 0.7891	<b>0.0455</b>	<b>JR17x20x16.5</b>
<b>0.025</b> 0.055	<b>20</b> 0.7874	<b>19.991</b> 0.787	<b>25.976</b> 1.0227	<b>25.989</b> 1.0232	<b>25.976</b> 1.0227	<b>20.02</b> 0.7882	<b>20.043</b> 0.7891	<b>0.0505</b>	<b>JR17x20x20.5</b>
<b>0.028</b> 0.062	<b>20</b> 0.7874	<b>19.991</b> 0.787	<b>25.976</b> 1.0227	<b>25.989</b> 1.0232	<b>25.976</b> 1.0227	<b>20.02</b> 0.7882	<b>20.043</b> 0.7891	<b>0.0505</b>	<b>JR17x20x20.5</b>
<b>0.025</b> 0.055	<b>22</b> 0.8661	<b>21.991</b> 0.8658	<b>27.976</b> 1.1014	<b>27.989</b> 1.1019	<b>27.976</b> 1.1014	<b>22.02</b> 0.8669	<b>22.043</b> 0.8678		<b>22</b>
<b>0.027</b> 0.06	<b>22</b> 0.8661	<b>21.991</b> 0.8658	<b>27.976</b> 1.1014	<b>27.989</b> 1.1019	<b>27.976</b> 1.1014	<b>22.02</b> 0.8669	<b>22.043</b> 0.8678	<b>0.0541</b>	<b>JR17x22x23</b>
<b>0.026</b> 0.057	<b>22</b> 0.8661	<b>21.991</b> 0.8658	<b>27.976</b> 1.1014	<b>27.989</b> 1.1019	<b>27.976</b> 1.1014	<b>22.02</b> 0.8669	<b>22.043</b> 0.8678	<b>0.0541</b>	<b>JR17x22x23</b>
<b>0.03</b> 0.066	<b>25</b> 0.9843	<b>24.991</b> 0.9839	<b>31.972</b> 1.2587	<b>31.988</b> 1.2594	<b>31.972</b> 1.2587	<b>25.02</b> 0.985	<b>25.043</b> 0.9859	<b>0.051</b>	<b>JR20x25x17</b>
<b>0.034</b> 0.075	<b>25</b> 0.9843	<b>24.991</b> 0.9839	<b>31.972</b> 1.2587	<b>31.988</b> 1.2594	<b>31.972</b> 1.2587	<b>25.02</b> 0.985	<b>25.043</b> 0.9859	<b>0.0576</b>	<b>JR20x25x20.5</b>
<b>0.038</b> 0.084	<b>25</b> 0.9843	<b>24.991</b> 0.9839	<b>31.972</b> 1.2587	<b>31.988</b> 1.2594	<b>31.972</b> 1.2587	<b>25.02</b> 0.985	<b>25.043</b> 0.9859	<b>0.0576</b>	<b>JR20x25x20.5</b>
<b>0.042</b> 0.093	<b>25</b> 0.9843	<b>24.991</b> 0.9839	<b>31.972</b> 1.2587	<b>31.988</b> 1.2594	<b>31.972</b> 1.2587	<b>25.02</b> 0.985	<b>25.043</b> 0.9859	<b>0.0622</b>	<b>JR20x25x26</b>
<b>0.047</b> 0.104	<b>25</b> 0.9843	<b>24.991</b> 0.9839	<b>31.972</b> 1.2587	<b>31.988</b> 1.2594	<b>31.972</b> 1.2587	<b>25.02</b> 0.985	<b>25.043</b> 0.9859	<b>0.0622</b>	<b>JR20x25x26</b>
<b>0.042</b> 0.093	<b>28</b> 1.1024	<b>27.991</b> 1.102	<b>34.972</b> 1.3769	<b>34.988</b> 1.3775	<b>34.972</b> 1.3769	<b>28.02</b> 1.1031	<b>28.043</b> 1.1041	<b>0.0606</b>	<b>JR22x28x20.5</b>
<b>0.03</b> 0.066	<b>30</b> 1.1811	<b>29.991</b> 1.1807	<b>36.972</b> 1.4556	<b>36.988</b> 1.4562	<b>36.972</b> 1.4556	<b>30.02</b> 1.1819	<b>30.043</b> 1.1828	<b>0.0567</b>	<b>JR25x30x17</b>
<b>0.042</b> 0.093	<b>30</b> 1.1811	<b>29.991</b> 1.1807	<b>36.972</b> 1.4556	<b>36.988</b> 1.4562	<b>36.972</b> 1.4556	<b>30.02</b> 1.1819	<b>30.043</b> 1.1828	<b>0.064</b>	<b>JR25x30x20.5</b>
<b>0.04</b> 0.088	<b>30</b> 1.1811	<b>29.991</b> 1.1807	<b>36.972</b> 1.4556	<b>36.988</b> 1.4562	<b>36.972</b> 1.4556	<b>30.02</b> 1.1819	<b>30.043</b> 1.1828	<b>0.064</b>	<b>JR25x30x20.5</b>

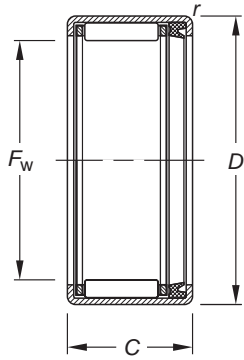
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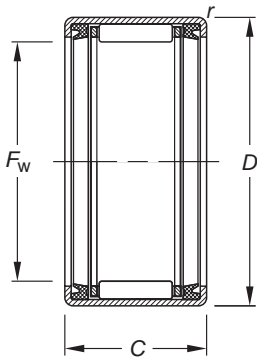
# NEEDLE ROLLER BEARINGS

## SEALED BEARINGS METRIC SERIES

*continued*



HK RS



HK .2RS

Shaft Dia.	Dimensions mm/in.					Bearing Designation	Load Ratings kN/lbf.		Limiting Speed Approx. Grease RPM	C <sub>9</sub>
	F <sub>w</sub>	D	C	C <sub>3 min</sub>	r <sub>s min</sub>		C	C <sub>0</sub>		
30	30	37	22	—	1	HK3022RS	22.4	39.6	6500	0.0535
	1.1811	1.4567	0.866		0.039		5040	8900		
30	30	37	24	—	1	HK3024.2RS	22.4	39.6	6500	0.0535
	1.1811	1.4567	0.945		0.039		5040	8900		
35	35	42	16	—	1	HK3516.2RS	14.2	23.2	5500	0.0492
	1.378	1.6535	0.63		0.039		3190	5220		
35	35	42	18	—	1	HK3518RS	17.4	29.9	5500	0.0534
	1.378	1.6535	0.709		0.039		3910	6720		
35	35	42	20	—	1	HK3520.2RS	17.4	29.9	5500	0.0534
	1.378	1.6535	0.787		0.039		3910	6720		
40	40	47	16	—	1	HK4016.2RS	13.4	22.4	4900	0.0528
	1.5748	1.8504	0.63		0.039		3010	5040		
40	40	47	18	—	1	HK4018RS	18.9	34.8	4900	0.0589
	1.5748	1.8504	0.709		0.039		4250	7820		
40	40	47	20	—	1	HK4020.2RS	18.9	34.8	4900	0.0589
	1.5748	1.8504	0.787		0.039		4250	7820		
45	45	52	18	—	1	HK4518RS	19.8	38.5	4300	0.0637
	1.7717	2.0472	0.709		0.039		4450	8660		
45	45	52	20	—	1	HK4520.2RS	19.8	38.5	4300	0.0637
	1.7717	2.0472	0.787		0.039		4450	8660		
50	50	58	22	—	1	HK5022RS	28.8	56.6	3900	0.0714
	1.9685	2.2835	0.866		0.039		6470	12700		
50	50	58	24	—	1	HK5024.2RS	28.8	56.6	3900	0.0714
	1.9685	2.2835	0.945		0.039		6470	12700		

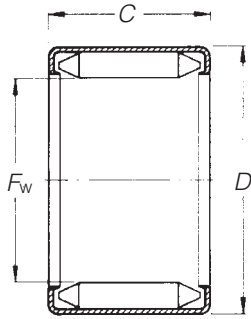
Wt. kg/lbs.	Mounting Dimensions mm/in.					Plug Gage		C <sub>g</sub>	Matching Inner Ring	Shaft Dia. mm
	Max.	Min.	Min.	Max.	Ring Gage	Go	No-Go			
	S		H							
<b>0.051</b> 0.112	<b>30</b> 1.1811	<b>29.991</b> 1.1807	<b>36.972</b> 1.4556	<b>36.988</b> 1.4562	<b>36.972</b> 1.4556	<b>30.02</b> 1.1819	<b>30.043</b> 1.1828	<b>0.0702</b>	JR25x30x26	
<b>0.057</b> 0.126	<b>30</b> 1.1811	<b>29.991</b> 1.1807	<b>36.972</b> 1.4556	<b>36.988</b> 1.4562	<b>36.972</b> 1.4556	<b>30.02</b> 1.1819	<b>30.043</b> 1.1828	<b>0.0702</b>	JR25x30x26	
<b>0.047</b> 0.104	<b>35</b> 1.378	<b>34.989</b> 1.3775	<b>41.972</b> 1.6524	<b>41.988</b> 1.6531	<b>41.972</b> 1.6524	<b>35.025</b> 1.3789	<b>35.052</b> 1.38	<b>0.0646</b>	JR30x35x17	<b>35</b>
<b>0.54</b> 1.19	<b>35</b> 1.378	<b>34.989</b> 1.3775	<b>41.972</b> 1.6524	<b>41.988</b> 1.6531	<b>41.972</b> 1.6524	<b>35.025</b> 1.3789	<b>35.052</b> 1.38	<b>0.0701</b>	JR30x35x20.5	
<b>0.044</b> 0.097	<b>35</b> 1.378	<b>34.989</b> 1.3775	<b>41.972</b> 1.6524	<b>41.988</b> 1.6531	<b>41.972</b> 1.6524	<b>35.025</b> 1.3789	<b>35.052</b> 1.38	<b>0.0701</b>	JR30x35x20.5	
<b>0.037</b> 0.082	<b>40</b> 1.5748	<b>39.989</b> 1.5744	<b>46.972</b> 1.8493	<b>46.988</b> 1.8499	<b>46.972</b> 1.8493	<b>40.025</b> 1.5758	<b>40.052</b> 1.5769	<b>0.0693</b>	JR35x40x20	<b>40</b>
<b>0.057</b> 0.126	<b>40</b> 1.5748	<b>39.989</b> 1.5744	<b>46.972</b> 1.8493	<b>46.988</b> 1.8499	<b>46.972</b> 1.8493	<b>40.025</b> 1.5758	<b>40.052</b> 1.5769	<b>0.0773</b>	JR35x40x20.5	
<b>0.053</b> 0.117	<b>40</b> 1.5748	<b>39.989</b> 1.5744	<b>46.972</b> 1.8493	<b>46.988</b> 1.8499	<b>46.972</b> 1.8493	<b>40.025</b> 1.5758	<b>40.052</b> 1.5769	<b>0.0773</b>	JR35x40x20.5	
<b>0.064</b> 0.141	<b>45</b> 1.7717	<b>44.989</b> 1.7712	<b>51.967</b> 2.0459	<b>51.986</b> 2.0467	<b>51.967</b> 2.0459	<b>45.025</b> 1.7726	<b>45.052</b> 1.7737	<b>0.0836</b>	JR40x45x20.5	<b>45</b>
<b>0.075</b> 0.165	<b>45</b> 1.7717	<b>44.989</b> 1.7712	<b>51.967</b> 2.0459	<b>51.986</b> 2.0467	<b>51.967</b> 2.0459	<b>45.025</b> 1.7726	<b>45.052</b> 1.7737	<b>0.0836</b>	JR40x45x20.5	
<b>0.097</b> 0.214	<b>50</b> 1.9685	<b>49.989</b> 1.9681	<b>57.967</b> 2.2822	<b>57.986</b> 2.2829	<b>57.967</b> 2.2822	<b>50.025</b> 1.9695	<b>50.052</b> 1.9706	<b>0.0937</b>	JR45x50x25.5	<b>50</b>
<b>0.083</b> 0.183	<b>50</b> 1.9685	<b>49.989</b> 1.9681	<b>57.967</b> 2.2822	<b>57.986</b> 2.2829	<b>57.967</b> 2.2822	<b>50.025</b> 1.9695	<b>50.052</b> 1.9706	<b>0.0937</b>	JR45x50x25.5	



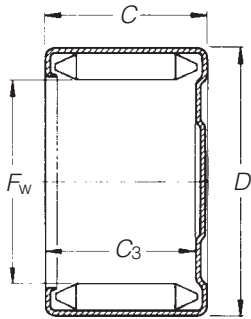


# NEEDLE ROLLER BEARINGS

**FULL  
COMPLEMENT  
OPEN ENDS,  
CLOSED ONE END  
METRIC SERIES**



**DL**



**DLF**

Shaft Dia.	Dimensions mm/in.				Bearing Designation	Load Ratings kN/lbf.		Limiting Speed Approx.		C <sub>g</sub>
	-0.3, -.012					Dynamic	Static	Grease	Oil	
mm	F <sub>w</sub>	D	C	C <sub>3 min</sub>		C	C <sub>0</sub>	RPM		
6	6	12	10	-	DL 6 10	2.90	3.80	33000	50000	0.0120
	0.2362	0.4724	0.394			650	850			
	6	12	10	7.7	DLF 6 10	2.90	3.80	33000	50000	0.0120
	0.2362	0.4724	0.394	0.303		650	850			
8	8	14	10	-	DL 8 10	4.50	6.50	24000	37500	0.0145
	0.3150	0.5512	0.394			1010	1460			
	8	14	10	7.7	DLF 8 10	4.50	6.50	24000	37500	0.0145
	0.3150	0.5512	0.394	0.303		1010	1460			
10	10	16	12	-	DL 10 12	7.00	10.9	20000	30000	0.0180
	0.3937	0.6299	0.472			1570	2450			
	10	16	12	9.7	DLF 10 12	7.00	10.9	20000	30000	0.0180
	0.3937	0.6299	0.472	0.382		1570	2450			
12	12	18	10	-	DL 12 10	6.00	9.7	16000	25000	0.0195
	0.4724	0.7087	0.394			1350	2180			
	12	20	12	-	DL 12 12	7.00	11.5	16000	25000	0.0206
	0.4724	0.7874	0.472			1570	2590			
	12	20	12	9.7	DLF 12 12	7.00	11.5	16000	25000	0.0206
	0.4724	0.7874	0.472	0.382		1570	2590			
13	13	19	12	-	DL 13 12	8.50	14.2	15000	23000	0.0217
	0.5118	0.7480	0.472			1910	3190			
	13	19	12	9.7	DLF 13 12	8.50	14.2	15000	23000	0.0217
	0.5118	0.7480	0.472	0.382		1910	3190			
14	14	20	12	-	DL 14 12	7.90	13.5	14000	21500	0.0229
	0.5512	0.7874	0.472			1780	3030			
	14	20	12	9.7	DLF 14 12	7.90	13.5	14000	21500	0.0229
	0.5512	0.7874	0.472	0.382		1780	3030			
15	15	21	12	-	DL 15 12	9.40	16.4	13000	20000	0.0238
	0.5906	0.8268	0.472			2110	3690			
	15	21	12	9.7	DLF 15 12	9.40	16.4	13000	20000	0.0238
	0.5906	0.8268	0.472	0.382		2110	3690			
16	16	22	12	-	DL 16 12	8.70	15.5	12000	18500	0.0251
	0.6299	0.8661	0.472			1960	3480			
	16	22	12	9.7	DLF 16 12	8.70	15.5	12000	18500	0.0251
	0.6299	0.8661	0.472	0.382		1960	3480			
17	17	23	12	-	DL 17 12	9.00	16.2	11000	17500	0.0260
	0.6693	0.9055	0.472			2020	3640			
	17	23	12	9.7	DLF 17 12	9.00	16.2	11000	17500	0.0260
	0.6693	0.9055	0.472	0.382		2020	3640			
18	18	24	12	-	DL 18 12	10.7	19.5	11000	16500	0.0272
	0.7087	0.9449	0.472			2410	4380			
	18	24	12	9.7	DLF 18 12	10.7	19.5	11000	16500	0.0272
	0.7087	0.9449	0.472	0.382		2410	4380			
	18	24	16	-	DL 18 16	16.0	29.5	11000	16500	0.0304
	0.7087	0.9449	0.630			3600	6630			
	18	24	16	13.7	DLF 18 16	16.0	29.5	11000	16500	0.0304
	0.7087	0.9449	0.630	0.539		3600	6630			
20	20	26	12	-	DL 20 12	10.2	19.5	10000	15000	0.0292
	0.7874	1.0236	0.472			2290	4380			
	20	26	12	9.7	DLF 20 12	10.2	19.5	10000	15000	0.0292
	0.7874	1.0236	0.472	0.382		2290	4380			
	20	26	16	-	DL 20 16	16.0	30.5	10000	15000	0.0327
	0.7874	1.0236	0.630			3600	6860			
	20	26	16	13.7	DLF 20 16	16.0	30.5	10000	15000	0.0327
	0.7874	1.0236	0.630	0.539		3600	6860			
22	22	28	16	-	DL 22 16	17.0	33.0	8800	13500	0.0349
	0.8661	1.1024	0.630			3820	7420			
	22	28	16	13.7	DLF 22 16	17.0	33.0	8800	13500	0.0349
	0.8661	1.1024	0.630	0.539		3820	7420			

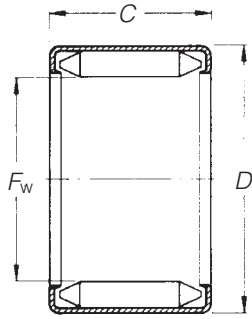
Wt. kg/lbs.	Mounting Dimensions mm/in.					Plug Gage		Matching Inner Ring	Shaft Dia. mm
	Max.	Min.	Min.	Max.	Ring Gage	Go	No-Go		
	S		H			C <sub>g</sub>			
<b>0.004</b> 0.009	<b>6.000</b> 0.2362	<b>5.995</b> 0.2360	<b>12.000</b> 0.4724	<b>12.011</b> 0.4729	<b>12.000</b> 0.4724	<b>6.009</b> 0.2366	<b>6.036</b> 0.2376		<b>6</b>
<b>0.004</b> 0.010	<b>6.000</b> 0.2362	<b>5.995</b> 0.2360	<b>12.000</b> 0.4724	<b>12.011</b> 0.4729	<b>12.000</b> 0.4724	<b>6.009</b> 0.2366	<b>6.036</b> 0.2376		
<b>0.005</b> 0.012	<b>8.000</b> 0.3150	<b>7.994</b> 0.3147	<b>14.000</b> 0.5512	<b>14.011</b> 0.5516	<b>14.000</b> 0.5512	<b>8.009</b> 0.3153	<b>8.036</b> 0.3164		<b>8</b>
<b>0.005</b> 0.012	<b>8.000</b> 0.3150	<b>7.994</b> 0.3147	<b>14.000</b> 0.5512	<b>14.011</b> 0.5516	<b>14.000</b> 0.5512	<b>8.009</b> 0.3153	<b>8.036</b> 0.3164		
<b>0.008</b> 0.018	<b>10.000</b> 0.3937	<b>9.994</b> 0.3935	<b>16.000</b> 0.6299	<b>16.011</b> 0.6304	<b>16.000</b> 0.6299	<b>10.009</b> 0.3941	<b>10.036</b> 0.3951		<b>10</b>
<b>0.008</b> 0.018	<b>10.000</b> 0.3937	<b>9.994</b> 0.3935	<b>16.000</b> 0.6299	<b>16.011</b> 0.6304	<b>16.000</b> 0.6299	<b>10.009</b> 0.3941	<b>10.036</b> 0.3951		
<b>0.008</b> 0.017	<b>12.000</b> 0.4724	<b>11.992</b> 0.4721	<b>18.000</b> 0.7087	<b>18.011</b> 0.7091	<b>18.000</b> 0.7087	<b>12.009</b> 0.4728	<b>12.035</b> 0.4738		<b>12</b>
<b>0.009</b> 0.021	<b>12.000</b> 0.4724	<b>11.992</b> 0.4721	<b>20.000</b> 0.7874	<b>20.013</b> 0.7879	<b>20.000</b> 0.7874	<b>12.009</b> 0.4728	<b>12.035</b> 0.4738	<b>0.0270</b>	<b>IM 8 12 12.4</b>
<b>0.009</b> 0.021	<b>12.000</b> 0.4724	<b>11.992</b> 0.4721	<b>20.000</b> 0.7874	<b>20.013</b> 0.7879	<b>20.000</b> 0.7874	<b>12.009</b> 0.4728	<b>12.035</b> 0.4738	<b>0.0270</b>	<b>IM 8 12 12.4</b>
<b>0.010</b> 0.022	<b>13.000</b> 0.5118	<b>12.992</b> 0.5115	<b>19.000</b> 0.7480	<b>19.013</b> 0.7485	<b>19.000</b> 0.7480	<b>13.009</b> 0.5122	<b>13.035</b> 0.5132	<b>0.0285</b>	<b>IM 9 13 12.4</b>
<b>0.010</b> 0.022	<b>13.000</b> 0.5118	<b>12.992</b> 0.5115	<b>19.000</b> 0.7480	<b>19.013</b> 0.7485	<b>19.000</b> 0.7480	<b>13.009</b> 0.5122	<b>13.035</b> 0.5132	<b>0.0285</b>	<b>IM 9 13 12.4</b>
<b>0.011</b> 0.023	<b>14.000</b> 0.5512	<b>13.992</b> 0.5509	<b>20.000</b> 0.7874	<b>20.013</b> 0.7879	<b>20.000</b> 0.7874	<b>14.009</b> 0.5515	<b>14.035</b> 0.5526	<b>0.0300</b>	<b>IM 10 14 12.4</b>
<b>0.011</b> 0.023	<b>14.000</b> 0.5512	<b>13.992</b> 0.5509	<b>20.000</b> 0.7874	<b>20.013</b> 0.7879	<b>20.000</b> 0.7874	<b>14.009</b> 0.5515	<b>14.035</b> 0.5526	<b>0.0300</b>	<b>IM 10 14 12.4</b>
<b>0.011</b> 0.024	<b>15.000</b> 0.5906	<b>14.992</b> 0.5902	<b>21.000</b> 0.8268	<b>21.013</b> 0.8273	<b>21.000</b> 0.8268	<b>15.009</b> 0.5909	<b>15.035</b> 0.5919	<b>0.0312</b>	<b>IM 12 15 12.4</b>
<b>0.011</b> 0.024	<b>15.000</b> 0.5906	<b>14.992</b> 0.5902	<b>21.000</b> 0.8268	<b>21.013</b> 0.8273	<b>21.000</b> 0.8268	<b>15.009</b> 0.5909	<b>15.035</b> 0.5919	<b>0.0312</b>	<b>IM 12 15 12.4</b>
<b>0.012</b> 0.026	<b>16.000</b> 0.6299	<b>15.992</b> 0.6296	<b>22.000</b> 0.8661	<b>22.013</b> 0.8667	<b>22.000</b> 0.8661	<b>16.009</b> 0.6303	<b>16.035</b> 0.6313		<b>16</b>
<b>0.012</b> 0.026	<b>16.000</b> 0.6299	<b>15.992</b> 0.6296	<b>22.000</b> 0.8661	<b>22.013</b> 0.8667	<b>22.000</b> 0.8661	<b>16.009</b> 0.6303	<b>16.035</b> 0.6313		
<b>0.013</b> 0.029	<b>17.000</b> 0.6693	<b>16.992</b> 0.6690	<b>23.000</b> 0.9055	<b>23.013</b> 0.9060	<b>23.000</b> 0.9055	<b>17.009</b> 0.6696	<b>17.035</b> 0.6707	<b>0.0341</b>	<b>IM 13 17 12.4</b>
<b>0.013</b> 0.029	<b>17.000</b> 0.6693	<b>16.992</b> 0.6690	<b>23.000</b> 0.9055	<b>23.013</b> 0.9060	<b>23.000</b> 0.9055	<b>17.009</b> 0.6696	<b>17.035</b> 0.6707	<b>0.0341</b>	<b>IM 13 17 12.4</b>
<b>0.014</b> 0.031	<b>18.000</b> 0.7087	<b>17.992</b> 0.7083	<b>24.000</b> 0.9449	<b>24.013</b> 0.9454	<b>24.000</b> 0.9449	<b>18.009</b> 0.7090	<b>18.035</b> 0.7100	<b>0.0357</b>	<b>IM 13 18 12.4</b>
<b>0.014</b> 0.031	<b>18.000</b> 0.7087	<b>17.992</b> 0.7083	<b>24.000</b> 0.9449	<b>24.013</b> 0.9454	<b>24.000</b> 0.9449	<b>18.009</b> 0.7090	<b>18.035</b> 0.7100	<b>0.0357</b>	<b>IM 13 18 12.4</b>
<b>0.019</b> 0.042	<b>18.000</b> 0.7087	<b>17.992</b> 0.7083	<b>24.000</b> 0.9449	<b>24.013</b> 0.9454	<b>24.000</b> 0.9449	<b>18.009</b> 0.7090	<b>18.035</b> 0.7100	<b>0.0399</b>	<b>IM 13 18 16.4</b>
<b>0.019</b> 0.042	<b>18.000</b> 0.7087	<b>17.992</b> 0.7083	<b>24.000</b> 0.9449	<b>24.013</b> 0.9454	<b>24.000</b> 0.9449	<b>18.009</b> 0.7090	<b>18.035</b> 0.7100	<b>0.0399</b>	<b>IM 13 18 16.4</b>
<b>0.015</b> 0.033	<b>20.000</b> 0.7874	<b>19.991</b> 0.7870	<b>26.000</b> 1.0236	<b>26.013</b> 1.0241	<b>26.000</b> 1.0236	<b>20.009</b> 0.7878	<b>20.035</b> 0.7888	<b>0.0383</b>	<b>IM 15 20 12.4</b>
<b>0.015</b> 0.033	<b>20.000</b> 0.7874	<b>19.991</b> 0.7870	<b>26.000</b> 1.0236	<b>26.013</b> 1.0241	<b>26.000</b> 1.0236	<b>20.009</b> 0.7878	<b>20.035</b> 0.7888	<b>0.0383</b>	<b>IM 15 20 12.4</b>
<b>0.020</b> 0.044	<b>20.000</b> 0.7874	<b>19.991</b> 0.7870	<b>26.000</b> 1.0236	<b>26.013</b> 1.0241	<b>26.000</b> 1.0236	<b>20.009</b> 0.7878	<b>20.035</b> 0.7888	<b>0.0429</b>	<b>IM 15 20 16.4</b>
<b>0.020</b> 0.044	<b>20.000</b> 0.7874	<b>19.991</b> 0.7870	<b>26.000</b> 1.0236	<b>26.013</b> 1.0241	<b>26.000</b> 1.0236	<b>20.009</b> 0.7878	<b>20.035</b> 0.7888	<b>0.0429</b>	<b>IM 15 20 16.4</b>
<b>0.022</b> 0.049	<b>22.000</b> 0.8661	<b>21.991</b> 0.8658	<b>28.000</b> 1.1024	<b>28.013</b> 1.1029	<b>28.000</b> 1.1024	<b>20.009</b> 0.7878	<b>20.035</b> 0.7888	<b>0.0458</b>	<b>IM 17 22 16.4</b>
<b>0.022</b> 0.049	<b>22.000</b> 0.8661	<b>21.991</b> 0.8658	<b>28.000</b> 1.1024	<b>28.013</b> 1.1029	<b>28.000</b> 1.1024	<b>20.009</b> 0.7878	<b>20.035</b> 0.7888	<b>0.0458</b>	<b>IM 17 22 16.4</b>

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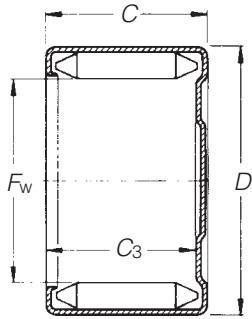


# NEEDLE ROLLER BEARINGS

**FULL  
COMPLEMENT  
OPEN ENDS,  
CLOSED ONE END  
METRIC SERIES**



**DL**



**DLF**

Shaft Dia.	Dimensions mm/in.				Bearing Designation	Load Ratings kN/lbf.		Limiting Speed Approx.		C <sub>g</sub>
	F <sub>w</sub>	D	C	C <sub>3 min</sub>		Dynamic	Static	Grease	Oil	
mm						C	C <sub>0</sub>	RPM		
25	25	33	16	-	DL 25 16	16.0	32.5	7800	12000	0.0348
	0.9843	1.2992	0.630			3600	7310			
	25	33	16	13.7	DLF 25 16	16.0	32.5	7800	12000	0.0348
	0.9843	1.2992	0.630	0.539		3600	7310			
	25	33	20	-	DL 25 20	22.8	46.0	7800	12000	0.0379
	0.9843	1.2992	0.787			5130	10300			
	25	33	20	17.7	DLF 25 20	22.8	46.0	7800	12000	0.0379
	0.9843	1.2992	0.787	0.697		5130	10300			
28	28	36	20	-	DL 28 20	24.5	52.0	7200	11000	0.0417
	1.1024	1.4173	0.787			5510	11700			
30	30	38	16	-	DL 30 16	21.7	46.5	6500	10000	0.0403
	1.1811	1.4961	0.630			4880	10500			
	30	38	20	-	DL 30 20	26.0	56.0	6500	10000	0.0437
	1.1811	1.4961	0.787			5850	12600			
	30	38	20	17.7	DLF 30 20	26.0	56.0	6500	10000	0.0437
	1.1811	1.4961	0.787	0.697		5850	12600			
	30	38	25	-	DL 30 25	35.5	76.0	6500	10000	0.0470
	1.1811	1.4961	0.984			7980	17100			
35	35	35	16	-	DL 35 16	24.0	54.0	5500	8500	0.0437
	1.3780	0.0000	0.630			5400	12100			
	35	43	20	-	DL 35 20	29.0	65.0	5500	8500	0.0477
	1.3780	1.6929	0.787			6520	14600			
	35	43	20	17.7	DLF 35 20	29.0	65.0	5500	8500	0.0477
	1.3780	1.6929	0.787	0.697		6520	14600			
40	40	48	16	-	DL 40 16	26.5	62.0	4900	7500	0.0479
	1.5748	1.8898	0.630			5960	13900			
	40	48	20	-	DL 40 20	36.0	84.0	4900	7500	0.0523
	1.5748	1.8898	0.787			8090	18900			
	40	48	20	17.7	DLF 40 20	36.0	84.0	4900	7500	0.0523
	1.5748	1.8898	0.787	0.697		8090	18900			
44	44	52	16	-	DL 44 16	23.8	57.0	4400	6800	0.0512
	1.7323	2.0472	0.630			5350	12800			
47	47	55	16	-	DL 47 16	25.0	61.0	4200	6400	0.0536
	1.8504	2.1654	0.630			5620	13700			
50	50	58	12	-	DL 50 12	20.0	50.0	3900	6000	0.0508
	1.9685	2.2835	0.472			4500	11200			
	50	58	18	-	DL 50 18	36.5	92.0	3900	6000	0.0587
	1.9685	2.2835	0.709			8210	20700			
	50	58	20	-	DL 50 20	37.0	93.0	3900	6000	0.0611
	1.9685	2.2835	0.787			8320	20900			
	50	58	20	17.7	DLF 50 20	37.0	93.0	3900	6000	0.0611
	1.9685	2.2835	0.787	0.697		8320	20900			
55	55	63	20	-	DL 55 20	39.5	102.0	3600	5500	0.0653
	2.1654	2.4803	0.787			8880	22900			

Wt. kg/lbs.	Mounting Dimensions mm/in.								Matching Inner Ring	Shaft Dia. mm
	Max.	Min.	Min.	Max.	Ring Gage	Plug Gage		C <sub>g</sub>		
	S		H			Go	No-Go			
<b>0.035</b> 0.077	<b>25.000</b> 0.9843	<b>24.991</b> 0.9839	<b>33.000</b> 1.2992	<b>33.016</b> 1.2998	<b>33.000</b> 1.2992	<b>22.009</b> 0.8665	<b>22.035</b> 0.8675	<b>0.0457</b>	IM 20 25 16.4	25
<b>0.035</b> 0.077	<b>25.000</b> 0.9843	<b>24.991</b> 0.9839	<b>33.000</b> 1.2992	<b>33.016</b> 1.2998	<b>33.000</b> 1.2992	<b>22.009</b> 0.8665	<b>22.035</b> 0.8675	<b>0.0457</b>	IM 20 25 16.4	
<b>0.043</b> 0.095	<b>25.000</b> 0.9843	<b>24.991</b> 0.9839	<b>33.000</b> 1.2992	<b>33.016</b> 1.2998	<b>33.000</b> 1.2992	<b>25.015</b> 0.9848	<b>25.041</b> 0.9859	<b>0.0497</b>	IM 20 25 20.4	
<b>0.043</b> 0.095	<b>25.000</b> 0.9843	<b>24.991</b> 0.9839	<b>33.000</b> 1.2992	<b>33.016</b> 1.2998	<b>33.000</b> 1.2992	<b>25.015</b> 0.9848	<b>25.041</b> 0.9859	<b>0.0497</b>	IM 20 25 20.4	
<b>0.047</b> 0.104	<b>28.000</b> 1.1024	<b>27.991</b> 1.1020	<b>36.000</b> 1.4173	<b>36.016</b> 1.4180	<b>36.000</b> 1.4173	<b>28.015</b> 1.1030	<b>28.041</b> 1.1040	<b>0.0547</b>	IM 23 28 20.4	28
<b>0.040</b> 0.088	<b>30.000</b> 1.1811	<b>29.991</b> 1.1807	<b>38.000</b> 1.4961	<b>38.016</b> 1.4967	<b>38.000</b> 1.4961	<b>30.015</b> 1.1817	<b>30.041</b> 1.1827	<b>0.0529</b>	IM 25 30 16.4	30
<b>0.050</b> 0.110	<b>30.000</b> 1.1811	<b>29.991</b> 1.1807	<b>38.000</b> 1.4961	<b>38.016</b> 1.4967	<b>38.000</b> 1.4961	<b>30.015</b> 1.1817	<b>30.041</b> 1.1827	<b>0.0573</b>	IM 25 30 20.4	
<b>0.050</b> 0.110	<b>30.000</b> 1.1811	<b>29.991</b> 1.1807	<b>38.000</b> 1.4961	<b>38.016</b> 1.4967	<b>38.000</b> 1.4961	<b>30.015</b> 1.1817	<b>30.041</b> 1.1827	<b>0.0573</b>	IM 25 30 20.4	
<b>0.063</b> 0.139	<b>30.000</b> 1.1811	<b>29.991</b> 1.1807	<b>38.000</b> 1.4961	<b>38.016</b> 1.4967	<b>38.000</b> 1.4961	<b>30.015</b> 1.1817	<b>30.041</b> 1.1827	<b>0.0617</b>	IM 25 30 25	
<b>0.046</b> 0.101	<b>35.000</b> 1.3780	<b>34.989</b> 1.3775	<b>0.000</b> 0.0000	<b>#N/A</b> #N/A	<b>43.000</b> 1.6929	<b>35.015</b> 1.3785	<b>35.041</b> 1.3796	<b>0.0573</b>	IM 30 35 16.4	35
<b>0.057</b> 0.126	<b>35.000</b> 1.3780	<b>34.989</b> 1.3775	<b>43.000</b> 1.6929	<b>43.016</b> 1.6935	<b>43.000</b> 1.6929	<b>35.015</b> 1.3785	<b>35.041</b> 1.3796	<b>0.0626</b>	IM 30 35 20.4	
<b>0.057</b> 0.126	<b>35.000</b> 1.3780	<b>34.989</b> 1.3775	<b>43.000</b> 1.6929	<b>43.016</b> 1.6935	<b>43.000</b> 1.6929	<b>35.015</b> 1.3785	<b>35.041</b> 1.3796	<b>0.0626</b>	IM 30 35 20.4	
<b>0.051</b> 0.112	<b>40.000</b> 1.5748	<b>39.989</b> 1.5744	<b>48.000</b> 1.8898	<b>48.016</b> 1.8904	<b>48.000</b> 1.8898	<b>40.015</b> 1.5754	<b>40.041</b> 1.5764	<b>0.0628</b>	IM 35 40 16.4	40
<b>0.064</b> 0.141	<b>40.000</b> 1.5748	<b>39.989</b> 1.5744	<b>48.000</b> 1.8898	<b>48.016</b> 1.8904	<b>48.000</b> 1.8898	<b>40.015</b> 1.5754	<b>40.041</b> 1.5764	<b>0.0686</b>	IM 35 40 20.4	
<b>0.064</b> 0.141	<b>40.000</b> 1.5748	<b>39.989</b> 1.5744	<b>48.000</b> 1.8898	<b>48.016</b> 1.8904	<b>48.000</b> 1.8898	<b>40.015</b> 1.5754	<b>40.041</b> 1.5764	<b>0.0686</b>	IM 35 40 20.4	
<b>0.056</b> 0.123	<b>44.000</b> 1.7323	<b>43.989</b> 1.7319	<b>52.000</b> 2.0472	<b>52.019</b> 2.0480	<b>52.000</b> 2.0472	<b>44.015</b> 1.7329	<b>44.041</b> 1.7339	<b>0.0672</b>	IM 40 44 16.4	44
<b>0.060</b> 0.132	<b>47.000</b> 1.8504	<b>46.989</b> 1.8500	<b>55.000</b> 2.1654	<b>55.019</b> 2.1661	<b>55.000</b> 2.1654	<b>47.015</b> 1.8510	<b>47.041</b> 1.8520	<b>0.0703</b>	IM 40 44 16.4	47
<b>0.047</b> 0.104	<b>50.000</b> 1.9685	<b>49.989</b> 1.9681	<b>58.000</b> 2.2835	<b>58.019</b> 2.2842	<b>58.000</b> 2.2835	<b>50.015</b> 1.9691	<b>50.041</b> 1.9701			50
<b>0.071</b> 0.157	<b>50.000</b> 1.9685	<b>49.989</b> 1.9681	<b>58.000</b> 2.2835	<b>58.019</b> 2.2842	<b>58.000</b> 2.2835	<b>50.015</b> 1.9691	<b>50.041</b> 1.9701			
<b>0.077</b> 0.170	<b>50.000</b> 1.9685	<b>49.989</b> 1.9681	<b>58.000</b> 2.2835	<b>58.019</b> 2.2842	<b>58.000</b> 2.2835	<b>50.015</b> 1.9691	<b>50.041</b> 1.9701	<b>0.0802</b>	IM 45 50 20.4	
<b>0.077</b> 0.170	<b>50.000</b> 1.9685	<b>49.989</b> 1.9681	<b>58.000</b> 2.2835	<b>58.019</b> 2.2842	<b>58.000</b> 2.2835	<b>50.015</b> 1.9691	<b>50.041</b> 1.9701	<b>0.0802</b>	IM 45 50 20.4	
<b>0.086</b> 0.190	<b>55.000</b> 2.1654	<b>54.987</b> 2.1648	<b>63.000</b> 2.4803	<b>63.019</b> 2.4811	<b>63.000</b> 2.4803	<b>55.015</b> 2.1659	<b>55.041</b> 2.1670	<b>0.0857</b>	IM 50 55 20.4	55





## DRAWN CUP NEEDLE ROLLER BEARINGS –

### INCH SERIES

When a rolling bearing is needed for a compact and economical design where it is not practical to harden and grind the housing bore, or where the housing materials are of low rigidity such as cast iron, aluminum or even plastics, drawn cup needle roller bearings should be considered.

### REFERENCE STANDARDS

- **ANSI/ABMA 18.2** - Needle roller bearings - Radial, inch design.

Before selecting specific inch series drawn cup needle roller bearings, the engineering section of this catalog should be reviewed.

### TYPES OF INCH SERIES DRAWN CUP NEEDLE ROLLER BEARINGS



**B**

Full complement bearings



**M**



**J**

Caged bearings



**JTT**

### IDENTIFICATION

The prefix letter or letters in inch series drawn cup bearing designation denote whether the bearings are made with a full complement of needle rollers or caged needle rollers. The use of full complement of needle rollers is indicated by the prefix code letter B and for use of caged needle rollers by the prefix code letter J.

Inch bearings are available in either of two radial cross-sections. The larger cross-section is indicated by the prefix code letter H. Absence of the letter H indicates the smaller radial cross section.

These major features of dimension and construction are summarized in Table 1.

In addition, there can be other identifying letters which cover special modification. Please consult your Timken representative when special modifications are required.

Since the entire identification code in the bearing designation may not appear on the bearing itself, the manufacturer's parts list or another reliable source should always be consulted when ordering bearings for service or field replacement to make certain that the correct bearing with the correct lubricant is used.

TABLE 1 – IDENTIFYING LETTERS – INCH SERIES

	Prefix letters in Bearing Designation	
	Smaller Roller	Larger Roller
Full complement (mechanically retained)	B	BH
Caged	J	JH

Other prefix letters denoting major construction features are:

- M – closed end style
- P – open end (finger) cage
- T – single seal
- TT – double seal
- G – extra-precision

### CONSTRUCTION

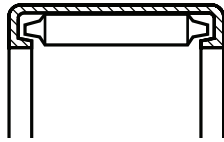
#### FULL COMPLEMENT BEARINGS

The original drawn cup needle roller bearing employs a full complement of needle rollers. The full complement drawn cup bearing combines maximum load carrying capability and low cost with the advantages of the drawn outer ring.

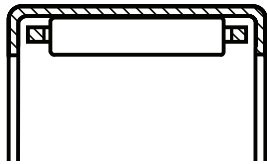
The inward turned lips of the cup are used to mechanically

retain the full complement of needle rollers, providing their positive radial retention even though it may be necessary to remove the shaft repeatedly during servicing of the mechanism employing the bearing.

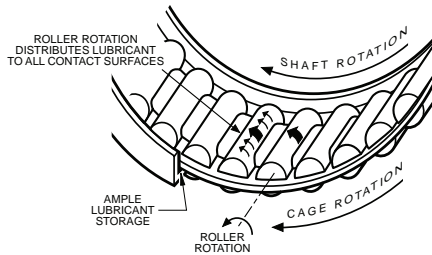




Full Complement Bearing



Caged Bearing



### CAGED BEARINGS

The one-piece steel cage, used in most Timken® Torrington® caged drawn cup bearings, is designed to provide rigidity and minimize wear. This cage design separates the roller guiding and roller retention functions. The portions of the cage that retain the rollers cannot contact the rollers while the bearing is operating. Thus, there is no wear which might affect roller retention.

The cage contacts the rollers only near their ends at the roller pitch line, so accurate guidance is achieved with least effort. Pitch line guidance at the ends of the rollers prevents skewing and assures roller stability, with little stress on the cage itself. The design minimizes the contact area and force required for roller guidance, and thus minimizes drag between cage and rollers.

The same design feature which assures no contact between roller retention bars and rollers while the bearing is operating also provides ample clearance along the length of the roller to enhance the circulation of lubricant.

Timken also has available bearings with other cage designs. Bearings with engineered polymer cages are for use where operating conditions permit. Before applying bearings with engineered polymer cages, please consult your Timken representative.

### SEALED BEARINGS

Drawn cup caged needle roller bearings are offered with integral seals. The tables of dimensions on pages C90-C91 indicate those sizes available with lip contact seals which limit the bearing operating temperature between -25° F and 225° F. The seal lip design achieves a light and constant contact with the shaft throughout the range of mounting bearing clearances thereby ensuring positive sealing and low frictional drag.

Sealed drawn cup bearings are intended to retain grease or non-pressurized oil within a bearing while also preventing contaminants from entering the raceway area.

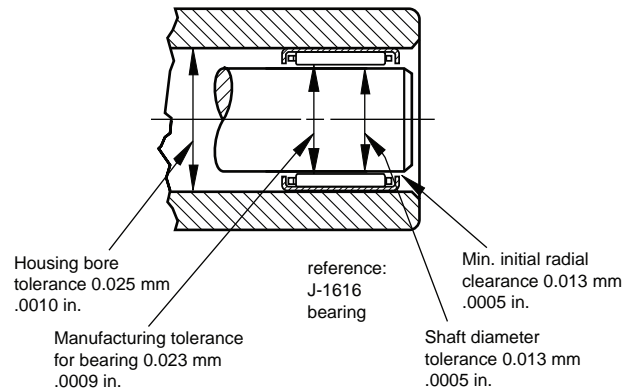
Details of shaft design for sealed bearings are given in the engineering section.

The standard lip contact seals are compatible with common lubricating oils and petroleum based fuels, but they are adversely affected by certain fire-resistant hydraulic fluids and most common solvents.

If the operating temperature must be outside of the specified range, or if the seals are exposed to unusual fluids, please consult your Timken representative.

## DIMENSIONAL ACCURACY AND MOUNTING DIMENSIONS

### MANUFACTURING TOLERANCES AND RESULTING CLEARANCES



### BEARING MOUNTING FITS AND RADIAL INTERNAL CLEARANCE

Drawn cup bearings are manufactured to a degree of precision that will satisfy the radial clearance requirements of most applications. The total radial clearance of an installed drawn cup bearing results from the build up of manufacturing tolerances of the housing bore, inner raceway O.D. and the bearing, as well as the minimum radial clearance required for the application.

For bearings of nominal inch dimensions, the suggested mounting dimensions will provide correct running clearance for most applications. Closer control of radial clearance would be governed by the user's capability of holding housing and shaft raceway dimensional tolerances tighter than the limits shown on the tabular pages.

The drawing illustrates the manufacturing tolerances and resulting clearances applying to medium size drawn cup bearings in rotating applications when using the suggested tabulated mounting dimensions.

Radial clearance in a mounted bearing may be more closely controlled by reducing the manufacturing tolerances of the housing bore and inner raceway diameter. Where extremely close control of radial clearance is required for bearings of nominal inch dimensions, extra-precision full complement bearings are available (see page C80).



## TOLERANCES FOR HOUSING MATERIALS OF LOW RIGIDITY

For housing materials of low rigidity, or steel housings of small section, it is suggested that for initial trial the housing bore diameters given in the tabular pages be reduced by the amounts shown in Table 3. To maintain normal radial internal clearance, the inner raceway diameter tolerance given in the tabular pages should be used.

TABLE 3 – LOW RIGIDITY HOUSING BORE

Nom. Housing Bore				Subtract	
inch				inch	
mm	inch	mm	inch	mm	inch
over	incl.	over	incl.		
0	9.5	0	.38	.010	.0004
9.5	25.4	.38	1.00	.015	.0006
25.4	50.8	1.00	2.00	.025	.0010
50.8	76.2	2.00	3.00	.030	.0012
76.2	152.4	3.00	6.00	.036	.0014

## OUTER RING ROTATION

For applications where the outer ring rotates with respect to the load, it is suggested that both the housing bore and inner raceway diameter be reduced. Bearings of nominal inch dimensions should have the housing bore and inner raceway diameters reduced by .0005 in.

## OSCILLATING MOTION

Applications involving oscillating motion often require reduced radial clearances. This reduction is accomplished by increasing the shaft raceway diameters as shown in Table 4.

TABLE 4 – NOMINAL INCH BEARING OSCILLATING SHAFT SIZE

Shaft Size		Add	
mm	inch	mm	inch
2.38 to 4.76	.094 to .188	.008	.0003
6.35 to 47.62	.25 to 1.875	.013	.0005
50.8 to 139.7	2 to 5.5	.015	.0006

## INNER RINGS

Where it becomes impractical to meet the shaft raceway design requirements (hardness, case depth, surface finish, etc.) outlined in the general engineering section, standard inner rings for drawn cup bearings are available. These are tabulated on pages C92 of the drawn cup section.

Inner rings for drawn cup bearings are designed to be a loose transition fit on the shaft and should be clamped against a shoulder. If a tight transition fit must be used to keep the inner ring from rotating relative to the shaft, the inner ring O.D., as mounted, must not exceed the raceway diameters required by the drawn cup bearing for the particular application. See the previous discussion on internal clearances and fits for further details on inner raceway diameter choice.

## LUBRICATION

Inch series drawn cup bearings can be furnished with an oil hole (centered in the drawn cup) to facilitate relubrication. If desired, specify on order by adding an -OH suffix to the bearing designation.

## LOAD RATING FACTORS DYNAMIC LOADS

Drawn cup needle roller bearings can accommodate only radial loads.

$$P = F_r$$

P = The maximum dynamic radial load that may be applied to a drawn cup bearing based on the dynamic load rating, C given in the tabular pages. This load should be  $\leq C/3$ .

## STATIC LOADS

$$f_0 = \frac{C_0}{P_0}$$

$f_0$  – static load safety factor

$C_0$  – basic static load rating

$P_0$  – maximum applied static load

To ensure satisfactory operation of drawn cup needle roller bearings under all types of conditions the static load safety factor  $f_0$  should be  $\geq 3$ .

## ADJUSTED RATING LIFE

When application data includes details of operating temperature, oil viscosity, operating speed and the applied load meets the  $\leq C/3$  condition adjusted rating life may be evaluated using the information given in the engineering section.

C

### INSPECTION PROCEDURES

Although the bearing cup (outer ring) is accurately drawn from strip steel it may go out of round during heat treatment. When the bearing is pressed into a true, round housing or ring gage of correct size and wall thickness, it becomes round and is sized properly. For this reason, it is incorrect to inspect an unmounted drawn cup bearing by measuring the O.D. The correct method for inspecting the bearing size is to:

1. press the bearing into a ring gage of proper size.
2. plug the bearing bore with the appropriate “go” and “no go” gages.

Table 2 provides the correct ring and plug gage diameters for inspecting Torrington drawn cup needle roller bearings. When the letter H appears in the columns headed “Bearing Bore Designation” and “Nominal Shaft Diameter”, the gage sizes listed are for the larger cross section bearings which include H in their bearing designation prefix.

### EXAMPLE

Find the ring gage and plug gage dimensions for a BH-68 bearing.

The nominal bore diameter ( $F_w$ ) for this bearing, as shown in the table of dimensions on this page, is .3750”. Since the letter H appears in the bearing designation, the following information will be found opposite H6 .3750” in Table 2.

	inch
ring gage	.6255
diameter under needle rollers, min.	.3765
diameter under needle rollers, max.	.3774

The “go” plug gage is the same size as the minimum needle roller complement bore diameter and the “no go” plug gage size is .0001” larger than the maximum bore diameter. Therefore the correct ring and plug gage dimensions are:

	inch
ring gage	.6255
plug gage, “go”	.3765
plug gage, “no go”	.3775

These same gage dimensions also apply to JH-68.

TABLE 2 –  
INCH SERIES BEARINGS

Bearing Bore Designation	Nominal Shaft Diameter	Nominal Bore Diameter	Ring Gage	Dimensions - inch	
				Needle Roller Complement Bore Diameter	
inch				min.	max.
2	1/8	.1250	.2505	.1258	.1267
2 1/2	5/32	.1562	.2817	.1571	.1580
3	3/16	.1875	.3437	.1883	.1892
4	1/4	.2500	.4380	.2515	.2524
5	5/16	.3125	.5005	.3140	.3149
H 5	H 5/16	.3125	.5630	.3140	.3149
6	3/8	.3750	.5630	.3765	.3774
H 6	H 3/8	.3750	.6255	.3765	.3774
7	7/16	.4375	.6255	.4390	.4399
H 7	H 7/16	.4375	.6880	.4390	.4399
8	1/2	.5000	.6880	.5015	.5024
H 8	H 1/2	.5000	.7505	.5015	.5024
9	9/16	.5625	.7505	.5640	.5649
H 9	H 9/16	.5625	.8130	.5640	.5649
10	5/8	.6250	.8130	.6265	.6274
H 10	H 5/8	.6250	.8755	.6265	.6274
11	11/16	.6875	.8755	.6890	.6899
H 11	H 11/16	.6875	.9380	.6890	.6899
12	3/4	.7500	.9995	.7505	.7514
H 12	H 3/4	.7500	1.0620	.7505	.7514
13	13/16	.8125	1.0620	.8130	.8139
H 13	H 13/16	.8125	1.1245	.8130	.8139
14	7/8	.8750	1.1245	.8755	.8764
H 14	H 7/8	.8750	1.1870	.8755	.8764
15	15/16	.9375	1.1870	.9380	.9389
16	1	1.0000	1.2495	1.0005	1.0014
H 16	H 1	1.0000	1.3120	1.0005	1.0014
17	1 1/16	1.0625	1.3120	1.0630	1.0639
18	1 1/8	1.1250	1.3745	1.1255	1.1264
H 18	H 1 1/8	1.1250	1.4995	1.1255	1.1264
19	1 3/16	1.1875	1.4995	1.1880	1.1889
20	1 1/4	1.2500	1.4995	1.2505	1.2514
H 20	H 1 1/4	1.2500	1.6245	1.2505	1.2514
21	1 5/16	1.3125	1.6245	1.3130	1.3140
22	1 3/8	1.3750	1.6245	1.3755	1.3765
H 22	H 1 3/8	1.3750	1.7495	1.3755	1.3765
24	1 1/2	1.5000	1.8745	1.5005	1.5016
26	1 5/8	1.6250	1.9995	1.6255	1.6266
28	1 3/4	1.7500	2.1245	1.7505	1.7517
30	1 7/8	1.8750	2.2495	1.8755	1.8767
32	2	2.0000	2.3745	2.0006	2.0018
H 32	H 2 1/16	2.0625	2.5307	2.0630	2.0644
34	2 1/8	2.1250	2.4995	2.1256	2.1270
36	2 1/4	2.2500	2.6245	2.2506	2.2520
42	2 5/8	2.6250	2.9995	2.6260	2.6274
44	2 3/4	2.7500	3.1245	2.7510	2.7524
56	3 1/2	3.5000	3.9995	3.5010	3.5024
88	5 1/2	5.5000	5.9990	5.5010	5.5029

Bearing bore should be checked with “go” and “no go” plug gages. The “go” gage size is the minimum needle roller complement bore diameter. The “no go” gage size is larger than the maximum needle roller complement bore diameter by 0.0001”.



## INSTALLATION OF DRAWN CUP BEARINGS

### GENERAL INSTALLATION REQUIREMENTS

- A drawn cup bearing must be pressed into its housing.
- An installation tool, similar to the ones shown, must be used in conjunction with a standard press.
- The bearing must not be hammered into its housing, even in conjunction with the proper assembly mandrel.
- The bearing must not be pressed tightly against a shoulder in the housing.
- If it is necessary to use a shouldered housing, the depth of the housing bore must be sufficient to ensure the housing shoulder fillet, as well as the shoulder face, clears the bearing.
- The installation tool must be coaxial with the housing bore.

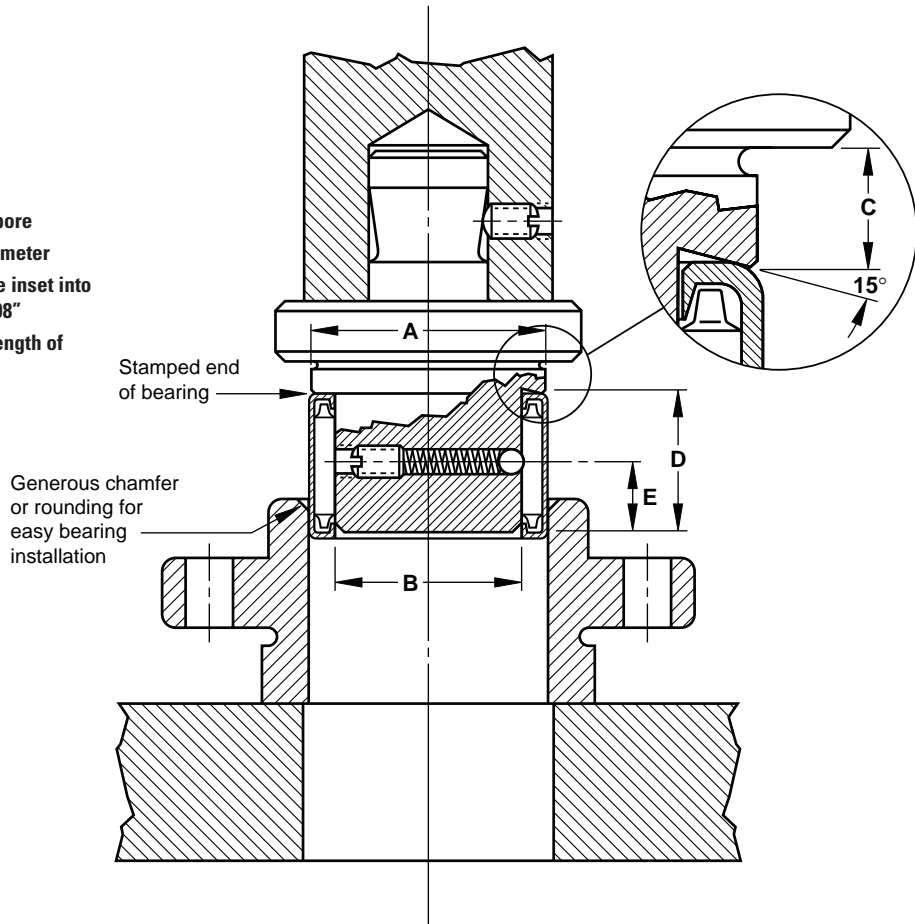
## C

### INSTALLATION OF OPEN END BEARINGS

It is advisable to utilize a positive stop on the press tool to locate the bearing properly in the housing. The assembly tool should have a leader or a pilot, as shown, to aid in starting the bearing true in the housing. The ball detent shown on the drawing is used to assist in aligning the rollers of a full complement bearing during installation and to hold the bearing on the installation tool. A caged type drawn cup bearing does not require a ball detent to align its rollers. The

ball detent may still be used to hold the bearing on the installation tool or an "O" ring may be used as shown in the drawing on page C41. The bearing should be installed with the marked end (the end with identification markings) against the angled shoulder of the pressing tool.

- A –  $\frac{1}{64}$ " less than housing bore
- B – .003" less than shaft diameter
- C – distance bearing will be inset into housing, minimum of .008"
- D – pilot length should be length of bearing less  $\frac{1}{32}$ "
- E – approximately  $\frac{1}{2}$  D

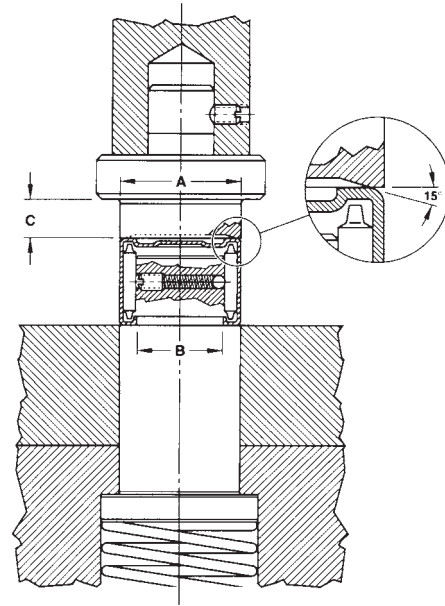


### INSTALLATION OF CLOSED END BEARINGS

The installation tool combines all the features of the tool used to install open end bearings, but the pilot is spring loaded and is part of the press bed.

The angled shoulder of the pressing tool should bear against the closed end with the bearing held on the pilot to aid in starting the bearing true in the housing.

- A** –  $\frac{1}{64}$ " less than housing bore
- B** – .003" less than shaft diameter
- C** – distance bearing will be inset into housing, minimum of .008"

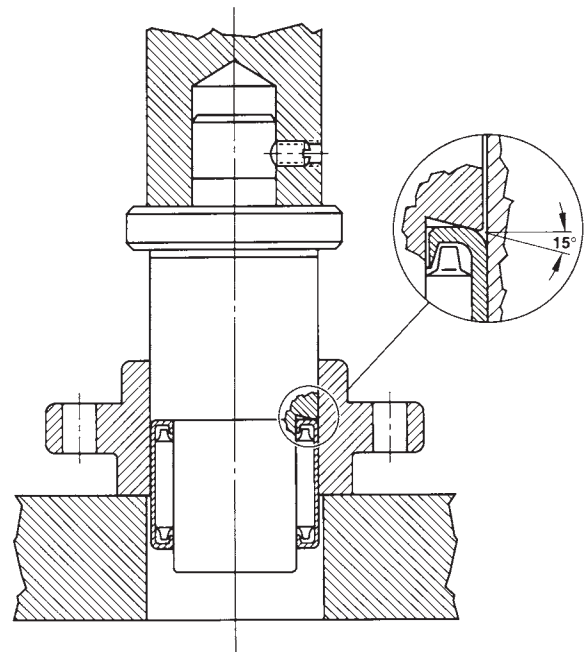


### EXTRACTION OF DRAWN CUP BEARINGS

The need to extract a drawn cup bearing does not arise often. Standard extractor tools may be purchased from a reputable manufacturer. Customers may produce the special extraction tools at their own facilities. In certain cases, The Timken Company may assist, particularly when a drawn cup bearing appears to be damaged and a full analysis is required. After extraction, the drawn cup bearing should not be reused.

#### EXTRACTION FROM A STRAIGHT HOUSING

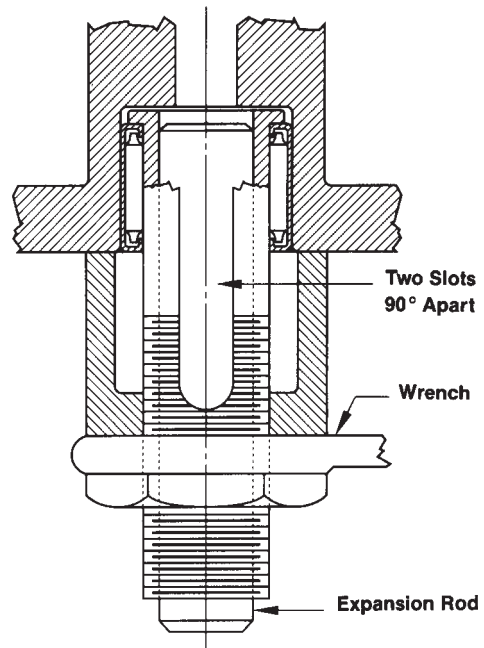
When it is necessary to extract a drawn cup bearing from a straight housing, a similar tool to the installation tool, but without the stop, may be used. To avoid damage to the bearing, pressure should be applied against the marked end of the bearing, just as it is done at installation.





### EXTRACTION FROM A SHOULDERED OR DEAD END HOUSING (with space between the bearing and the housing shoulder)

Bearings may be extracted from shouldered or dead end housings with a common bearing puller tool as shown. This type of tool is slotted in two places at right angles to form four prongs. The four puller prongs are pressed together and inserted into the space between the end of the bearing and the shoulder. The prongs are forced outward by inserting the expansion rod, and then the bearing is extracted. Do not reuse the bearing after extraction.



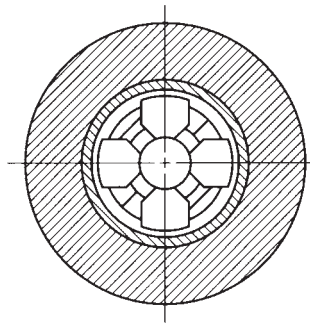
C



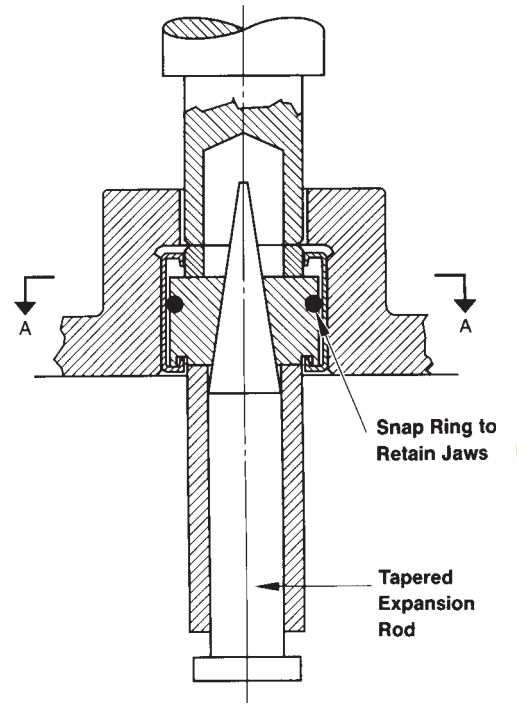
**EXTRACTION FROM A SHOULDERED HOUSING (with bearing pressed up close to the shoulder)**

The tool to be used, as shown, is of a similar type described for a shouldered or dead end housing, but the rollers must first be removed from the bearing.

The four segment puller jaws are collapsed and slipped into the empty cup. The jaws are then forced outward into the cup bore by means of the tapered expansion rod. The jaws should bear on the lip as near as possible to the cup bore. The cup is then pressed out from the top.



Section A-A of Four Jaws

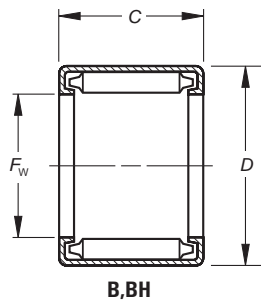




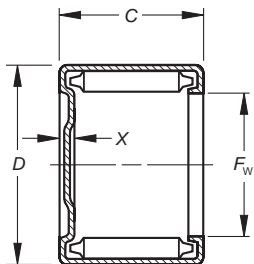


**FULL COMPLEMENT BEARINGS,  
OPEN ENDS, CLOSED ONE END**

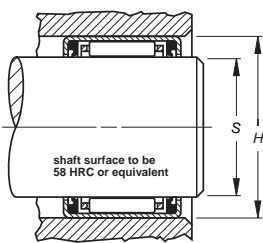
**INCH SERIES**



**B,BH**



**M-1, MH-1**



**Full Complement Bearing**

Drawn cup bearings of nominal inch dimensions, with one closed end, that are not tabulated, may be made available upon request.

Mounting dimensions are based on the inner ring rotating and the outer ring being stationary relative to the load. The housing should be of high strength material. See engineering section for discussion of shaft and housing design.

Shaft Dia.	Dimensions mm/in.				Bearing Designation		Load Ratings		Limiting Speed		C <sub>g</sub>
	+0 +0.000 -0.3 -0.100						Dynamic	Static	Grease	Oil	
in.	F <sub>w</sub>	D	C	Y	C	C <sub>0</sub>	RPM				
1/8	3.175	6.350	6.35	—	B-24	—	1.73	1.65	8100	13000	0.0081
	0.1250	0.2500	0.250				390	370			
5/32	3.970	7.142	6.35	—	B-2-1/2-4	—	2.00	2.00	7000	11000	0.0093
	0.1563	0.2812	0.250				450	450			
3/16	3.970	7.142	7.92	—	B-2-1/2-5	—	2.58	2.80	7000	11000	0.0101
	0.1563	0.2812	0.312				580	630			
1/4	4.763	8.733	6.35	1.78	B-34	M-341	2.22	2.14	7000	11000	0.0099
	0.1875	0.3438	0.250	0.07			500	480			
1/4	4.763	8.733	9.53	1.78	B-36	M-361	3.78	4.23	7000	11000	0.0118
	0.1875	0.3438	0.375	0.07			850	950			
1/4	6.350	11.113	6.35	2.03	B-44	M-441	2.76	2.62	6500	10000	0.0115
	0.2500	0.4375	0.250	0.08			620	590			
1/4	6.350	11.113	7.92	2.03	B-45	M-451	3.56	3.69	6500	10000	0.0125
	0.2500	0.4375	0.312	0.08			800	830			
1/4	6.350	11.113	9.53	—	B-46	—	4.54	5.03	6500	10000	N/A
	0.2500	0.4375	0.375				1020	1130			
5/16	6.350	11.113	11.13	2.03	B-47	M-471	5.52	6.45	6500	10000	0.0143
	0.2500	0.4375	0.438	0.08			1240	1450			
5/16	7.938	12.700	7.92	2.03	B-55	M-551	4.09	4.58	5400	8300	0.0144
	0.3125	0.5000	0.312	0.08			920	1030			
5/16	7.938	12.700	9.53	—	B-56	—	5.25	6.32	5400	8300	0.0156
	0.3125	0.5000	0.375				1180	1420			
5/16	7.938	12.700	11.13	2.03	B-57	M-571	6.32	8.1	5400	8300	0.0165
	0.3125	0.5000	0.438	0.08			1420	1820			
5/16	7.938	12.700	14.27	—	B-59	—	8.36	11.60	5400	8300	0.0181
	0.3125	0.5000	0.562				1880	2600			
5/16	7.938	14.288	11.13	2.29	BH-57	MH-571	7.03	7.34	7500	12000	0.0156
	0.3125	0.5625	0.438	0.09			1580	1650			
3/8	7.938	14.288	14.27	—	BH-59	—	9.47	10.80	7500	12000	0.0171
	0.3125	0.5625	0.562				2130	2420			
3/8	9.525	14.288	7.92	2.03	B-65	M-651	4.54	5.52	4600	7100	0.0162
	0.3750	0.5625	0.312	0.08			1020	1240			
3/8	9.525	14.288	9.53	2.03	B-66	M-661	5.83	7.61	4600	7100	0.0175
	0.3750	0.5625	0.375	0.08			1310	1710			
3/8	9.525	14.288	11.13	—	B-67	—	7.07	9.7	4600	7100	0.0186
	0.3750	0.5625	0.438				1590	2180			
3/8	9.525	14.288	12.70	2.03	B-68	M-681	8.18	11.80	4600	7100	0.0195
	0.3750	0.5625	0.500	0.08			1840	2650			
3/8	9.525	14.288	14.27	—	B-69	—	9.34	13.92	4600	7100	0.0203
	0.3750	0.5625	0.562				2100	3130			
3/8	9.525	14.288	15.88	2.03	B-610	M-6101	10.4	16.00	4600	7100	0.0211
	0.3750	0.5625	0.625	0.08			2340	3590			
7/16	9.525	15.875	12.70	—	BH-68	—	9.34	10.90	6500	10000	0.0184
	0.3750	0.6250	0.500				2100	2460			
7/16	11.113	15.875	9.53	—	B-76	—	6.36	8.90	4100	6300	0.0194
	0.4375	0.6250	0.375				1430	2000			
7/16	11.113	15.875	11.13	—	B-77	—	7.70	11.3	4100	6300	0.0206
	0.4375	0.6250	0.438				1730	2550			
7/16	11.113	15.875	12.70	2.03	B-78	M-781	8.99	13.80	4100	6300	0.0216
	0.4375	0.6250	0.500	0.08			2020	3100			
7/16	11.113	15.875	15.88	—	B-710	—	11.3	18.7	4100	6300	0.0233
	0.4375	0.6250	0.625				2550	4200			



Wt. kg/lbs. Approx.		Bearing Mounting mm/in.				Inspection mm/in.			Matching Inner Ring*	Shaft Dia.
Open Ends	Closed Ends	Max.	Min.	Min.	Max.	Ring Gage	Plug-GO	Plug-NO-Go		
		S		H						
0.001 0.002	—	3.175 0.1250	3.167 0.1247	6.350 0.2500	6.363 0.2505	6.363 0.2505	3.195 0.1258	3.221 0.1268		1/8
0.001 0.002	—	3.970 0.1563	3.962 0.1560	7.142 0.2812	7.155 0.2817	7.155 0.2817	3.990 0.1571	4.016 0.1581		5/32
0.001 0.003	—	3.970 0.1563	3.962 0.1560	7.142 0.2812	7.155 0.2817	7.155 0.2817	3.990 0.1571	4.016 0.1581		
0.001 0.003	0.002 0.004	4.763 0.1875	4.755 0.1872	8.717 0.3432	8.730 0.3437	8.730 0.3437	4.783 0.1883	4.808 0.1893		3/16
0.002 0.005	0.003 0.006	4.763 0.1875	4.755 0.1872	8.717 0.3432	8.730 0.3437	8.730 0.3437	4.783 0.1883	4.808 0.1893		
0.002 0.005	0.003 0.006	6.350 0.2500	6.337 0.2495	11.100 0.4370	11.125 0.4380	11.125 0.4380	6.388 0.2515	6.414 0.2525		1/4
0.003 0.007	0.004 0.008	6.350 0.2500	6.337 0.2495	11.100 0.4370	11.125 0.4380	11.125 0.4380	6.388 0.2515	6.414 0.2525		
0.004 0.008	—	6.350 0.2500	6.337 0.2495	11.100 0.4370	11.125 0.4380	11.125 0.4380	6.388 0.2515	6.414 0.2525		
0.004 0.009	0.005 0.011	6.350 0.2500	6.337 0.2495	11.100 0.4370	11.125 0.4380	11.125 0.4380	6.388 0.2515	6.414 0.2525		
0.004 0.008	0.004 0.009	7.938 0.3125	7.925 0.3120	12.687 0.4995	12.713 0.5005	12.713 0.5005	7.976 0.3140	8.001 0.3150		5/16
0.005 0.010	—	7.938 0.3125	7.925 0.3120	12.687 0.4995	12.713 0.5005	12.713 0.5005	7.976 0.3140	8.001 0.3150		
0.005 0.011	0.006 0.013	7.938 0.3125	7.925 0.3120	12.687 0.4995	12.713 0.5005	12.713 0.5005	7.976 0.3140	8.001 0.3150		
0.006 0.014	—	7.938 0.3125	7.925 0.3120	12.687 0.4995	12.713 0.5005	12.713 0.5005	7.976 0.3140	8.001 0.3150		
0.007 0.016	0.008 0.018	7.938 0.3125	7.925 0.3120	14.275 0.5620	14.300 0.5630	14.300 0.5630	7.976 0.3140	8.001 0.3150		
0.009 0.020	—	7.938 0.3125	7.925 0.3120	14.275 0.5620	14.300 0.5630	14.300 0.5630	7.976 0.3140	8.001 0.3150		
0.004 0.009	0.005 0.010	9.525 0.3750	9.512 0.3745	14.275 0.5620	14.300 0.5630	14.300 0.5630	9.563 0.3765	9.589 0.3775		3/8
0.005 0.011	0.005 0.012	9.525 0.3750	9.512 0.3745	14.275 0.5620	14.300 0.5630	14.300 0.5630	9.563 0.3765	9.589 0.3775		
0.006 0.013	—	9.525 0.3750	9.512 0.3745	14.275 0.5620	14.300 0.5630	14.300 0.5630	9.563 0.3765	9.589 0.3775		
0.007 0.015	0.008 0.017	9.525 0.3750	9.512 0.3745	14.275 0.5620	14.300 0.5630	14.300 0.5630	9.563 0.3765	9.589 0.3775	IRA-3	
0.007 0.016	—	9.525 0.3750	9.512 0.3745	14.275 0.5620	14.300 0.5630	14.300 0.5630	9.563 0.3765	9.589 0.3775		
0.008 0.018	0.01 0.021	9.525 0.3750	9.512 0.3745	14.275 0.5620	14.300 0.5630	14.300 0.5630	9.563 0.3765	9.589 0.3775		
0.010 0.021	0.000	9.525 0.3750	9.512 0.3745	15.862 0.6245	15.888 0.6255	15.888 0.6255	9.563 0.3765	9.589 0.3775	IRA-3	
0.005 0.012	—	11.113 0.4375	11.100 0.4370	15.862 0.6245	15.888 0.6255	15.888 0.6255	11.151 0.4390	11.176 0.4400	IRA-4	7/16
0.007 0.015	—	11.113 0.4375	11.100 0.4370	15.862 0.6245	15.888 0.6255	15.888 0.6255	11.151 0.4390	11.176 0.4400	IRA-4	
0.008 0.017	0.009 0.019	11.113 0.4375	11.100 0.4370	15.862 0.6245	15.888 0.6255	15.888 0.6255	11.151 0.4390	11.176 0.4400	IRA-4	
0.010 0.021	—	11.113 0.4375	11.100 0.4370	15.862 0.6245	15.888 0.6255	15.888 0.6255	11.151 0.4390	11.176 0.4400		

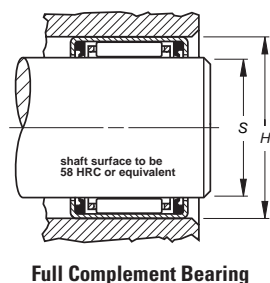
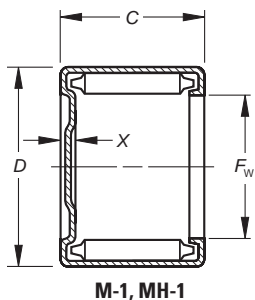
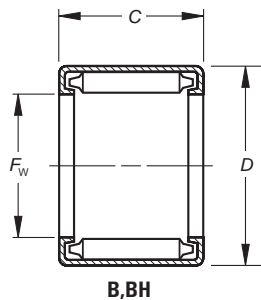
\* Further reduces shaft diameter.

Continued on next page.



**FULL COMPLEMENT BEARINGS,  
OPEN ENDS, CLOSED ONE END** – *continued*

**INCH SERIES**



Drawn cup bearings of nominal inch dimensions, with one closed end, that are not tabulated, may be made available upon request.

Mounting dimensions are based on the inner ring rotating and the outer ring being stationary relative to the load. The housing should be of high strength material. See engineering section for discussion of shaft and housing design.

Shaft Dia.	Dimensions mm/in.				Bearing Designation		Load Ratings		Limiting Speed		C <sub>g</sub>
	+0 +0.000 -0.3 -0.100						Dynamic	Static	Grease	Oil	
in.	F <sub>w</sub>	D	C	Y			C	C <sub>0</sub>	RPM		
	11.113 0.4375	17.463 0.6875	12.70 0.500	—	BH-78	—	10.3 2320	12.8 2870	5700	8800	0.0203
	12.700 0.5000	17.463 0.6875	7.92 0.312	2.03 0.08	B-85	M-851	5.34 1200	7.38 1660	3600	5600	0.0196
1/2	12.700 0.5000	17.463 0.6875	9.53 0.375	2.03 0.08	B-86	M-861	6.85 1540	10.1 2280	3600	5600	0.0212
	12.700 0.5000	17.463 0.6875	11.13 0.438	2.03 0.08	B-87	M-871	8.32 1870	13.0 2920	3600	5600	0.0225
	12.700 0.5000	17.463 0.6875	12.70 0.500	2.03 0.08	B-88	M-881	9.61 2160	15.7 3530	3600	5600	0.0236
	12.700 0.5000	17.463 0.6875	15.88 0.625	2.03 0.08	B-810	M-8101	12.2 2750	21.34 4800	3600	5600	0.0255
	12.700 0.5000	17.463 0.6875	19.05 0.750	2.03 0.08	B-812	M-8121	14.7 3300	27.0 6060	3600	5600	0.0270
	12.700 0.5000	19.050 0.7500	11.13 0.438	—	BH-87	—	9.47 2130	11.8 2650	5100	7900	0.0210
	12.700 0.5000	19.050 0.7500	12.70 0.500	—	BH-88	—	11.2 2510	14.6 3280	5100	7900	0.0221
	12.700 0.5000	19.050 0.7500	15.88 0.625	—	BH-810	—	14.4 3230	20.2 4540	5100	7900	0.0240
9/16	12.700 0.5000	19.050 0.7500	19.05 0.750	2.29 0.09	BH-812	MH-8121	17.4 3910	25.8 5790	5100	7900	0.0255
	14.288 0.5625	19.050 0.7500	7.92 0.312	2.03 0.08	B-95	M-951	5.74 1290	8.32 1870	3300	5000	0.0212
	14.288 0.5625	19.050 0.7500	9.53 0.375	2.03 0.08	B-96	M-961	7.34 1650	11.4 2570	3300	5000	0.0229
	14.288 0.5625	19.050 0.7500	11.13 0.438	2.03 0.08	B-97	M-971	8.85 1990	14.6 3280	3300	5000	0.0244
	14.288 0.5625	19.050 0.7500	12.70 0.500	2.03 0.08	B-98	M-981	10.3 2320	17.7 3990	3300	5000	0.0256
	14.288 0.5625	19.050 0.7500	15.88 0.625	2.03 0.08	B-910	M-9101	13.1 2940	24.0 5400	3300	5000	0.0276
	14.288 0.5625	19.050 0.7500	19.05 0.750	2.03 0.08	B-912	M-9121	15.7 3520	30.3 6820	3300	5000	0.0292
	14.288 0.5625	20.638 0.8125	12.70 0.500	—	BH-98	—	12.0 2690	16.5 3700	4600	7100	0.0239
	14.288 0.5625	20.638 0.8125	15.88 0.625	—	BH-910	—	15.4 3460	22.7 5110	4600	7100	0.0259
	14.288 0.5625	20.638 0.8125	19.05 0.750	—	BH-912	—	18.6 4190	29.0 6520	4600	7100	0.0275
5/8	15.875 0.6250	20.638 0.8125	7.92 0.312	2.03 0.08	B-105	M-1051	6.1 1360	9.25 2080	3000	4500	0.0227
	15.875 0.6250	20.638 0.8125	11.13 0.438	2.03 0.08	B-107	M-1071	9.39 2110	16.2 3650	3000	4500	0.0262
	15.875 0.6250	20.638 0.8125	12.70 0.500	2.03 0.08	B-108	M-1081	10.9 2450	19.7 4430	3000	4500	0.0275
	15.875 0.6250	20.638 0.8125	15.88 0.625	2.03 0.08	B-1010	M-10101	13.80 3110	26.7 6000	3000	4500	0.0296
	15.875 0.6250	20.638 0.8125	19.05 0.750	2.03 0.08	B-1012	M-10121	16.6 3720	33.7 7580	3000	4500	0.0314
	15.875 0.6250	22.212 0.8745	12.70 0.500	2.29 0.09	BH-108	MH-1081	12.7 2860	18.3 4110	4200	6500	0.0256

Wt. kg/lbs. Approx.		Bearing Mounting mm/in.				Inspection mm/in.			Matching Inner Ring*	Shaft Dia.  in.
Open Ends	Closed Ends	Max.	Min.	Min.	Max.	Ring Gage	Plug-GO	Plug-NO-Go		
		S		H						
0.010 0.023	—	11.113 0.4375	11.100 0.4370	17.450 0.6870	17.475 0.6880	17.475 0.6880	11.151 0.4390	11.176 0.4400	IRA-4	
0.005 0.012	0.006 0.014	12.700 0.5000	12.687 0.4995	17.450 0.6870	17.475 0.6880	17.475 0.6880	12.738 0.5015	12.764 0.5025	IRA-5	1/2
0.006 0.014	0.007 0.016	12.700 0.5000	12.687 0.4995	17.450 0.6870	17.475 0.6880	17.475 0.6880	12.738 0.5015	12.764 0.5025	IRA-5	
0.007 0.016	0.008 0.018	12.700 0.5000	12.687 0.4995	17.450 0.6870	17.475 0.6880	17.475 0.6880	12.738 0.5015	12.764 0.5025	IRA-5	
0.009 0.019	0.010 0.021	12.700 0.5000	12.687 0.4995	17.450 0.6870	17.475 0.6880	17.475 0.6880	12.738 0.5015	12.764 0.5025		
0.010 0.023	0.012 0.026	12.700 0.5000	12.687 0.4995	17.450 0.6870	17.475 0.6880	17.475 0.6880	12.738 0.5015	12.764 0.5025		
0.013 0.028	0.014 0.031	12.700 0.5000	12.687 0.4995	17.450 0.6870	17.475 0.6880	17.475 0.6880	12.738 0.5015	12.764 0.5025		
0.010 0.023	—	12.700 0.5000	12.687 0.4995	19.037 0.7495	19.063 0.7505	19.063 0.7505	12.738 0.5015	12.764 0.5025	IRA-5	
0.012 0.026	—	12.700 0.5000	12.687 0.4995	19.037 0.7495	19.063 0.7505	19.063 0.7505	12.738 0.5015	12.764 0.5025	IRA-5	
0.015 0.033	—	12.700 0.5000	12.687 0.4995	19.037 0.7495	19.063 0.7505	19.063 0.7505	12.738 0.5015	12.764 0.5025		
0.018 0.039	0.020 0.044	12.700 0.5000	12.687 0.4995	19.037 0.7495	19.063 0.7505	19.063 0.7505	12.738 0.5015	12.764 0.5025		
0.006 0.013	0.006 0.014	14.288 0.5625	14.275 0.5620	19.037 0.7495	19.063 0.7505	19.063 0.7505	14.326 0.5640	14.351 0.5650	IR-68	9/16
0.007 0.015	0.008 0.018	14.288 0.5625	14.275 0.5620	19.037 0.7495	19.063 0.7505	19.063 0.7505	14.326 0.5640	14.351 0.5650	IR-68	
0.008 0.018	0.010 0.021	14.288 0.5625	14.275 0.5620	19.037 0.7495	19.063 0.7505	19.063 0.7505	14.326 0.5640	14.351 0.5650	IR-68	
0.009 0.020	0.010 0.023	14.288 0.5625	14.275 0.5620	19.037 0.7495	19.063 0.7505	19.063 0.7505	14.326 0.5640	14.351 0.5650	IR-68	
0.012 0.026	0.013 0.029	14.288 0.5625	14.275 0.5620	19.037 0.7495	19.063 0.7505	19.063 0.7505	14.326 0.5640	14.351 0.5650	IR-612	
0.014 0.031	0.015 0.034	14.288 0.5625	14.275 0.5620	19.037 0.7495	19.063 0.7505	19.063 0.7505	14.326 0.5640	14.351 0.5650	IR-612	
0.013 0.029	—	14.288 0.5625	14.275 0.5620	20.625 0.8120	20.650 0.8130	20.650 0.8130	14.326 0.5640	14.351 0.5650	IR-68	
0.016 0.036	—	14.288 0.5625	14.275 0.5620	20.625 0.8120	20.650 0.8130	20.650 0.8130	14.326 0.5640	14.351 0.5650	IR-612	
0.020 0.043	—	14.288 0.5625	14.275 0.5620	20.625 0.8120	20.650 0.8130	20.650 0.8130	14.326 0.5640	14.351 0.5650	IRA-6	
0.006 0.014	0.007 0.016	15.875 0.6250	15.862 0.6245	20.625 0.8120	20.650 0.8130	20.650 0.8130	15.913 0.6265	15.939 0.6275	IR-68-1	5/8
0.009 0.020	0.010 0.022	15.875 0.6250	15.862 0.6245	20.625 0.8120	20.650 0.8130	20.650 0.8130	15.913 0.6265	15.939 0.6275	IR-68-1	
0.010 0.022	0.012 0.026	15.875 0.6250	15.862 0.6245	20.625 0.8120	20.650 0.8130	20.650 0.8130	15.913 0.6265	15.939 0.6275	IR-68-1	
0.013 0.028	0.015 0.032	15.875 0.6250	15.862 0.6245	20.625 0.8120	20.650 0.8130	20.650 0.8130	15.913 0.6265	15.939 0.6275	IR-612-1	
0.015 0.034	0.017 0.038	15.875 0.6250	15.862 0.6245	20.625 0.8120	20.650 0.8130	20.650 0.8130	15.913 0.6265	15.939 0.6275	IR-612-1	
0.014 0.031	0.016 0.035	15.875 0.6250	15.862 0.6245	22.212 0.8745	22.238 0.8755	22.238 0.8755	15.913 0.6265	15.939 0.6275	IR-68-1	5/8

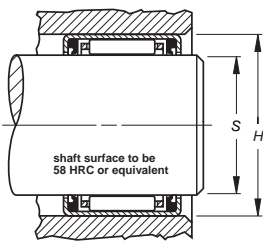
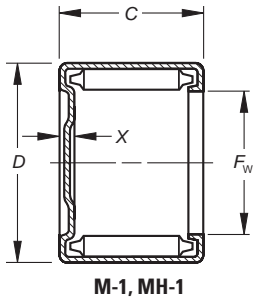
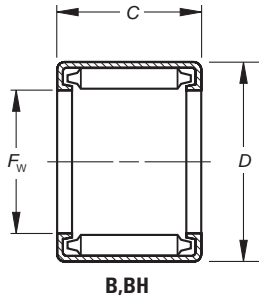
\* Further reduces shaft diameter.

Continued on next page.



**FULL COMPLEMENT BEARINGS,  
OPEN ENDS, CLOSED ONE END** – *continued*

**INCH SERIES**



Drawn cup bearings of nominal inch dimensions, with one closed end, that are not tabulated, may be made available upon request.

Mounting dimensions are based on the inner ring rotating and the outer ring being stationary relative to the load. The housing should be of high strength material. See engineering section for discussion of shaft and housing design.

Shaft Dia.	Dimensions mm/in.				Bearing Designation		Load Ratings		Limiting Speed		C <sub>g</sub>
	+0 +0.000 -0.3 -0.100						Dynamic	Static	Grease	Oil	
in.	F <sub>w</sub>	D	C	Y			C	C <sub>0</sub>	RPM		
	15.875	22.212	15.88	—	BH-1010	—	16.4	25.3	4200	6500	0.0278
	0.6250	0.8745	0.625	—			3680	5680			
5/8	15.875	22.212	19.05	—	BH-1012	—	19.8	32.3	4200	6500	0.0295
	0.6250	0.8745	0.750	—			4450	7250			
	15.875	22.212	25.40	—	BH-1016	—	26.2	46.3	4200	6500	0.0322
	0.6250	0.8745	1.000	—			5890	10400			
11/16	17.463	22.212	9.53	2.03	B-116	M-1161	8.18	14.0	2700	4200	0.0263
	0.6875	0.8745	0.375	0.08			1840	3140			
	17.463	22.212	12.70	2.03	B-118	M-1181	11.5	21.7	2700	4200	0.0293
	0.6875	0.8745	0.500	0.08			2580	4880			
	17.463	22.212	15.88	2.03	B-1110	M-11101	14.6	29.4	2700	4200	0.0316
	0.6875	0.8745	0.625	0.08			3270	6610			
	17.463	22.212	19.05	2.03	B-1112	M-11121	17.4	37.1	2700	4200	0.0335
	0.6875	0.8745	0.750	0.08			3920	8340			
	17.463	23.813	11.13	—	BH-117	—	11.4	16.2	3900	6000	0.0259
	0.6875	0.9375	0.438	—			2560	3650			
	17.463	23.813	15.88	2.29	BH-1110	MH-11101	17.3	27.8	3900	6000	0.0296
	0.6875	0.9375	0.625	0.09			3890	6250			
	17.463	23.813	19.05	—	BH-1112	—	20.9	35.5	3900	6000	0.0314
	0.6875	0.9375	0.750	—			4700	7980			
3/4	19.050	25.400	9.53	2.29	B-126	M-1261	9.7	13.6	3600	5600	0.0256
	0.7500	1.0000	0.375	0.09			2180	3050			
	19.050	25.400	12.70	2.29	B-128	M-1281	14.1	22.0	3600	5600	0.0289
	0.7500	1.0000	0.500	0.09			3170	4940			
	19.050	25.400	15.88	2.29	B-1210	M-12101	18.2	30.3	3600	5600	0.0313
	0.7500	1.0000	0.625	0.09			4080	6820			
	19.050	25.400	19.05	2.29	B-1212	M-12121	21.9	38.7	3600	5600	0.0333
	0.7500	1.0000	0.750	0.09			4930	8710			
13/16	20.638	26.988	9.53	—	B-136	—	10.1	14.68	3400	5200	0.0271
	0.8125	1.0625	0.375	—			2280	3300			
	20.638	26.988	12.70	2.29	B-138	M-1381	14.8	23.80	3400	5200	0.0305
	0.8125	1.0625	0.500	0.09			3320	5350			
	20.638	26.988	22.23	2.29	B-1314	M-13141	26.7	51.15	3400	5200	0.0369
	0.8125	1.0625	0.875	0.09			6010	11500			
	20.638	26.988	25.40	2.29	B-1316	M-13161	30.3	60.05	3400	5200	0.0384
	0.8125	1.0625	1.000	0.09			6820	13500			
	20.638	26.988	31.75	—	B-1320	—	37.3	78.29	3500	5200	N/A
	0.8125	1.0625	1.250	—			8380	17600			
	20.643	28.575	12.70	2.79	BH-138	MH-1381	14.9	20.82	4100	6300	0.0287
	0.8127	1.1250	0.500	0.11			3340	4680			
	20.638	28.575	15.88	2.79	BH-1310	MH-13101	19.70	29.89	4100	6300	0.0314
	0.8125	1.1250	0.625	0.11			4430	6720			
	20.638	28.575	19.05	2.79	BH-1312	MH-13121	24.2	38.97	4100	6300	0.0336
	0.8125	1.1250	0.750	0.11			5440	8760			
7/8	22.225	28.575	9.53	2.29	B-146	M-1461	10.5	15.84	3100	4800	0.0285
	0.8750	1.1250	0.375	0.09			2370	3560			
	22.225	28.575	12.70	2.29	B-148	M-1481	15.4	25.62	3100	4800	0.0321
	0.8750	1.1250	0.500	0.09			3450	5760			
	22.225	28.575	19.05	2.29	B-1412	M-14121	23.9	45.37	3100	4800	0.0369
	0.8750	1.1250	0.750	0.09			5370	10200			
	22.225	28.575	25.40	2.29	B-1416	M-14161	31.6	64.94	3100	4800	0.0404
	0.8750	1.1250	1.000	0.09			7100	14600			

Wt. kg/lbs. Approx.		Bearing Mounting mm/in.				Inspection mm/in.			Matching Inner Ring*	Shaft Dia.  in.
Open Ends	Closed Ends	Max.	Min.	Min.	Max.	Ring Gage	Plug-GO	Plug-NO-Go		
		S		H						
0.018 0.039	—	15.875 0.6250	15.862 0.6245	22.212 0.8745	22.238 0.8755	22.238 0.8755	15.913 0.6265	15.939 0.6275	IR-612-1	
0.021 0.047	—	15.875 0.6250	15.862 0.6245	22.212 0.8745	22.238 0.8755	22.238 0.8755	15.913 0.6265	15.939 0.6275	IR-612-1	5/8
0.028 0.062	—	15.875 0.6250	15.862 0.6245	22.212 0.8745	22.238 0.8755	22.238 0.8755	15.913 0.6265	15.939 0.6275		
0.008 0.018	0.009 0.020	17.463 0.6875	17.450 0.6870	22.212 0.8745	22.238 0.8755	22.238 0.8755	17.501 0.6890	17.526 0.6900		11/16
0.011 0.024	0.012 0.027	17.463 0.6875	17.450 0.6870	22.212 0.8745	22.238 0.8755	22.238 0.8755	17.501 0.6890	17.526 0.6900		
0.014 0.030	0.015 0.034	17.463 0.6875	17.450 0.6870	22.212 0.8745	22.238 0.8755	22.238 0.8755	17.501 0.6890	17.526 0.6900		
0.016 0.036	0.019 0.041	17.463 0.6875	17.450 0.6870	22.212 0.8745	22.238 0.8755	22.238 0.8755	17.501 0.6890	17.526 0.6900		
0.014 0.030	—	17.463 0.6875	17.450 0.6870	23.800 0.9370	23.825 0.9380	23.825 0.9380	17.501 0.6890	17.526 0.6900		
0.019 0.042	0.021 0.047	17.463 0.6875	17.450 0.6870	23.800 0.9370	23.825 0.9380	23.825 0.9380	17.501 0.6890	17.526 0.6900		
0.023 0.051	—	17.463 0.6875	17.450 0.6870	23.800 0.9370	23.825 0.9380	23.825 0.9380	17.501 0.6890	17.526 0.6900		
0.012 0.027	0.014 0.031	19.050 0.7500	19.037 0.7495	25.387 0.9995	25.413 1.0005	25.387 0.9995	19.063 0.7505	19.088 0.7515	IR-88	3/4
0.016 0.036	0.019 0.041	19.050 0.7500	19.037 0.7495	25.387 0.9995	25.413 1.0005	25.387 0.9995	19.063 0.7505	19.088 0.7515	IR-88	
0.020 0.045	0.024 0.052	19.050 0.7500	19.037 0.7495	25.387 0.9995	25.413 1.0005	25.387 0.9995	19.063 0.7505	19.088 0.7515		
0.024 0.054	0.028 0.062	19.050 0.7500	19.037 0.7495	25.387 0.9995	25.413 1.0005	25.387 0.9995	19.063 0.7505	19.088 0.7515	IR-812	
0.013 0.029	—	20.638 0.8125	20.625 0.8120	26.975 1.0620	27.000 1.0630	26.975 1.0620	20.650 0.8130	20.676 0.8140		13/16
0.018 0.039	0.020 0.044	20.638 0.8125	20.625 0.8120	26.975 1.0620	27.000 1.0630	26.975 1.0620	20.650 0.8130	20.676 0.8140		
0.031 0.068	0.035 0.077	20.638 0.8125	20.625 0.8120	26.975 1.0620	27.000 1.0630	26.975 1.0620	20.650 0.8130	20.676 0.8140		
0.035 0.078	0.040 0.088	20.638 0.8125	20.625 0.8120	26.975 1.0620	27.000 1.0630	26.975 1.0620	20.650 0.8130	20.676 0.8140		
0.044 0.098	—	20.638 0.8125	29.625 0.8120	27.000 1.0630	26.975 1.0620	26.975 1.0620	20.650 0.8130	20.676 0.8140		
0.023 0.050	0.026 0.057	20.638 0.8125	20.625 0.8120	28.562 1.1245	28.588 1.1255	28.562 1.1245	20.650 0.8130	20.676 0.8140		
0.029 0.063	0.032 0.071	20.638 0.8125	20.625 0.8120	28.562 1.1245	28.588 1.1255	28.562 1.1245	20.650 0.8130	20.676 0.8140		
0.034 0.076	0.039 0.086	20.638 0.8125	20.625 0.8120	28.562 1.1245	28.588 1.1255	28.562 1.1245	20.650 0.8130	20.676 0.8140		
0.014 0.031	0.016 0.035	22.225 0.8750	22.212 0.8745	28.562 1.1245	28.588 1.1255	28.562 1.1245	22.238 0.8755	22.263 0.8765		7/8
0.019 0.042	0.022 0.048	22.225 0.8750	22.212 0.8745	28.562 1.1245	28.588 1.1255	28.562 1.1245	22.238 0.8755	22.263 0.8765	IR-1012	
0.028 0.062	0.032 0.070	22.225 0.8750	22.212 0.8745	28.562 1.1245	28.588 1.1255	28.562 1.1245	22.238 0.8755	22.263 0.8765	IRA-10	
0.038 0.083	0.043 0.094	22.225 0.8750	22.212 0.8745	28.562 1.1245	28.588 1.1255	28.562 1.1245	22.238 0.8755	22.263 0.8765	IR-1016	

\* Further reduces shaft diameter.

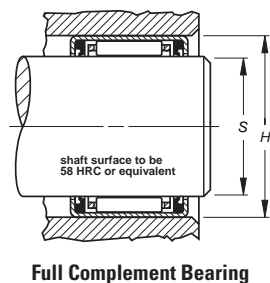
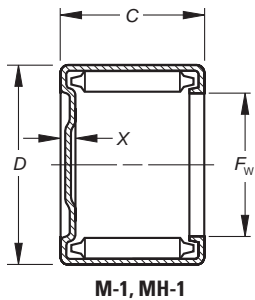
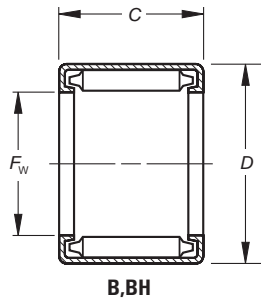
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# NEEDLE ROLLER BEARINGS

## FULL COMPLEMENT BEARINGS, OPEN ENDS, CLOSED ONE END — *continued*

### INCH SERIES



Drawn cup bearings of nominal inch dimensions, with one closed end, that are not tabulated, may be made available upon request.

Mounting dimensions are based on the inner ring rotating and the outer ring being stationary relative to the load. The housing should be of high strength material.

See engineering section for discussion of shaft and housing design.

Shaft Dia.	Dimensions mm/in.				Bearing Designation	Load Ratings		Limiting Speed		C <sub>g</sub>
	F <sub>w</sub>	D	C	Y		Dynamic	Static	Grease	Oil	
in.	F <sub>w</sub>	D	C	Y		C	C <sub>0</sub>	RPM		
	22.225 0.8750	28.575 1.1250	28.58 1.125	—	B-1418 —	35.2 7920	74.73 16800	3100	4800	0.0418
	22.225 0.8750	30.163 1.1875	15.88 0.625	2.79 0.11	BH-1410 MH-14101	20.3 4570	32.21 7240	3800	5880	0.0331
	22.225 0.8750	30.163 1.1875	19.05 0.750	2.79 0.11	BH-1412 MH-14121	25.0 5620	41.99 9440	3800	5880	0.0354
	22.225 0.8750	30.163 1.1875	25.40 1.000	—	BH-1416 —	33.7 7570	61.39 13800	3800	5880	0.0389
15/16	23.813 0.9375	30.163 1.1875	12.70 0.500	—	B-158 —	15.9 3580	27.49 6180	3000	4500	0.0336
	23.813 0.9375	30.163 1.1875	25.40 1.000	2.29 0.09	B-1516 M-15161	32.8 7370	69.39 15600	3000	4500	0.0423
1/2	25.400 1.0000	31.750 1.2500	9.53 0.375	—	B-166 —	11.3 2550	18.10 4070	2800	4300	0.0312
	25.400 1.0000	31.750 1.2500	11.13 0.438	2.29 0.09	B-167 M-1671	14.0 3140	23.66 5320	2800	4300	0.0333
	25.400 1.0000	31.750 1.2500	15.88 0.625	2.29 0.09	B-1610 M-16101	21.2 4770	40.52 9110	2800	4300	0.0381
	25.400 1.0000	31.750 1.2500	19.05 0.750	2.29 0.09	B-1612 M-16121	25.7 5770	51.60 11600	2800	4300	0.0404
	25.400 1.0000	31.750 1.2500	25.40 1.000	2.29 0.09	B-1616 M-16161	33.9 7630	74.29 16700	2800	4300	0.0442
	25.400 1.0000	33.338 1.3125	12.70 0.500	2.79 0.11	BH-168 MH-1681	16.6 3740	25.6 5760	3400	5200	0.0330
	25.400 1.0000	33.338 1.3125	15.88 0.625	—	BH-1610 —	22.0 4950	36.8 8280	3400	5200	0.0361
	25.400 1.0000	33.338 1.3125	19.05 0.750	2.79 0.11	BH-1612 MH-16121	27.1 6090	48.0 10800	3400	5200	0.0386
	25.400 1.0000	33.338 1.3125	22.23 0.875	—	BH-1614 —	31.9 7170	59.2 13300	3400	5200	0.0407
	25.400 1.0000	33.338 1.3125	25.40 1.000	2.79 0.11	BH-1616 MH-16161	36.5 8200	70.3 15800	3400	5200	0.0425
	25.400 1.0000	33.338 1.3125	31.75 1.250	—	BH-1620 —	45.4 10200	93.0 20900	3400	5200	0.0455
	25.400 1.0000	33.338 1.3125	38.10 1.500	2.79 0.11	BH-1624 MH-16241	53.4 12000	115.2 25900	3400	5200	0.0480
1 1/16	26.988 1.0625	33.338 1.3125	15.88 0.625	2.29 0.09	B-1710 M-17101	21.9 4930	43.1 9680	2600	4000	0.0397
	26.988 1.0625	34.925 1.3750	19.05 0.750	—	BH-1712 —	29.49 6630	52.49 11800	2300	3400	N/A
1 1/8	28.575 1.1250	34.925 1.3750	9.53 0.375	2.29 0.09	B-186 M-1861	12.1 2720	20.37 4580	2500	3800	0.0338
	28.575 1.1250	34.925 1.3750	12.70 0.500	2.29 0.09	B-188 M-1881	17.6 3950	33.0 7420	2500	3800	0.0381
	28.575 1.1250	34.925 1.3750	15.88 0.625	—	B-1810 —	22.6 5080	45.8 10300	2500	3800	0.0413
	28.575 1.1250	34.925 1.3750	19.05 0.750	2.29 0.09	B-1812 M-18121	27.3 6140	58.3 13100	2500	3800	0.0438
	28.575 1.1250	34.925 1.3750	25.40 1.000	2.29 0.09	B-1816 M-18161	36.2 8130	83.6 18800	2500	3800	0.0479
	28.575 1.1250	38.100 1.5000	19.05 0.750	3.05 0.12	BH-1812 MH-18121	31.5 7090	52.9 11900	3600	5600	0.0405

Wt. kg/lbs. Approx.		Bearing Mounting mm/in.				Inspection mm/in.			Matching Inner Ring*	Shaft Dia.
Open Ends	Closed Ends	Max.	Min.	Min.	Max.	Ring Gage	Plug-GO	Plug-NO-Go		
		S		H						in.
0.043 0.094	—	22.225 0.8750	22.212 0.8745	28.562 1.1245	28.588 1.1255	28.562 1.1245	22.238 0.8755	22.263 0.8765		
0.030 0.067	0.035 0.076	22.225 0.8750	22.212 0.8745	30.150 1.1870	30.175 1.1880	30.150 1.1870	22.238 0.8755	22.263 0.8765	IR-1012	
0.036 0.080	0.041 0.091	22.225 0.8750	22.212 0.8745	30.150 1.1870	30.175 1.1880	30.150 1.1870	22.238 0.8755	22.263 0.8765	IRA-10	
0.049 0.107	—	22.225 0.8750	22.212 0.8745	30.150 1.1870	30.175 1.1880	30.150 1.1870	22.238 0.8755	22.263 0.8765	IR-1016	
0.020 0.044	—	23.813 0.9375	23.800 0.9370	30.150 1.1870	30.175 1.1880	30.150 1.1870	23.825 0.9380	23.851 0.9390		15/16
0.040 0.088	0.045 0.100	23.813 0.9375	23.800 0.9370	30.150 1.1870	30.175 1.1880	30.150 1.1870	23.825 0.9380	23.851 0.9390		
0.016 0.035	—	25.400 1.0000	25.387 0.9995	31.737 1.2495	31.763 1.2505	31.737 1.2495	25.413 1.0005	25.438 1.0015	IR-128	1/2
0.019 0.041	0.021 0.046	25.400 1.0000	25.387 0.9995	31.737 1.2495	31.763 1.2505	31.737 1.2495	25.413 1.0005	25.438 1.0015	IR-128	
0.026 0.058	0.030 0.066	25.400 1.0000	25.387 0.9995	31.737 1.2495	31.763 1.2505	31.737 1.2495	25.413 1.0005	25.438 1.0015	IR-1212	
0.032 0.070	0.036 0.080	25.400 1.0000	25.387 0.9995	31.737 1.2495	31.763 1.2505	31.737 1.2495	25.413 1.0005	25.438 1.0015	IR-1212	
0.043 0.094	0.048 0.106	25.400 1.0000	25.387 0.9995	31.737 1.2495	31.763 1.2505	31.737 1.2495	25.413 1.0005	25.438 1.0015	IR-1216	
0.027 0.060	0.031 0.068	25.400 1.0000	25.387 0.9995	33.325 1.3120	33.350 1.3130	33.325 1.3120	25.413 1.0005	25.438 1.0015	IR-128	
0.034 0.075	—	25.400 1.0000	25.387 0.9995	33.325 1.3120	33.350 1.3130	33.325 1.3120	25.413 1.0005	25.438 1.0015	IR-1212	
0.041 0.090	0.046 0.102	25.400 1.0000	25.387 0.9995	33.325 1.3120	33.350 1.3130	33.325 1.3120	25.413 1.0005	25.438 1.0015	IR-1212	
0.048 0.105	—	25.400 1.0000	25.387 0.9995	33.325 1.3120	33.350 1.3130	33.325 1.3120	25.413 1.0005	25.438 1.0015	IR-1216	
0.054 0.120	0.062 0.136	25.400 1.0000	25.387 0.9995	33.325 1.3120	33.350 1.3130	33.325 1.3120	25.413 1.0005	25.438 1.0015	IR-1216	
0.068 0.150	—	25.400 1.0000	25.387 0.9995	33.325 1.3120	33.350 1.3130	33.325 1.3120	25.413 1.0005	25.438 1.0015	IR-1220	
0.082 0.180	0.093 0.204	25.400 1.0000	25.387 0.9995	33.325 1.3120	33.350 1.3130	33.325 1.3120	25.413 1.0005	25.438 1.0015	IR-1224	
0.028 0.062	0.032 0.070	26.988 1.0625	26.975 1.0620	33.325 1.3120	33.350 1.3130	33.325 1.3120	27.000 1.0630	27.026 1.0640		1 1/16
0.035 0.078	—	26.988 1.0625	26.975 1.0620	34.912 1.3745	34.938 1.3755	33.325 1.3120	25.413 1.0005	25.438 1.0015		
0.018 0.039	0.020 0.044	28.575 1.1250	28.562 1.1245	34.912 1.3745	34.938 1.3755	34.912 1.3745	28.588 1.1255	28.613 1.1265		1 1/8
0.024 0.052	0.027 0.059	28.575 1.1250	28.562 1.1245	34.912 1.3745	34.938 1.3755	34.912 1.3745	28.588 1.1255	28.613 1.1265		
0.029 0.065	—	28.575 1.1250	28.562 1.1245	34.912 1.3745	34.938 1.3755	34.912 1.3745	28.588 1.1255	28.613 1.1265		
0.035 0.078	0.040 0.088	28.575 1.1250	28.562 1.1245	34.912 1.3745	34.938 1.3755	34.912 1.3745	28.588 1.1255	28.613 1.1265		
0.047 0.104	0.054 0.118	28.575 1.1250	28.562 1.1245	34.912 1.3745	34.938 1.3755	34.912 1.3745	28.588 1.1255	28.613 1.1265	IR-1416	
0.056 0.123	0.063 0.138	28.575 1.1250	28.562 1.1245	38.087 1.4995	38.113 1.5005	38.087 1.4995	28.588 1.1255	28.613 1.1265		

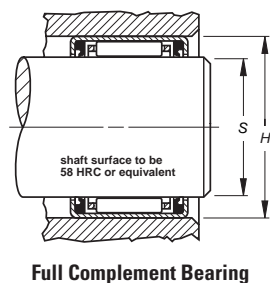
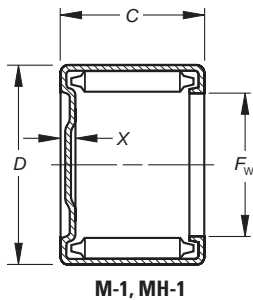
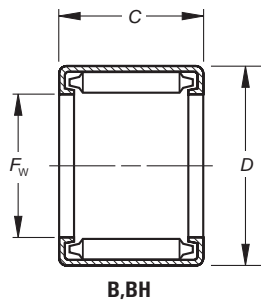
\* Further reduces shaft diameter.

Continued on next page.



**FULL COMPLEMENT BEARINGS,  
OPEN ENDS, CLOSED ONE END** – *continued*

**INCH SERIES**



Drawn cup bearings of nominal inch dimensions, with one closed end, that are not tabulated, may be made available upon request.

Mounting dimensions are based on the inner ring rotating and the outer ring being stationary relative to the load. The housing should be of high strength material. See engineering section for discussion of shaft and housing design.

Shaft Dia.	Dimensions mm/in.				Bearing Designation		Load Ratings		Limiting Speed		C <sub>g</sub>
	+0 +0.000 -0.3 -0.100						Dynamic	Static	Grease	Oil	
in.	F <sub>w</sub>	D	C	Y	C	C <sub>0</sub>	RPM				
	28.575	38.100	25.40	3.05	BH-1816	MH-18161	42.5	77.8	3600	5600	0.0446
	1.1250	1.5000	1.000	0.12			9560	17500			
	28.575	38.100	31.75	3.05	BH-1820	MH-18201	52.9	103.2	3600	5600	0.0479
	1.1250	1.5000	1.250	0.12			11900	23200			
1 3/16	30.163	38.100	15.88	2.79	B-1910	M-19101	24.1	43.8	2900	4400	0.0406
	1.1875	1.5000	0.625	0.11			5420	9840			
	30.163	38.100	25.40	—	B-1916	—	40.0	83.6	2900	4400	0.0477
	1.1875	1.5000	1.000	—			8980	18800			
1 1/4	31.750	38.100	12.70	2.29	B-208	M-2081	18.6	36.6	2300	3500	0.0409
	1.2500	1.5000	0.500	0.09			4170	8240			
	31.750	38.100	15.88	2.29	B-2010	M-20101	23.9	50.7	2300	3500	0.0444
	1.2500	1.5000	0.625	0.09			5370	11400			
	31.750	38.100	19.05	2.29	B-2012	M-20121	28.9	64.5	2300	3500	0.0471
	1.2500	1.5000	0.750	0.09			6490	14500			
	31.750	38.100	25.40	2.29	B-2016	M-20161	38.2	92.5	2300	3500	0.0515
	1.2500	1.5000	1.000	0.09			8590	20800			
	31.750	38.100	31.75	2.29	B-2020	M-20201	47.2	121	2300	3500	0.0550
	1.2500	1.5000	1.250	0.09			10600	27200			
	31.750	41.275	12.70	3.05	BH-208	MH-2081	19.7	30	3300	5000	0.0369
	1.2500	1.6250	0.500	0.12			4420	6750			
	31.750	41.275	19.05	3.05	BH-2012	MH-20121	33.1	58.7	3300	5000	0.0435
	1.2500	1.6250	0.750	0.12			7440	13200			
	31.750	41.275	25.40	3.05	BH-2016	MH-20161	44.9	86.7	3300	5000	0.0480
	1.2500	1.6250	1.000	0.12			10100	19500			
	31.750	41.275	31.75	3.05	BH-2020	MH-20201	56.0	115	3300	5000	0.0515
	1.2500	1.6250	1.250	0.12			12600	25800			
1 5/16	33.338	41.275	12.70	2.79	B-218	M-2181	19.3	33.7	2600	4100	0.0397
	1.3125	1.6250	0.500	0.11			4330	7570			
	33.338	41.275	15.88	2.79	B-2110	M-21101	25.5	48.5	2600	4100	0.0435
	1.3125	1.6250	0.625	0.11			5740	10900			
	33.338	41.275	31.75	—	B-2120	—	52.5	122	2600	4100	0.0547
	1.3125	1.6250	1.250	—			11800	27500			
1 3/8	34.925	41.275	12.70	2.29	B-228	M-2281	19.5	40.4	2100	3200	0.0437
	1.3750	1.6250	0.500	0.09			4390	9070			
	34.925	41.275	19.05	2.29	B-2212	M-22121	30.4	71.2	2100	3200	0.0504
	1.3750	1.6250	0.750	0.09			6830	16000			
	34.925	41.275	25.40	2.29	B-2216	M-22161	40.2	102	2100	3200	0.0551
	1.3750	1.6250	1.000	0.09			9030	22900			
	34.925	41.275	31.75	2.29	B-2220	M-22201	49.4	133	2100	3200	0.0588
	1.3750	1.6250	1.250	0.09			11100	29900			
	34.925	44.450	12.70	—	BH-228	—	21.2	33.5	3000	4700	0.0394
	1.3750	1.7500	0.500	—			4770	7540			
	34.925	44.450	15.88	—	BH-2210	—	28.5	48.9	3000	4700	0.0432
	1.3750	1.7500	0.625	—			6410	11000			
	34.925	44.450	19.05	3.05	BH-2212	MH-22121	35.3	64.5	3000	4700	0.0463
	1.3750	1.7500	0.750	0.12			7930	14500			
	34.925	44.450	25.40	3.05	BH-2216	MH-22161	47.6	94.8	3000	4700	0.0509
	1.3750	1.7500	1.000	0.12			10700	21300			
	34.925	44.450	31.75	—	BH-2220	—	59.6	126	3000	4700	0.0547
	1.3750	1.7500	1.250	—			13400	28300			
1 1/2	38.100	47.625	12.70	3.05	B-248	M-2481	22.3	37.1	2800	4300	0.0420
	1.5000	1.8750	0.500	0.12			5020	8340			



Wt. kg/lbs. Approx.		Bearing Mounting mm/in.				Inspection mm/in.			Matching Inner Ring*	Shaft Dia.
Open Ends	Closed Ends	Max.	Min.	Min.	Max.	Ring Gage	Plug-GO	Plug-NO-Go		in.
		S		H						
0.074 0.164	0.084 0.186	28.575 1.1250	28.562 1.1245	38.087 1.4995	38.113 1.5005	38.087 1.4995	28.588 1.1255	28.613 1.1265	IR-1416	
0.093 0.205	0.105 0.232	28.575 1.1250	28.562 1.1245	38.087 1.4995	38.113 1.5005	38.087 1.4995	28.588 1.1255	28.613 1.1265		
0.040 0.088	0.045 0.099	30.163 1.1875	30.150 1.1870	38.087 1.4995	38.113 1.5005	38.087 1.4995	30.175 1.1880	30.201 1.1890		1 3/16
0.064 0.140	—	30.163 1.1875	30.150 1.1870	38.087 1.4995	38.113 1.5005	38.087 1.4995	30.175 1.1880	30.201 1.1890		
0.026 0.057	0.029 0.065	31.750 1.2500	31.737 1.2495	38.087 1.4995	38.113 1.5005	38.087 1.4995	31.763 1.2505	31.788 1.2515		1 1/4
0.032 0.071	0.044 0.097	31.750 1.2500	31.737 1.2495	38.087 1.4995	38.113 1.5005	38.087 1.4995	31.763 1.2505	31.788 1.2515		
0.039 0.086	0.045 0.099	31.750 1.2500	31.737 1.2495	38.087 1.4995	38.113 1.5005	38.087 1.4995	31.763 1.2505	31.788 1.2515	IR-1612	
0.052 0.114	0.059 0.130	31.750 1.2500	31.737 1.2495	38.087 1.4995	38.113 1.5005	38.087 1.4995	31.763 1.2505	31.788 1.2515	IR-1616	
0.065 0.143	0.073 0.162	31.750 1.2500	31.737 1.2495	38.087 1.4995	38.113 1.5005	38.087 1.4995	31.763 1.2505	31.788 1.2515		
0.041 0.090	0.046 0.102	31.750 1.2500	31.737 1.2495	41.262 1.6245	41.288 1.6255	41.262 1.6245	31.763 1.2505	31.788 1.2515		
0.061 0.135	0.069 0.153	31.750 1.2500	31.737 1.2495	41.262 1.6245	41.288 1.6255	41.262 1.6245	31.763 1.2505	31.788 1.2515	IR-1612	
0.081 0.179	0.092 0.203	31.750 1.2500	31.737 1.2495	41.262 1.6245	41.288 1.6255	41.262 1.6245	31.763 1.2505	31.788 1.2515	IR-1616	
0.102 0.224	0.115 0.254	31.750 1.2500	31.737 1.2495	41.262 1.6245	41.288 1.6255	41.262 1.6245	31.763 1.2505	31.788 1.2515		
0.034 0.076	0.039 0.086	33.338 1.3125	33.325 1.3120	41.262 1.6245	41.288 1.6255	41.262 1.6245	33.350 1.3130	33.378 1.3141		1 5/16
0.043 0.095	0.049 0.108	33.338 1.3125	33.325 1.3120	41.262 1.6245	41.288 1.6255	41.262 1.6245	33.350 1.3130	33.378 1.3141		
0.087 0.191	—	33.338 1.3125	33.325 1.3120	41.262 1.6245	41.288 1.6255	41.262 1.6245	33.350 1.3130	33.378 1.3141		
0.028 0.062	0.032 0.070	34.925 1.3750	34.912 1.3745	41.262 1.6245	41.288 1.6255	41.262 1.6245	34.938 1.3755	34.966 1.3766		1 3/8
0.043 0.094	0.049 0.107	34.925 1.3750	34.912 1.3745	41.262 1.6245	41.288 1.6255	41.262 1.6245	34.938 1.3755	34.966 1.3766	IR-1812	
0.057 0.125	0.064 0.142	34.925 1.3750	34.912 1.3745	41.262 1.6245	41.288 1.6255	41.262 1.6245	34.938 1.3755	34.966 1.3766	IR-1816	
0.071 0.156	0.080 0.177	34.925 1.3750	34.912 1.3745	41.262 1.6245	41.288 1.6255	41.262 1.6245	34.938 1.3755	34.966 1.3766	IR-1820	
0.044 0.098	—	34.925 1.3750	34.912 1.3745	44.437 1.7495	44.463 1.7505	44.437 1.7495	34.938 1.3755	34.966 1.3766		
0.055 0.122	—	34.925 1.3750	34.912 1.3745	44.437 1.7495	44.463 1.7505	44.437 1.7495	34.938 1.3755	34.966 1.3766	IR-1812	
0.066 0.146	0.075 0.165	34.925 1.3750	34.912 1.3745	44.437 1.7495	44.463 1.7505	44.437 1.7495	34.938 1.3755	34.966 1.3766	IR-1812	
0.088 0.195	0.100 0.221	34.925 1.3750	34.912 1.3745	44.437 1.7495	44.463 1.7505	44.437 1.7495	34.938 1.3755	34.966 1.3766	IR-1816	
0.111 0.244	0.125 0.276	34.925 1.3750	34.912 1.3745	44.437 1.7495	44.463 1.7505	44.437 1.7495	34.938 1.3755	34.966 1.3766	IR-1820	
0.048 0.105	0.054 0.119	38.100 1.5000	38.087 1.4995	47.612 1.8745	47.638 1.8755	47.612 1.8745	38.113 1.5005	38.143 1.5017		1 1/2

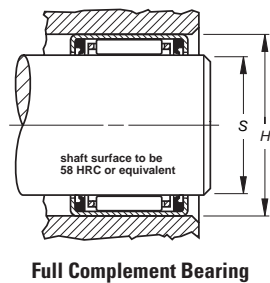
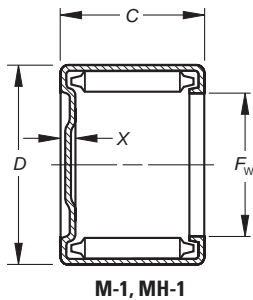
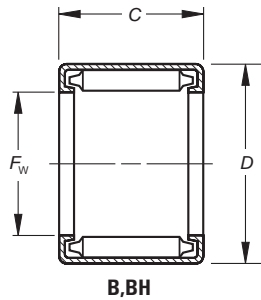
\* Further reduces shaft diameter.

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**FULL COMPLEMENT BEARINGS,  
OPEN ENDS, CLOSED ONE END** – *continued*

**INCH SERIES**



Drawn cup bearings of nominal inch dimensions, with one closed end, that are not tabulated, may be made available upon request.

Mounting dimensions are based on the inner ring rotating and the outer ring being stationary relative to the load. The housing should be of high strength material. See engineering section for discussion of shaft and housing design.

Shaft Dia.	Dimensions mm/in.				Bearing Designation		Load Ratings		Limiting Speed		C <sub>g</sub>
	+0 +0.000 -0.3 -0.100						Dynamic	Static	Grease	Oil	
in.	F <sub>w</sub>	D	C	Y	C	C <sub>0</sub>	RPM				
1	38.100	47.625	15.88	3.05	B-2410	M-24101	29.8	53.8	2800	4300	0.0460
	1.5000	1.8750	0.625	0.12			6710	12100			
1	38.100	47.625	19.05	3.05	B-2412	M-24121	36.9	70.7	2800	4300	0.0493
	1.5000	1.8750	0.750	0.12			8290	15900			
1	38.100	47.625	22.23	3.05	B-2414	M-24141	43.5	87.6	2800	4300	0.0519
	1.5000	1.8750	0.875	0.12			9780	19700			
1	38.100	47.625	25.40	3.05	B-2416	M-24161	49.8	103	2800	4300	0.0542
	1.5000	1.8750	1.000	0.12			11200	23300			
1	38.100	47.625	31.75	3.05	B-2420	M-24201	61.8	138	2800	4300	0.0581
	1.5000	1.8750	1.250	0.12			13900	31000			
1 5/8	41.275	50.800	12.70	—	B-268	—	22.8	39.2	2600	3900	0.0441
	1.6250	2.0000	0.500	—			5120	8820			
1 5/8	41.275	50.800	15.88	3.05	B-2610	M-26101	30.6	57.4	2600	3900	0.0485
	1.6250	2.0000	0.625	0.12			6890	12900			
1 5/8	41.275	50.800	25.40	—	B-2616	—	51.6	112	2600	3900	0.0573
	1.6250	2.0000	1.000	—			11600	25200			
1 5/8	41.275	50.800	31.75	3.05	B-2620	M-26201	64.0	149	2600	3900	0.0614
	1.6250	2.0000	1.250	0.12			14400	33400			
1 3/4	44.450	53.975	19.05	3.05	B-2812	M-28121	39.3	81.4	2400	3700	0.0547
	1.7500	2.1250	0.750	0.12			8830	18300			
1 3/4	44.450	53.975	25.40	3.05	B-2816	M-28161	53.4	121	2400	3700	0.0603
	1.7500	2.1250	1.000	0.12			12000	27100			
1 3/4	44.450	53.975	31.75	—	B-2820	—	66.3	160	2400	3700	0.0647
	1.7500	2.1250	1.250	—			14900	36000			
1 3/4	44.450	53.975	38.10	3.05	B-2824	M-26241	78.7	199	2400	3700	0.0683
	1.7500	2.1250	1.500	0.12			17700	44800			
1 7/8	47.625	57.150	12.70	3.05	B-308	M-3081	25.1	46.3	2300	3500	0.0489
	1.8750	2.2500	0.500	0.12			5650	10400			
1 7/8	47.625	57.150	15.888	—	B-3010	—	33.6	67.61	2300	3500	N/A
	1.8750	2.2500	0.625	—			7550	15200			
1 7/8	47.625	57.150	19.05	—	B-3012	—	41.5	88.5	2300	3500	0.0574
	1.8750	2.2500	0.750	—			9330	19900			
1 7/8	47.625	57.150	25.40	3.05	B-3016	M-30161	56.0	130	2300	3500	0.0632
	1.8750	2.2500	1.000	0.12			12600	29200			
2	50.800	60.325	12.70	3.05	B-328	M-3281	25.4	48.0	2100	3300	0.0509
	2.0000	2.3750	0.500	0.12			5710	10800			
2	50.800	60.325	15.88	—	B-3210	—	34.2	70.7	2200	3300	N/A
	2.0000	2.3750	0.625	—			7680	15900			
2	50.800	60.325	22.23	—	B-3214	—	54.3	115	2200	3300	N/A
	2.0000	2.3750	0.875	—			11300	26000			
2	50.800	60.325	25.40	3.05	B-3216	M-32161	57.4	138	2100	3300	0.0661
	2.0000	2.3750	1.000	0.12			12900	31000			
2	50.800	60.325	31.75	3.05	B-3220	M-32201	71.6	183	2100	3300	0.0708
	2.0000	2.3750	1.250	0.12			16100	41100			
2	50.800	60.325	38.10	3.05	B-3224	M-32241	85.0	228	2100	3300	0.0748
	2.0000	2.3750	1.500	0.12			19100	51200			
2	50.800	60.325	44.45	3.05	B-3228	M-32281	97.4	273	2100	3300	0.0782
	2.0000	2.3750	1.750	0.12			21900	61300			
2 1/16	52.388	64.292	19.05	—	BH-3312	—	46.3	86.7	2600	4100	0.0574
	2.0625	2.5312	0.750	—			10400	19500			

Wt. kg/lbs. Approx.		Bearing Mounting mm/in.				Inspection mm/in.			Matching Inner Ring*	Shaft Dia.
Open Ends	Closed Ends	Max.	Min.	Min.	Max.	Ring Gage	Plug-GO	Plug-NO-Go		
		S		H						in.
0.060 0.132	0.068 0.150	38.100 1.5000	38.087 1.4995	47.612 1.8745	47.638 1.8755	47.612 1.8745	38.113 1.5005	38.143 1.5017		
0.072 0.158	0.081 0.179	38.100 1.5000	38.087 1.4995	47.612 1.8745	47.638 1.8755	47.612 1.8745	38.113 1.5005	38.143 1.5017		
0.083 0.184	0.095 0.209	38.100 1.5000	38.087 1.4995	47.612 1.8745	47.638 1.8755	47.612 1.8745	38.113 1.5005	38.143 1.5017		
0.096 0.211	0.108 0.239	38.100 1.5000	38.087 1.4995	47.612 1.8745	47.638 1.8755	47.612 1.8745	38.113 1.5005	38.143 1.5017	IR-1916	
0.119 0.263	0.135 0.298	38.100 1.5000	38.087 1.4995	47.612 1.8745	47.638 1.8755	47.612 1.8745	38.113 1.5005	38.143 1.5017	IR-1920	
0.051 0.113	—	41.275 1.6250	41.262 1.6245	50.787 1.9995	50.813 2.0005	50.787 1.9995	41.288 1.6255	41.318 1.6267		1 5/8
0.064 0.141	0.073 0.16	41.275 1.6250	41.262 1.6245	50.787 1.9995	50.813 2.0005	50.787 1.9995	41.288 1.6255	41.318 1.6267		
0.103 0.226	—	41.275 1.6250	41.262 1.6245	50.787 1.9995	50.813 2.0005	50.787 1.9995	41.288 1.6255	41.318 1.6267		
0.128 0.282	0.145 0.32	41.275 1.6250	41.262 1.6245	50.787 1.9995	50.813 2.0005	50.787 1.9995	41.288 1.6255	41.318 1.6267	IR-2220	
0.082 0.181	0.093 0.205	44.450 1.7500	44.437 1.7495	53.962 2.1245	53.988 2.1255	53.962 2.1245	44.463 1.7505	44.496 1.7518		1 3/4
0.110 0.242	0.124 0.274	44.450 1.7500	44.437 1.7495	53.962 2.1245	53.988 2.1255	53.962 2.1245	44.463 1.7505	44.496 1.7518	IR-2316	
0.137 0.302	—	44.450 1.7500	44.437 1.7495	53.962 2.1245	53.988 2.1255	53.962 2.1245	44.463 1.7505	44.496 1.7518		
0.165 0.363	0.186 0.411	44.450 1.7500	44.437 1.7495	53.962 2.1245	53.988 2.1255	53.962 2.1245	44.463 1.7505	44.496 1.7518	IR-2324	
0.059 0.129	0.066 0.146	47.625 1.8750	47.612 1.8745	57.137 2.2495	57.163 2.2505	57.137 2.2495	47.638 1.8755	47.671 1.8768		1 7/8
0.073 0.161	—	47.625 1.8750	47.612 1.8745	57.137 2.2495	57.163 2.2505	57.137 2.2495	47.638 1.8755	47.671 1.8768		
0.088 0.193	—	47.625 1.8750	47.612 1.8745	57.137 2.2495	57.163 2.2505	57.137 2.2495	47.638 1.8755	47.671 1.8768		
0.117 0.258	0.132 0.292	47.625 1.8750	47.612 1.8745	57.137 2.2495	57.163 2.2505	57.137 2.2495	47.638 1.8755	47.671 1.8768		
0.062 0.136	0.070 0.154	50.800 2.0000	50.785 1.9994	60.312 2.3745	60.338 2.3755	60.312 2.3745	50.815 2.0006	50.848 2.0019		2
0.078 0.171	—	50.800 2.0000	50.785 1.9994	60.312 2.3745	60.335 2.3755	60.312 2.3745	50.815 2.0006	50.848 2.0019		
0.108 0.239	—	50.800 2.0000	50.785 1.9994	60.312 2.3745	60.338 2.3755	60.312 2.3745	50.815 2.0006	50.848 2.0019		
0.124 0.273	0.140 0.309	50.800 2.0000	50.785 1.9994	60.312 2.3745	60.338 2.3755	60.312 2.3745	50.815 2.0006	50.848 2.0019		
0.155 0.341	0.175 0.386	50.800 2.0000	50.785 1.9994	60.312 2.3745	60.338 2.3755	60.312 2.3745	50.815 2.0006	50.848 2.0019		
0.186 0.410	0.211 0.465	50.800 2.0000	50.785 1.9994	60.312 2.3745	60.338 2.3755	60.312 2.3745	50.815 2.0006	50.848 2.0019		
0.217 0.478	0.245 0.541	50.800 2.0000	50.785 1.9994	60.312 2.3745	60.338 2.3755	60.312 2.3745	50.815 2.0006	50.848 2.0019		
0.122 0.269	—	52.388 2.0625	52.372 2.0619	64.280 2.5307	64.305 2.5317	64.280 2.5307	50.815 2.0006	50.848 2.0019	IR-2916	2 1/16

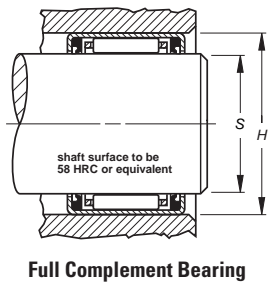
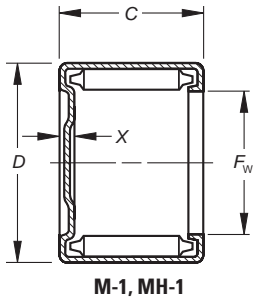
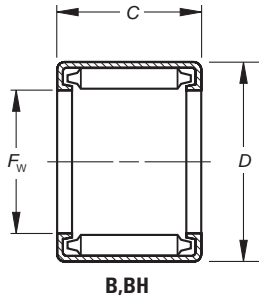
\* Further reduces shaft diameter.

Continued on next page.



**FULL COMPLEMENT BEARINGS,  
OPEN ENDS, CLOSED ONE END** – *continued*

**INCH SERIES**



Shaft Dia.	Dimensions mm/in.				Bearing Designation		Load Ratings		Limiting Speed		C <sub>g</sub>
	F <sub>w</sub>	D	C	Y			Dynamic	Static	Grease	Oil	
in.	F <sub>w</sub>	D	C	Y	C	C <sub>0</sub>	RPM				
	52.388	64.292	25.40	3.56	BH-3316	MH-33161	64.0	133	2600	4100	0.0639
	2.0625	2.5312	1.000	0.14			14400	29900			
	52.388	64.292	38.10	3.56	BH-3324	MH-33241	97.0	226	2600	4100	0.0728
	2.0625	2.5312	1.500	0.14			21800	50700			
2 1/8	53.975	63.500	12.70	—	B-348	—	26.1	51.2	2000	3100	0.0531
	2.1250	2.5000	0.500	—			5870	11500			
	53.975	63.500	19.05	—	B-3412	—	43.6	99.2	2100	3100	N/A
	2.1250	2.5000	0.750	—			9790	22300			
	53.975	63.500	25.40	3.05	B-3416	M-34161	59.2	147	2000	3100	0.069
	2.1250	2.5000	1.000	0.12			13300	33000			
	53.975	63.500	31.75	—	B-3420	—	73.4	194	2000	3100	0.074
	2.1250	2.5000	1.250	—			16500	43700			
	53.975	63.500	38.10	3.05	B-3424	M-34241	87.2	242	2000	3100	0.0781
	2.1250	2.5000	1.500	0.12			19600	54400			
2 1/4	57.150	66.675	19.05	3.30	B-3612	M-36121	45.8	105	2000	3000	0.0648
	2.2500	2.6250	0.750	0.13			10300	23700			
	57.150	66.675	31.75	—	B-3620	—	77.4	206	2000	3000	0.0766
	2.2500	2.6250	1.250	—			17400	46400			
	57.150	66.675	38.10	3.30	B-3624	M-36241	92.1	257	2000	3000	0.0809
	2.2500	2.6250	1.500	0.13			20700	57700			
2 5/8	66.675	76.200	25.40	3.30	B-4216	M-42161	66.7	182	1700	2500	0.0799
	2.6250	3.0000	1.000	0.13			15000	40900			
2 3/4	69.850	79.375	15.88	—	B-4410	—	41.0	98	1600	2500	0.0698
	2.7500	3.1250	0.625	—			9210	22000			
	69.850	79.375	25.40	—	B-4416	—	69.0	190	1600	2500	0.0824
	2.7500	3.1250	1.000	—			15500	42800			
	69.850	79.375	31.75	3.30	B-4420	M-44201	85.4	252	1600	2500	0.0883
	2.7500	3.1250	1.250	0.13			19200	56700			
3 1/2	88.900	101.600	19.05	—	B-5612	—	64.9	150	1800	2700	N/A
	3.5000	4.0000	0.750	—			14600	33700			
5 1/2	139.700	152.400	19.05	—	B-8812	—	77.00	231	1000	1600	0.114
	5.5000	6.0000	0.750	—			17300	52000			

Drawn cup bearings of nominal inch dimensions, with one closed end, that are not tabulated, may be made available upon request.

Mounting dimensions are based on the inner ring rotating and the outer ring being stationary relative to the load. The housing should be of high strength material. See engineering section for discussion of shaft and housing design.

Wt. kg/lbs. Approx.		Bearing Mounting mm/in.				Inspection mm/in.			Matching Inner Ring*	Shaft Dia.
Open Ends	Closed Ends	Max.	Min.	Min.	Max.	Ring Gage	Plug-GO	Plug-NO-Go		
		S		H						in.
0.162 0.358	0.184 0.406	52.388 2.0625	52.372 2.0619	64.280 2.5307	64.305 2.5317	64.280 2.5307	50.815 2.0006	50.848 2.0019	IR-2916	
0.244 0.537	0.276 0.609	52.388 2.0625	52.372 2.0619	64.280 2.5307	64.305 2.5317	64.280 2.5307	50.815 2.0006	50.848 2.0019	IR-2724	
0.065 0.144	—	53.975 2.1250	53.960 2.1244	63.487 2.4995	63.513 2.5005	63.487 2.4995	53.990 2.1256	54.028 2.1271		2 1/8
0.098 0.216	—	53.975 2.1250	53.960 2.1244	63.487 2.4995	63.513 2.5005	63.487 2.4995	53.990 2.1256	54.028 2.1271		
0.131 0.289	0.148 0.327	53.975 2.1250	53.960 2.1244	63.487 2.4995	63.513 2.5005	63.487 2.4995	53.990 2.1256	54.028 2.1271		
0.164 0.361	—	53.975 2.1250	53.960 2.1244	63.487 2.4995	63.513 2.5005	63.487 2.4995	53.990 2.1256	54.028 2.1271		
0.196 0.433	0.223 0.491	53.975 2.1250	53.960 2.1244	63.487 2.4995	63.513 2.5005	63.487 2.4995	53.990 2.1256	54.028 2.1271	IR-3024	
0.103 0.228	0.117 0.258	57.150 2.2500	57.135 2.2494	66.662 2.6245	66.688 2.6255	66.662 2.6245	57.165 2.2506	57.203 2.2521		2 1/4
0.172 0.380	—	57.150 2.2500	57.135 2.2494	66.662 2.6245	66.688 2.6255	66.662 2.6245	57.165 2.2506	57.203 2.2521		
0.207 0.456	0.235 0.517	57.150 2.2500	57.135 2.2494	66.662 2.6245	66.688 2.6255	66.662 2.6245	57.165 2.2506	57.203 2.2521		
0.159 0.351	0.181 0.398	66.675 2.6250	66.660 2.6244	76.187 2.9995	76.213 3.0005	76.187 2.9995	66.700 2.6260	66.739 2.6275		2 5/8
0.104 0.229	—	69.850 2.7500	69.835 2.7494	79.362 3.1245	79.388 3.1255	79.362 3.1245	69.875 2.7510	69.914 2.7525		2 3/4
0.166 0.366	—	69.850 2.7500	69.835 2.7494	79.362 3.1245	79.388 3.1255	79.362 3.1245	69.875 2.7510	69.914 2.7525	IR-4016	
0.208 0.458	0.235 0.519	69.850 2.7500	69.835 2.7494	79.362 3.1245	79.388 3.1255	79.362 3.1245	69.875 2.7510	69.914 2.7525		
0.212 0.468	—	88.900 3.5000	88.885 3.4994	101.587 3.9995	101.613 4.0005	101.587 3.9995	88.925 3.5010	88.964 3.5025		3 1/2
0.325 0.717	—	139.700 5.5000	139.682 5.4993	152.375 5.9990	152.425 6.0010	152.375 5.9990	139.725 5.5010	139.776 5.5030		5 1/2

\* Further reduces shaft diameter.





**EXTRA-PRECISION BEARINGS –**

**INCH SERIES**

Open end full complement mechanically retained drawn cup needle roller bearings, manufactured to inch standards, are offered with extra-precision specifications. The manufacturing tolerance of these bearings is one-third that of the precision bearings. In production operations using closer tolerances on shaft and housing, they will assemble with consistently lower radial internal clearances than can be expected with the precision series bearings.

Extra-precision bearings are suitable for those applications requiring close control of radial play and eccentricity. They are also preferred when two bearings are mounted adjacent to each other since the greater accuracy in manufacture will provide better load distribution between the bearings.

Nominal dimensions, load ratings, limiting speeds and other general specifications for extra-precision bearings are the same as for the corresponding “B” or “BH” sizes of drawn cup needle bearings. Consequently, the data on pages C66 to C79 can be used in bearing size selection.

When ordering an extra-precision bearing, add the prefix letter “G” to the bearing designation. For example, after following the size selection procedure outlined in the engineering section, bearing B-1212 is selected, but extra-precision tolerances are required. These are designated by ordering a GB-1212 bearing.

To realize the advantages of the expected closer radial internal clearance of the extra-precision bearing, the user must have the capability of producing housing bore and shaft raceway diameters to the close tolerances indicated by the tabular data on the facing page.

The resulting total radial internal clearance within the installed GB-1212 extra-precision drawn cup needle roller bearing will lie in the range from 0.0002 in. to 0.0012 in.

Inspection dimensions for the extra-precision bearings are given in the table at the right. Note that these bearings must be inspected while mounted in the specified ring gage. Bearing bores are checked with “GO” and “NO GO” plug gages. The “GO” gage size is the minimum diameter inside the needle rollers. The “NO GO” gage size is 0.0001 in. larger than the maximum diameter inside the needle rollers.

Procedures for selecting ring and plug gage dimensions are the same as for those involving precision needle bearings, except that the ring gage diameters and diameters inside the needle rollers must be drawn from the table on this page.

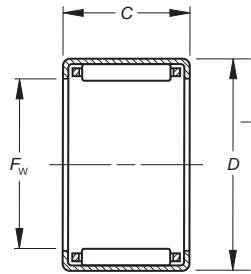
Nominal Inch Shaft Diameter	Gaging		
	Ring Gage	Diameter Inside Needle Rollers	
		Min.	Max.
1/8	0.2473	0.1256	0.1260
5/32	0.2785	0.1569	0.1573
3/16	0.3390	0.1881	0.1885
1/4	0.4328	0.2506	0.2510
5/16	0.4953	0.3131	0.3135
<b>H</b> 5/16	0.5578	0.3131	0.3135
3/8	0.5578	0.3756	0.3760
<b>H</b> 3/8	0.6203	0.3756	0.3760
7/16	0.6203	0.4381	0.4385
<b>H</b> 7/16	0.6828	0.4381	0.4385
1/2	0.6828	0.5006	0.5010
<b>H</b> 1/2	0.7453	0.5006	0.5010
9/16	0.7453	0.5631	0.5635
<b>H</b> 9/16	0.8078	0.5631	0.5635
5/8	0.8078	0.6256	0.6260
<b>H</b> 5/8	0.8703	0.6256	0.6260
11/16	0.8703	0.6881	0.6885
<b>H</b> 11/16	0.9328	0.6881	0.6885
3/4	0.9950	0.7503	0.7507
<b>H</b> 3/4	1.0575	0.7503	0.7507
13/16	1.0575	0.8128	0.8132
<b>H</b> 13/16	1.1200	0.8128	0.8132
7/8	1.1200	0.8753	0.8757
<b>H</b> 7/8	1.1825	0.8753	0.8757
15/16	1.1825	0.9378	0.9382
<b>H</b> 1	1.2450	1.0003	1.0007
<b>H</b> 1	1.3075	1.0003	1.0007
1 1/16	1.3075	1.0628	1.0632
1 1/8	1.3700	1.1253	1.1257
<b>H</b> 1 1/8	1.4950	1.1253	1.1257
1 3/16	1.4950	1.1878	1.1882
1 1/4	1.4950	1.2503	1.2507
<b>H</b> 1 1/4	1.6200	1.2503	1.2507
1 5/16	1.6200	1.3128	1.3132
1 3/8	1.6200	1.3753	1.3757
<b>H</b> 1 3/8	1.7450	1.3753	1.3757
1 1/2	1.8700	1.5003	1.5008
1 5/8	1.9950	1.6253	1.6258
1 3/4	2.1200	1.7503	1.7508
1 7/8	2.2450	1.8753	1.8758
2	2.3700	2.0003	2.0008
<b>H</b> 2 1/16	2.5262	2.0628	2.0633
2 1/8	2.4950	2.1253	2.1258
2 1/4	2.6200	2.2503	2.2508
2 5/8	2.9950	2.6254	2.6260
2 3/4	3.1200	2.7504	2.7510
3 1/2	3.9950	3.5004	3.5010

Bearing Bore Designation	Mounting					
	Nominal Bore Inch	Nominal O.D. Inch	Shaft Raceway Diameter		Housing Bore	
			Max.	Min.	Min.	Max.
GB-2	.1250	.2500	0.1251	0.1248	0.2470	0.2473
GB-2 1/2	.1562	.2812	0.1564	0.1561	0.2782	0.2785
GB-3	.1875	.3438	0.1876	0.1873	0.3387	0.3390
GB-4	.2500	.4375	0.2501	0.2498	0.4325	0.4328
GB-5	.3125	.5000	0.3126	0.3123	0.4950	0.4953
GBH-5	.3125	.5625	0.3126	0.3123	0.5575	0.5578
GB-6	.3750	.5625	0.3751	0.3748	0.5575	0.5578
GBH-6	.3750	.6250	0.3751	0.3748	0.6200	0.6203
GB-7	.4375	.6250	0.4376	0.4373	0.6200	0.6203
GBH-7	.4375	.6875	0.4376	0.4373	0.6825	0.6828
GB-8	.5000	.6875	0.5001	0.4998	0.6825	0.6828
GBH-8	.5000	.7500	0.5001	0.4998	0.7450	0.7453
GB-9	.5625	.7500	0.5626	0.5623	0.7450	0.7453
GBH-9	.5625	.8125	0.5626	0.5623	0.8075	0.8078
GB-10	.6250	.8125	0.6251	0.6248	0.8075	0.8078
GBH-10	.6250	.8750	0.6251	0.6248	0.8700	0.8703
GB-11	.6875	.8750	0.6876	0.6873	0.8700	0.8703
GBH-11	.6875	.9375	0.6876	0.6873	0.9325	0.9328
GB-12	.7500	1.0000	0.7501	0.7498	0.9950	0.9953
GBH-12	.7500	1.0625	0.7501	0.7498	1.0575	1.0578
GB-13	.8125	1.0625	0.8126	0.8123	1.0575	1.0578
GBH-13	.8125	1.1250	0.8126	0.8123	1.1200	1.1203
GB-14	.8750	1.1250	0.8751	0.8748	1.1200	1.1203
GBH-14	.8750	1.1875	0.8751	0.8748	1.1825	1.1829
GB-15	.9375	1.1875	0.9376	0.9373	1.1825	1.1829
GB-16	1.0000	1.2500	1.0001	0.9998	1.2450	1.2454
GBH-16	1.0000	1.3125	1.0001	0.9998	1.3075	1.3079
GB-17	1.0625	1.3125	1.0626	1.0623	1.3075	1.3079
GB-18	1.1250	1.3750	1.1251	1.1248	1.3700	1.3704
GBH-18	1.1250	1.5000	1.1251	1.1248	1.4950	1.4955
GB-19	1.1875	1.5000	1.1876	1.1873	1.4950	1.4955
GB-20	1.2500	1.5000	1.2501	1.2498	1.4950	1.4955
GBH-20	1.2500	1.6250	1.2501	1.2498	1.6200	1.6205
GB-21	1.3125	1.6250	1.3126	1.3123	1.6200	1.6205
GB-22	1.3750	1.6250	1.3750	1.3747	1.6200	1.6205
GBH-22	1.3750	1.7500	1.3750	1.3747	1.7450	1.7455
GB-24	1.5000	1.8750	1.5000	1.4997	1.8700	1.8705
GB-26	1.6250	2.0000	1.6250	1.6247	1.9950	1.9955
GB-28	1.7500	2.1250	1.7500	1.7497	2.1200	2.1205
GB-30	1.8750	2.2500	1.8750	1.8747	2.2450	2.2455
GB-32	2.0000	2.3750	2.0000	1.9997	2.3700	2.3705
GBH-33	2.0625	2.5312	2.0624	2.0621	2.5262	2.5267
GB-34	2.1250	2.5000	2.1249	2.1246	2.4950	2.4955
GB-36	2.2500	2.6250	2.2499	2.2496	2.6200	2.6205
GB-42	2.6250	3.0000	2.6248	2.6245	2.9950	2.9956
GB-44	2.7500	3.1250	2.7498	2.7495	3.1200	3.1206
GB-56	3.5000	4.0000	3.4998	3.4995	3.9950	3.9956

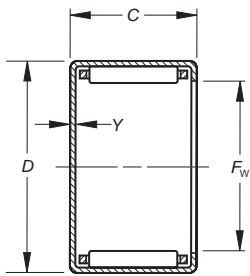
\* Check for availability as not every size may be in production.



**CAGED BEARINGS –  
OPEN ENDS, CLOSED ONE END  
INCH SERIES**



**J,JH**



**MJ-1, MJH-1**

Mounting dimensions are based on the inner ring rotating and the outer ring being stationary relative to the load. The housing should be of high strength material.

See engineering section for discussion of shaft and housing design. See page C62 for mounting procedure.

Shaft Diameter	Dimensions mm/in. +0 +0.000 -0.3 -0.100				Bearing Designation		Load Ratings kN/lbf.		Limiting Speed		C <sub>g</sub>
	in.	F <sub>w</sub>	D	C			Y	Dynamic	Static	Grease	
							C	C <sub>0</sub>	RPM		
1/8	3.175	6.350	4.780	—	JP-23-F	—	0.89	0.62	33000	51000	0.0064
	0.1250	0.2500	0.188	—			200	140			
5/32	3.970	7.142	4.780	—	JP-2-1/2-3F	—	0.93	0.62	31000	47000	0.007
	0.1563	0.2812	0.188	—			210	140			
3/16	4.763	8.733	9.530	1.02	J-36	MJ-361	2.27	1.91	25000	38000	0.0097
	0.1875	0.3438	0.375	0.04			510	430			
1/4	6.350	11.113	7.920	1.02	J-45	MJ-451	2.22	1.73	20000	30000	0.0103
	0.2500	0.4375	0.312	0.04			500	390			
	6.350	11.113	11.130	1.02	J-47	MJ-471	3.38	3.02	20000	30000	0.0119
	0.2500	0.4375	0.438	0.04			760	680			
5/16	7.938	12.700	7.920	—	J-55	—	2.40	2.00	18000	28000	0.0117
	0.3125	0.5000	0.312	—			540	450			
	7.938	12.700	11.130	1.02	J-57	MJ-571	4.05	3.91	18000	28000	0.013
	0.3125	0.5000	0.438	0.04			910	880			
	7.938	14.288	11.130	1.02	JH-57	MJH-571	4.63	3.78	14000	22000	0.0132
	0.3125	0.5625	0.438	0.04			1040	850			
3/8	9.525	14.288	7.920	1.02	J-65	MJ-651	2.76	2.49	18000	27000	0.0133
	0.3750	0.5625	0.312	0.04			620	560			
	9.525	14.288	9.530	1.02	J-66	MJ-661	3.51	3.47	18000	27000	0.0144
	0.3750	0.5625	0.375	0.04			790	780			
	9.525	14.288	12.700	1.02	J-68	MJ-681	5.20	5.74	18000	27000	0.0163
	0.3750	0.5625	0.500	0.04			1170	1290			
	9.525	15.875	12.700	—	JH-68	—	6.58	6.09	13000	20000	0.0159
	0.3750	0.6250	0.500	—			1480	1370			
7/16	11.113	15.875	12.700	1.02	J-78	MJ-781	6.36	7.70	17000	26000	0.0187
	0.4375	0.6250	0.500	0.04			1430	1730			
	11.113	17.463	12.700	—	JH-78	—	7.12	6.89	13000	19000	0.0174
	0.4375	0.6875	0.500	—			1600	1550			
1/2	12.700	17.463	7.920	1.02	J-85	MJ-851	3.47	3.65	16000	25000	0.0164
	0.5000	0.6875	0.312	0.04			780	820			
	12.700	17.463	9.530	1.02	J-86	MJ-861	4.67	5.38	16000	25000	0.0181
	0.5000	0.6875	0.375	0.04			1050	1210			
	12.700	17.463	12.700	1.02	J-88	MJ-881	6.32	7.92	16000	25000	0.0199
	0.5000	0.6875	0.500	0.04			1420	1780			
	12.700	17.463	19.050	—	J-812	—	10.23	14.72	16000	25000	0.0232
	0.5000	0.6875	0.750	—			2300	3310			
	12.700	19.050	11.130	1.02	JH-87	MJH-871	6.41	6.18	12000	19000	0.0179
	0.5000	0.7500	0.438	0.04			1440	1390			
	12.700	19.050	12.700	1.02	JH-88	MJH-881	7.56	7.70	12000	19000	0.0189
	0.5000	0.7500	0.500	0.04			1700	1730			
	12.700	19.050	19.050	—	JH-812	—	12.32	14.41	12000	19000	0.0221
	0.5000	0.7500	0.750	—			2770	3240			
9/16	14.288	19.050	11.130	1.02	J-97	MJ-971	5.47	6.81	16000	25000	
	0.5625	0.750	0.438	0.04			1230	1530			
	14.288	19.050	12.700	1.02	J-98	MJ-981	6.23	8.01	16000	25000	0.021
	0.5625	0.7500	0.500	0.04			1400	1800			

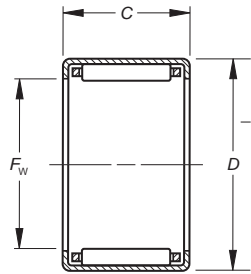


Wt. kg/lbs. Approx.		Bearing Mounting mm/in.				Inspection mm/in.			Matching Inner Ring	Shaft Diameter
Open Ends	Closed Ends	Max.	Min.	Min.	Max.	Ring Gage	Plug-GO	Plug-NO-Go		
		S		H						in.
0.0005 0.001	—	3.175 0.1250	3.167 0.1247	6.350 0.2500	6.363 0.2505	6.363 0.2505	3.195 0.1258	3.221 0.1268		1/8
0.0005 0.001	—	3.970 0.1563	3.962 0.1560	7.142 0.2812	7.155 0.2817	7.155 0.2817	3.990 0.1571	4.016 0.1581		5/32
0.0018 0.004	0.0023 0.005	4.763 0.1875	4.755 0.1872	8.717 0.3432	8.730 0.3437	8.730 0.3437	4.783 0.1883	4.808 0.1893		3/16
0.0027 0.006	0.0032 0.007	6.350 0.2500	6.337 0.2495	11.100 0.4370	11.125 0.4380	11.125 0.4380	6.388 0.2515	6.414 0.2525		1/4
0.0036 0.008	0.0041 0.009	6.350 0.2500	6.337 0.2495	11.100 0.4370	11.125 0.4380	11.125 0.4380	6.388 0.2515	6.414 0.2525		
0.0032 0.007	—	7.938 0.3125	7.925 0.3120	12.687 0.4995	12.713 0.5005	12.713 0.5005	7.976 0.3140	8.001 0.3150		5/16
0.0041 0.009	0.0050 0.011	7.938 0.3125	7.925 0.3120	12.687 0.4995	12.713 0.5005	12.713 0.5005	7.976 0.3140	8.001 0.3150		
0.0059 0.013	0.0073 0.016	7.938 0.3125	7.925 0.3120	14.275 0.5620	14.300 0.5630	14.300 0.5630	7.976 0.3140	8.001 0.3150		
0.0036 0.008	0.0041 0.009	9.525 0.3750	9.512 0.3745	14.275 0.5620	14.300 0.5630	14.300 0.5630	9.563 0.3765	9.589 0.3775		3/8
0.0041 0.009	0.0045 0.01	9.525 0.3750	9.512 0.3745	14.275 0.5620	14.300 0.5630	14.300 0.5630	9.563 0.3765	9.589 0.3775		
0.0054 0.012	0.0059 0.013	9.525 0.3750	9.512 0.3745	14.275 0.5620	14.300 0.5630	14.300 0.5630	9.563 0.3765	9.589 0.3775	IRA-3	
0.0077 0.017	—	9.525 0.3750	9.512 0.3745	15.862 0.6245	15.888 0.6255	15.888 0.6255	9.563 0.3765	9.589 0.3775	IRA-3	
0.0064 0.014	0.0073 0.016	11.113 0.4375	11.100 0.4370	15.862 0.6245	15.888 0.6255	15.888 0.6255	11.151 0.4390	11.176 0.4400		7/16
0.0086 0.019	—	11.113 0.4375	11.100 0.4370	17.450 0.6870	17.475 0.6880	17.475 0.6880	11.151 0.4390	11.176 0.4400		
0.0045 0.01	0.0054 0.012	12.700 0.5000	12.687 0.4995	17.450 0.6870	17.475 0.6880	17.475 0.6880	12.738 0.5015	12.764 0.5025		1/2
0.0050 0.011	0.0059 0.013	12.700 0.5000	12.687 0.4995	17.450 0.6870	17.475 0.6880	17.475 0.6880	12.738 0.5015	12.764 0.5025		
0.0068 0.015	0.0082 0.018	12.700 0.5000	12.687 0.4995	17.450 0.6870	17.475 0.6880	17.475 0.6880	12.738 0.5015	12.764 0.5025	IRA-5	
0.0104 0.023	—	12.700 0.5000	12.687 0.4995	17.450 0.6870	17.475 0.6880	17.475 0.6880	12.738 0.5015	12.764 0.5025		
0.0086 0.019	0.0104 0.023	12.700 0.5000	12.687 0.4995	19.037 0.7495	19.063 0.7505	19.063 0.7505	12.738 0.5015	12.764 0.5025		
0.0100 0.022	0.0118 0.026	12.700 0.5000	12.687 0.4995	19.037 0.7495	19.063 0.7505	19.063 0.7505	12.738 0.5015	12.764 0.5025		
0.0145 0.032	—	12.700 0.5000	12.687 0.4995	19.037 0.7495	19.063 0.7505	19.063 0.7505	12.738 0.5015	12.764 0.5025		
0.0073 0.016	0.0086 0.019	14.288 0.5625	14.275 0.5620	19.037 0.7495	19.063 0.7505	19.063 0.7505	14.326 0.5640	14.351 0.5650		9/16
0.0077 0.017	0.0091 0.02	14.288 0.5625	14.275 0.5620	19.037 0.7495	19.063 0.7505	19.063 0.7505	14.326 0.5640	14.351 0.5650	IR-68	

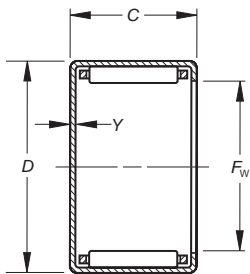
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**CAGED BEARINGS –  
OPEN ENDS, CLOSED ONE END – *continued***  
**INCH SERIES**



**J, JH**



**MJ-1, MJH-1**

Mounting dimensions are based on the inner ring rotating and the outer ring being stationary relative to the load. The housing should be of high strength material.

See engineering section for discussion of shaft and housing design. See page C62 for mounting procedure.

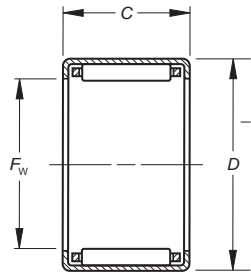
Shaft Diameter	Dimensions mm/in. +0 +0.000 -0.3 -0.100				Bearing Designation		Load Ratings kN/lbf.		Limiting Speed		C <sub>g</sub>	
	in.	F <sub>w</sub>	D	C	Y		C	C <sub>0</sub>	Grease	Oil		
									RPM			
	14.288 0.5625	19.050 0.7500	15.880 0.625	—		J-910	—	5.83 1310	7.21 1620	16000	25000	0.0205
	14.288 0.5625	20.638 0.8125	12.700 0.500	1.02 0.04		JH-98	MJH-981	8.01 1800	8.50 1910	12000	18000	N/A
5/8	15.875 0.6250	20.638 0.8125	12.700 0.500	1.02 0.04		J-108	MJ-1081	6.72 1510	9.12 2050	13000	21000	0.0227
	15.875 0.6250	20.638 0.8125	15.880 0.625	1.02 0.04		J-1010	MJ-10101	8.81 1980	12.94 2910	13000	21000	0.0247
	15.875 0.6250	20.638 0.8125	19.050 0.750	1.02 0.04		J-1012	MJ-10121	11.74 2640	18.86 4240	13000	21000	0.0272
	15.875 0.6250	22.212 0.8745	15.880 0.625	1.02 0.04		JH-1010	MJH-10101	11.57 2600	14.10 3170	14000	21000	0.024
	15.875 0.6250	22.212 0.8745	25.400 1.000	1.02 0.04		JH-1016	MJH-10161	19.79 4450	28.11 6320	14000	21000	0.0285
11/16	17.463 0.6875	22.212 0.8745	19.050 0.750	1.02 0.04		J-1112	MJ-11121	11.43 2570	18.73 4210	12000	19000	0.029
	17.463 0.6875	23.813 0.9375	15.880 0.625	1.02 0.04		JH-1110	MJH-11101	12.05 2710	15.21 3420	13000	19000	0.0255
	17.463 0.6875	23.813 0.9375	19.050 0.750	—		JH-1112	—	16.15 3630	22.20 4990	13000	19000	0.028
3/4	19.050 0.7500	25.400 1.0000	9.530 0.375	—		J-126	—	6.49 1460	7.03 1580	11000	18000	0.0218
	19.050 0.7500	25.400 1.0000	12.700 0.500	—		J-128	—	9.92 2230	12.19 2740	11000	18000	0.025
	19.050 0.7500	25.400 1.0000	15.880 0.625	1.02 0.04		J-1210	MJ-12101	12.50 2810	16.32 3670	11000	18000	0.0269
	19.050 0.7500	25.400 1.0000	19.050 0.750	1.02 0.04		J-1212	MJ-12121	15.52 3490	21.62 4860	11000	18000	0.0288
	19.050 0.7500	26.988 1.0625	19.050 0.750	1.02 0.04		JH-1212	MJH-12121	19.08 4290	23.58 5300	12000	18000	0.0285
13/16	20.638 0.8125	26.988 1.0625	22.230 0.875	—		J-1314	—	19.31 4340	29.31 6590	10000	16000	0.0321
	20.638 0.8125	28.575 1.1250	19.050 0.750	1.27 0.05		JH-1312	MJH-13121	18.77 4220	24.55 5520	11000	16000	0.0299
7/8	22.225 0.8750	28.575 1.1250	9.530 0.375	—		J-146	—	7.21 1620	8.41 1890	9700	15000	0.0243
	22.225 0.8750	28.575 1.1250	12.700 0.500	—		J-148	—	10.94 2460	14.50 3260	9700	15000	0.027
	22.225 0.8750	28.575 1.1250	19.050 0.750	1.02 0.04		J-1412	MJ-14121	17.88 4020	27.18 6110	9700	15000	0.0325
	22.225 0.8750	28.575 1.1250	25.400 1.000	1.02 0.04		J-1416	MJ-14161	23.66 5320	38.97 8760	9700	15000	0.0356
	22.225 0.8750	30.163 1.1875	19.050 0.750	1.27 0.05		JH-1412	MJH-14121	18.33 4120	24.55 5520	9800	15000	0.0309
	22.225 0.8750	30.163 1.1875	25.400 1.000	1.27 0.05		JH-1416	MJH-14161	25.40 5710	37.37 8400	9800	15000	0.0343

Wt. kg/lbs. Approx.		Bearing Mounting mm/in.				Inspection mm/in.			Matching Inner Ring	Shaft Diameter
Open Ends	Closed Ends	Max.	Min.	Min.	Max.	Ring Gage	Plug-GO	Plug-NO-Go		
		S		H						in.
0.0095 0.021	—	14.288 0.5625	14.275 0.5620	19.037 0.7495	19.063 0.7505	19.063 0.7505	14.326 0.5640	14.351 0.5650	IR-612	
0.0113 0.025	0.0136 0.03	14.288 0.5625	14.275 0.5620	20.625 0.8120	20.650 0.8130	20.650 0.8130	14.326 0.5640	14.351 0.5650	IR-68	
0.0086 0.019	0.0104 0.023	15.875 0.6250	15.862 0.6245	20.625 0.8120	20.650 0.8130	20.650 0.8130	15.913 0.6265	15.939 0.6275	IR-68-1	5/8
0.0104 0.023	0.0127 0.028	15.875 0.6250	15.862 0.6245	20.625 0.8120	20.650 0.8130	20.650 0.8130	15.913 0.6265	15.939 0.6275		
0.0127 0.028	0.0150 0.033	15.875 0.6250	15.862 0.6245	20.625 0.8120	20.650 0.8130	20.650 0.8130	15.913 0.6265	15.939 0.6275	IR-612-1	
0.0145 0.032	0.0168 0.037	15.875 0.6250	15.862 0.6245	22.212 0.8745	22.238 0.8755	22.238 0.8755	15.913 0.6265	15.939 0.6275		
0.0236 0.052	0.0281 0.062	15.875 0.6250	15.862 0.6245	22.212 0.8745	22.238 0.8755	22.238 0.8755	15.913 0.6265	15.939 0.6275		
0.0136 0.03	0.0163 0.036	17.463 0.6875	17.450 0.6870	22.212 0.8745	22.238 0.8755	22.238 0.8755	17.501 0.6890	17.526 0.6900		11/16
0.0159 0.035	0.0191 0.042	17.463 0.6875	17.450 0.6870	23.800 0.9370	23.825 0.9380	23.825 0.9380	17.501 0.6890	17.526 0.6900		
0.0191 0.042	—	17.463 0.6875	17.450 0.6870	23.800 0.9370	23.825 0.9380	23.825 0.9380	17.501 0.6890	17.526 0.6900		
0.0100 0.022	—	19.050 0.7500	19.037 0.7495	25.387 0.9995	25.413 1.0005	25.387 0.9995	19.063 0.7505	19.088 0.7515		3/4
0.0136 0.03	—	19.050 0.7500	19.037 0.7495	25.387 0.9995	25.413 1.0005	25.387 0.9995	19.063 0.7505	19.088 0.7515	IR-88	
0.0172 0.038	0.0204 0.045	19.050 0.7500	19.037 0.7495	25.387 0.9995	25.413 1.0005	25.387 0.9995	19.063 0.7505	19.088 0.7515		
0.0204 0.045	0.0245 0.054	19.050 0.7500	19.037 0.7495	25.387 0.9995	25.413 1.0005	25.387 0.9995	19.063 0.7505	19.088 0.7515	IR-812	
0.0263 0.058	0.0313 0.069	19.050 0.7500	19.037 0.7495	26.975 1.0620	27.000 1.0630	26.975 1.0620	19.063 0.7505	19.088 0.7515	IR-812	
0.0254 0.056	—	20.638 0.8125	20.625 0.8120	26.975 1.0620	27.000 1.0630	26.975 1.0620	20.650 0.8130	20.676 0.8140		13/16
0.0281 0.062	0.0336 0.074	20.638 0.8125	20.625 0.8120	28.562 1.1245	28.588 1.1255	28.562 1.1245	20.650 0.8130	20.676 0.8140		
0.0118 0.026	—	22.225 0.8750	22.212 0.8745	28.562 1.1245	28.588 1.1255	28.562 1.1245	22.238 0.8755	22.263 0.8765		7/8
0.0154 0.034	—	22.225 0.8750	22.212 0.8745	28.562 1.1245	28.588 1.1255	28.562 1.1245	22.238 0.8755	22.263 0.8765		
0.0236 0.052	0.0281 0.062	22.225 0.8750	22.212 0.8745	28.562 1.1245	28.588 1.1255	28.562 1.1245	22.238 0.8755	22.263 0.8765	IR-1012	
0.0313 0.069	0.0585 0.129	22.225 0.8750	22.212 0.8745	28.562 1.1245	28.588 1.1255	28.562 1.1245	22.238 0.8755	22.263 0.8765	IR-1016	
0.0299 0.066	0.0358 0.079	22.225 0.8750	22.212 0.8745	30.150 1.1870	30.175 1.1880	30.150 1.1870	22.238 0.8755	22.263 0.8765	IR-1012	
0.0404 0.089	0.0481 0.106	22.225 0.8750	22.212 0.8745	30.150 1.1870	30.175 1.1880	30.150 1.1870	22.238 0.8755	22.263 0.8765	IR-1016	

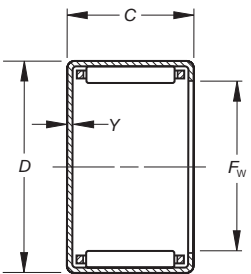
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**CAGED BEARINGS –  
OPEN ENDS, CLOSED ONE END – *continued***  
**INCH SERIES**



**J, JH**



**MJ-1, MJH-1**

Mounting dimensions are based on the inner ring rotating and the outer ring being stationary relative to the load. The housing should be of high strength material. See engineering section for discussion of shaft and housing design. See page C62 for mounting procedure.

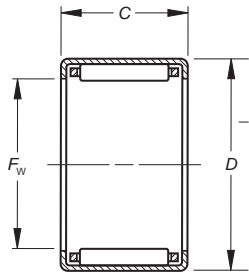
Shaft Diameter	Dimensions mm/in. +0 +0.000 -0.3 -0.100				Bearing Designation		Load Ratings kN/lbf.		Limiting Speed		C <sub>g</sub>
	in.	F <sub>w</sub>	D	C	Y		C	C <sub>0</sub>	Grease RPM	Oil RPM	
1	25.400	31.750	19.050	—	J-1612	—	18.15	28.82	8400	13000	0.035
	1.0000	1.2500	0.750	—			4080	6480			
	25.400	31.750	25.400	1.02	J-1616	MJ-16161	24.95	43.41	8400	13000	0.0387
	1.0000	1.2500	1.000	0.04			5610	9760			
	25.400	33.338	19.050	1.27	JH-1612	MJH-16121	20.68	29.58	8500	13000	0.0342
	1.0000	1.3125	0.750	0.05			4650	6650			
	25.400	33.338	25.400	1.27	JH-1616	MJH-16161	27.58	42.88	8500	13000	0.0375
	1.0000	1.3125	1.000	0.05			6200	9640			
1 1/8	28.575	34.925	12.700	1.02	J-188	MJ-1881	11.65	16.95	7400	11000	0.0323
	1.1250	1.3750	0.500	0.04			2620	3810			
	28.575	34.925	19.050	1.02	J-1812	MJ-18121	19.04	31.76	7400	11000	0.0377
	1.1250	1.3750	0.750	0.04			4280	7140			
	28.575	34.925	25.400	1.02	J-1816	MJ-18161	26.16	48.04	7400	11000	0.0418
	1.1250	1.3750	1.000	0.04			5880	10800			
	28.575	38.100	19.050	1.27	JH-1812	MJH-18121	23.35	31.32	7600	12000	0.0356
	1.1250	1.5000	0.750	0.05			5250	7040			
	28.575	38.100	25.400	1.27	JH-1816	MJH-18161	33.14	49.38	7600	12000	0.0398
	1.1250	1.5000	1.000	0.05			7450	11100			
	28.575	38.100	28.580	1.27	JH-1818	MJH-18181	36.30	55.16	7600	12000	0.041
	1.1250	1.5000	1.125	0.05			8160	12400			
1 1/4	31.750	38.100	19.050	1.02	J-2012	MJ-20121	19.84	34.70	6600	10000	0.0404
	1.2500	1.5000	0.750	0.04			4460	7800			
	31.750	38.100	25.400	1.02	J-2016	MJ-20161	28.82	56.49	6600	10000	0.0455
	1.2500	1.5000	1.000	0.04			6480	12700			
	31.750	41.275	19.050	—	JH-2012	—	24.11	33.94	6800	10000	0.038
	1.2500	1.6250	0.750	—			5420	7630			
	31.750	41.275	25.400	—	JH-2016	—	33.94	52.93	6800	10000	0.0424
	1.2500	1.6250	1.000	—			7630	11900			
	31.750	41.275	31.750	—	JH-2020	—	43.37	72.51	6800	10000	0.0459
	1.2500	1.6250	1.250	—			9750	16300			
1 3/8	34.925	41.275	12.700	1.02	J-228	MJ-2281	13.97	22.91	6000	9200	0.038
	1.3750	1.6250	0.500	0.04			3140	5150			
	34.925	41.275	19.050	—	J-2212	—	22.82	42.97	6000	9200	0.0444
	1.3750	1.6250	0.750	—			5130	9660			
	34.925	44.450	19.050	1.27	JH-2212	MJH-22121	26.24	38.43	6100	9400	0.0407
	1.3750	1.7500	0.750	0.05			5900	8640			
	34.925	44.450	25.400	1.27	JH-2216	MJH-22161	36.52	58.72	6100	9400	0.0452
	1.3750	1.7500	1.000	0.05			8210	13200			
1 1/2	38.100	47.625	19.050	1.27	J-2412	MJ-24121	29.89	47.15	5600	8600	0.0445
	1.5000	1.8750	0.750	0.05			6720	10600			
	38.100	47.625	25.400	1.27	J-2416	MJ-24161	39.32	66.72	5600	8600	0.0486
	1.5000	1.8750	1.000	0.05			8840	15000			
	38.100	47.625	31.750	—	J-2420	—	49.38	89.85	5600	8600	0.0523
	1.5000	1.8750	1.250	—			11100	20200			
1 5/8	41.275	50.800	15.880	—	J-2610	—	26.11	40.97	5100	7900	0.0446
	1.6250	2.0000	0.625	—			5870	9210			

Wt. kg/lbs. Approx.		Bearing Mounting mm/in.				Inspection mm/in.			Matching Inner Ring	Shaft Diameter
Open Ends	Closed Ends	Max.	Min.	Min.	Max.	Ring Gage	Plug-GO	Plug-NO-Go		
		S		H						in.
0.0263 0.058	—	25.400 1.0000	25.387 0.9995	31.737 1.2495	31.763 1.2505	31.737 1.2495	25.413 1.0005	25.438 1.0015	IR-1212	1
0.0349 0.077	0.0417 0.092	25.400 1.0000	25.387 0.9995	31.737 1.2495	31.763 1.2505	31.737 1.2495	25.413 1.0005	25.438 1.0015	IR-1216	
0.0336 0.074	0.0399 0.088	25.400 1.0000	25.387 0.9995	33.325 1.3120	33.350 1.3130	33.325 1.3120	25.413 1.0005	25.438 1.0015	IR-1212	
0.0449 0.099	0.0540 0.119	25.400 1.0000	25.387 0.9995	33.325 1.3120	33.350 1.3130	33.325 1.3120	25.413 1.0005	25.438 1.0015	IR-1216	
0.0195 0.043	0.0227 0.05	28.575 1.1250	28.562 1.1245	34.912 1.3745	34.938 1.3755	34.912 1.3745	28.588 1.1255	28.613 1.1265		1 1/8
0.0290 0.064	0.0345 0.076	28.575 1.1250	28.562 1.1245	34.912 1.3745	34.938 1.3755	34.912 1.3745	28.588 1.1255	28.613 1.1265		
0.0390 0.086	0.0467 0.103	28.575 1.1250	28.562 1.1245	34.912 1.3745	34.938 1.3755	34.912 1.3745	28.588 1.1255	28.613 1.1265	IR-1416	
0.0458 0.101	0.0549 0.121	28.575 1.1250	28.562 1.1245	38.087 1.4995	38.113 1.5005	38.087 1.4995	28.588 1.1255	28.613 1.1265		
0.0612 0.135	0.0735 0.162	28.575 1.1250	28.562 1.1245	38.087 1.4995	38.113 1.5005	38.087 1.4995	28.588 1.1255	28.613 1.1265	IR-1416	
0.0689 0.152	0.0821 0.181	28.575 1.1250	28.562 1.1245	38.087 1.4995	38.113 1.5005	38.087 1.4995	28.588 1.1255	28.613 1.1265		
0.0363 0.08	0.0431 0.095	31.750 1.2500	31.737 1.2495	38.087 1.4995	38.113 1.5005	38.087 1.4995	31.763 1.2505	31.788 1.2515	IR-1612	1 1/4
0.0426 0.094	0.0513 0.113	31.750 1.2500	31.737 1.2495	38.087 1.4995	38.113 1.5005	38.087 1.4995	31.763 1.2505	31.788 1.2515	IR-1616	
0.0503 0.111	—	31.750 1.2500	31.737 1.2495	41.262 1.6245	41.288 1.6255	41.262 1.6245	31.763 1.2505	31.788 1.2515	IR-1612	
0.0671 0.148	—	31.750 1.2500	31.737 1.2495	41.262 1.6245	41.288 1.6255	41.262 1.6245	31.763 1.2505	31.788 1.2515	IR-1616	
0.0839 0.185	—	31.750 1.2500	31.737 1.2495	41.262 1.6245	41.288 1.6255	41.262 1.6245	31.763 1.2505	31.788 1.2515		
0.0236 0.052	0.0281 0.062	34.925 1.3750	34.912 1.3745	41.262 1.6245	41.288 1.6255	41.262 1.6245	34.938 1.3755	34.966 1.3766		1 3/8
0.0349 0.077	—	34.925 1.3750	34.912 1.3745	41.262 1.6245	41.288 1.6255	41.262 1.6245	34.938 1.3755	34.966 1.3766	IR-1812	
0.0549 0.121	0.0653 0.144	34.925 1.3750	34.912 1.3745	44.437 1.7495	44.463 1.7505	44.437 1.7495	34.938 1.3755	34.966 1.3766	IR-1812	
0.0730 0.161	0.0871 0.192	34.925 1.3750	34.912 1.3745	44.437 1.7495	44.463 1.7505	44.437 1.7495	34.938 1.3755	34.966 1.3766	IR-1816	
0.0594 0.131	0.0943 0.208	38.100 1.5000	38.087 1.4995	47.612 1.8745	47.638 1.8755	47.612 1.8745	38.113 1.5005	38.143 1.5017		1 1/2
0.0789 0.174	0.0943 0.208	38.100 1.5000	38.087 1.4995	47.612 1.8745	47.638 1.8755	47.612 1.8745	38.113 1.5005	38.143 1.5017	IR-1916	
0.0989 0.218	—	38.100 1.5000	38.087 1.4995	47.612 1.8745	47.638 1.8755	47.612 1.8745	38.113 1.5005	38.143 1.5017	IR-1920	
0.0531 0.117	—	41.275 1.6250	41.262 1.6245	50.787 1.9995	50.813 2.0005	50.787 1.9995	41.288 1.6255	41.318 1.6267		1 5/8

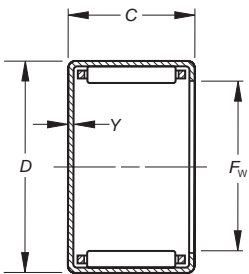
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**CAGED BEARINGS –  
OPEN ENDS, CLOSED ONE END – *continued***  
**INCH SERIES**



**J, JH**



**MJ-1, MJH-1**

Shaft Diameter	Dimensions mm/in. +0 +0.000 -0.3 -0.100				Bearing Designation		Load Ratings kN/lbf.		Limiting Speed		C <sub>g</sub>
	in.	F <sub>w</sub>	D	C	Y	C	C <sub>0</sub>	Grease RPM	Oil RPM		
	41.275 1.6250	50.800 2.0000	25.400 1.000	1.27 0.05		J-2616 M-26161	39.28 8830	68.95 15500	5100	7900	0.0508
1 3/4	44.450 1.7500	53.975 2.1250	19.050 0.750	1.27 0.05		J-2812 MJ-28121	29.58 6650	49.38 11100	4700	7300	0.0483
	44.450 1.7500	53.975 2.1250	25.400 1.000	1.27 0.05		J-2816 MJ-28161	40.08 9010	72.95 16400	4700	7300	0.0532
	44.450 1.7500	53.975 2.1250	38.100 1.500	1.27 0.05		J-2824 MJ-28241	59.61 13400	121.88 27400	4700	7300	0.0605
1 7/8	47.625 1.8750	57.150 2.2500	25.400 1.000	1.27 0.05		J-3016 MJ-30161	41.10 9240	76.06 17100	4400	6800	0.0553
2	50.800 2.0000	60.325 2.3750	25.400 1.000	1.27 0.05		J-3216 MJ-32161	42.39 9530	81.40 18300	4100	6300	0.0579
2 1/4	57.150 2.2500	66.675 2.6250	19.050 0.750	—		J-3612 —	35.41 7960	65.83 14800	3600	5600	0.0577
	57.150 2.2500	66.675 2.6250	25.400 1.000	—		J-3616 —	46.26 10400	92.52 20800	3600	5600	0.0628
2 3/4	69.850 2.7500	79.375 3.1250	19.050 0.750	—		J-4412 —	36.25 8150	72.95 16400	2900	4500	0.0649

Mounting dimensions are based on the inner ring rotating and the outer ring being stationary relative to the load. The housing should be of high strength material. See engineering section for discussion of shaft and housing design. See page C62 for mounting procedure.

Wt. kg/lbs. Approx.		Bearing Mounting mm/in.				Inspection mm/in.			Matching Inner Ring	Shaft Diameter
Open Ends	Closed Ends	Max.	Min.	Min.	Max.	Ring Gage	Plug-GO	Plug-NO-Go		
		S		H						in.
<b>0.0848</b> 0.187	<b>0.1012</b> 0.223	<b>41.275</b> 1.6250	<b>41.262</b> 1.6245	<b>50.787</b> 1.9995	<b>50.813</b> 2.0005	<b>50.787</b> 1.9995	<b>41.288</b> 1.6255	<b>41.318</b> 1.6267		
<b>0.0680</b> 0.15	<b>0.0812</b> 0.179	<b>44.450</b> 1.7500	<b>44.437</b> 1.7495	<b>53.962</b> 2.1245	<b>53.988</b> 2.1255	<b>53.962</b> 2.1245	<b>44.463</b> 1.7505	<b>44.496</b> 1.7518		1 3/4
<b>0.0907</b> 0.2	<b>0.1084</b> 0.239	<b>44.450</b> 1.7500	<b>44.437</b> 1.7495	<b>53.962</b> 2.1245	<b>53.988</b> 2.1255	<b>53.962</b> 2.1245	<b>44.463</b> 1.7505	<b>44.496</b> 1.7518	IR-2316	
<b>0.1361</b> 0.3	<b>0.1624</b> 0.358	<b>44.450</b> 1.7500	<b>44.437</b> 1.7495	<b>53.962</b> 2.1245	<b>53.988</b> 2.1255	<b>53.962</b> 2.1245	<b>44.463</b> 1.7505	<b>44.496</b> 1.7518	IR-2324	
<b>0.0966</b> 0.213	<b>0.1152</b> 0.254	<b>47.625</b> 1.8750	<b>47.612</b> 1.8745	<b>57.137</b> 2.2495	<b>57.163</b> 2.2505	<b>57.137</b> 2.2495	<b>47.638</b> 1.8755	<b>47.671</b> 1.8768		1 7/8
<b>0.1025</b> 0.226	<b>0.1365</b> 0.301	<b>50.800</b> 2.0000	<b>50.785</b> 1.9994	<b>60.312</b> 2.3745	<b>60.338</b> 2.3755	<b>60.312</b> 2.3745	<b>50.815</b> 2.0006	<b>50.848</b> 2.0019		2
<b>0.0857</b> 0.189	—	<b>57.150</b> 2.2500	<b>57.135</b> 2.2494	<b>66.662</b> 2.6245	<b>66.688</b> 2.6255	<b>66.662</b> 2.6245	<b>57.165</b> 2.2506	<b>57.203</b> 2.2521		2 1/4
<b>0.1143</b> 0.252	—	<b>57.150</b> 2.2500	<b>57.135</b> 2.2494	<b>66.662</b> 2.6245	<b>66.688</b> 2.6255	<b>66.662</b> 2.6245	<b>57.165</b> 2.2506	<b>57.203</b> 2.2521		
<b>0.1030</b> 0.227	—	<b>69.850</b> 2.7500	<b>69.835</b> 2.7494	<b>79.362</b> 3.1245	<b>79.388</b> 3.1255	<b>79.362</b> 3.1245	<b>69.875</b> 2.7510	<b>69.914</b> 2.7525	IR-4016	2 3/4

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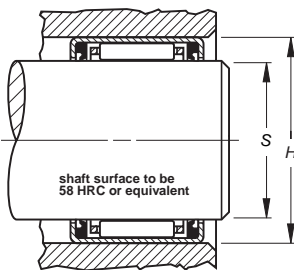
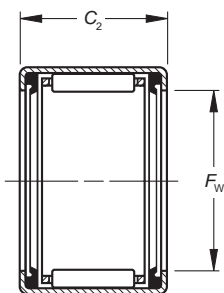
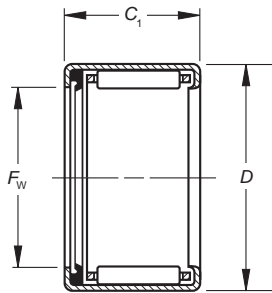




## SEALED DRAWN CUP BEARINGS

### INCH SERIES

- Check for availability. Not all bearings are in production.
- Prepacked with general purpose ball and roller bearing grease unless otherwise specified.
- Bearing operating temperature limited between -25° F and +225° F.
- Consult your Timken representative for operating temperatures outside the above range or if seals exposed to unusual fluids.
- Limiting speed based on shaft contact speed of 2000 RPM.
- Reduce the listed limiting speed by one-half for outer ring rotation.



Drawn cup bearings of nominal inch dimensions, with one seal and one end closed, may be made available upon request.

Mounting dimensions are based on the inner ring rotating and the outer ring being stationary relative to the load. The housing should be of high strength material. See engineering section for discussion of shaft and housing design. See page C62 for mounting procedure.

Shaft Diameter	Dimensions mm/in.			Bearings With One Seal mm/in.		Bearings With Two Seals mm/in.		
	$F_w$	$D$	$C_1$	Bearing Designation Open End	Wt. Approx. kg/lbs.	$C_2$	Bearing Designation	Wt. Approx. kg/lbs.
<b>in.</b>	<b><math>F_w</math></b>	<b><math>D</math></b>	<b><math>C_1</math></b>					
5/16	7.938 0.3125	12.700 0.5000	9.53 0.375	JT-56	0.004 0.008	11.13 0.438	JTT-57	0.004 0.009
	7.938 0.3125	12.700 0.5000	—	—	—	14.27 0.562	JTT-59	0.005 0.012
3/8	9.525 0.3750	14.288 0.5625	9.53 0.375	JT-66	0.004 0.009	11.13 0.438	JTT-67	0.005 0.011
	9.525 0.3750	14.288 0.5625	14.27 0.562	JT-69	0.006 0.014	—	—	—
1/2	12.700 0.5000	17.463 0.6875	9.53 0.375	JT-86	0.005 0.012	11.13 0.438	JTT-87	0.006 0.013
	12.700 0.5000	17.463 0.6875	14.27 0.562	JT-89	0.008 0.017	15.88 0.625	JTT-810	0.009 0.019
	12.700 0.5000	17.463 0.6875	—	—	—	22.23 0.875	JTT-814	0.012 0.027
9/16	14.288 0.5625	19.050 0.7500	14.27 0.562	JT-99	0.009 0.019	15.88 0.625	JTT-910	0.010 0.021
	14.288 0.5625	19.050 0.7500	—	—	—	19.05 0.75	JTT-912	0.011 0.025
5/8	15.875 0.6250	20.638 0.8125	14.27 0.562	JT-109	0.010 0.021	15.88 0.625	JTT-1010	0.010 0.023
	15.875 0.6250	20.638 0.8125	—	—	—	19.05 0.75	JTT-1012	0.013 0.028
	15.875 0.6250	20.638 0.8125	—	—	—	22.23 0.875	JTT-1014	0.015 0.032
11/16	17.463 0.6875	22.225 0.8750	—	—	—	22.23 0.875	JTT-1114	0.016 0.035
3/4	19.050 0.7500	25.400 1.0000	14.27 0.562	JT-129	0.015 0.034	15.88 0.625	JTT-1210	0.017 0.038
	19.050 0.7500	25.400 1.0000	17.48 0.688	JT-1211	0.019 0.041	—	—	—
	19.050 0.7500	25.400 1.0000	20.62 0.812	JT-1213	0.022 0.049	22.23 0.875	JTT-1214	0.024 0.053
7/4	22.225 0.8750	28.575 1.1250	14.27 0.562	JT-149	0.018 0.039	15.88 0.625	JTT-1410	0.020 0.043
	22.225 0.8750	28.575 1.1250	26.97 1.062	JT-1417	0.033 0.073	—	—	—
1	25.400 1.0000	31.750 1.2500	20.62 0.812	JT-1613	0.029 0.063	22.23 0.875	JTT-1614	0.031 0.068
1 1/8	28.575 1.1250	34.925 1.3750	20.62 0.812	JT-1813	0.032 0.070	22.23 0.875	JTT-1814	0.034 0.075
1 1/4	31.750 1.2500	38.100 1.5000	20.62 0.812	JT-2013	0.035 0.077	—	—	—
	31.750 1.2500	38.100 1.500	—	—	—	28.58 1.125	JTT-2018	0.048 0.106
1 1/2	38.100 1.500	47.625 1.875	33.32 1.312	JT-2421	0.104 0.229	—	—	—



Load Ratings KN/lbf.		Limiting Speed Approx.		Bearing Mounting mm/in.				Shaft Diameter
Dynamic	Static			Max.	Min.	Min.	Max.	
<b>C</b>	<b>C<sub>0</sub></b>	<b>RPM</b>	<b>C<sub>g</sub></b>	<b>S</b>		<b>H</b>		<b>in.</b>
2.40 540	2.00 450	18000	0.0117	7.938 0.3125	7.925 0.3120	12.687 0.4995	12.713 0.5005	5/16
4.05 910	3.91 880	18000	0.0138	7.938 0.3125	7.925 0.3120	12.687 0.4995	12.713 0.5005	
2.74 615	2.49 560	18000	0.0133	9.525 0.3750	9.512 0.3745	14.275 0.5620	14.300 0.5630	3/8
5.20 1 170	5.74 1 290	18000	0.0163	9.525 0.3750	9.512 0.3745	14.275 0.5620	14.300 0.5630	
3.47 780	3.65 820	15000	0.0164	12.700 0.5000	12.687 0.4995	17.450 0.6870	17.475 0.6880	1/2
6.32 1 420	7.92 1 780	15000	0.0199	12.700 0.5000	12.687 0.4995	17.450 0.6870	17.475 0.6880	
10.2 2 300	14.7 3 310	15000	0.0232	12.700 0.5000	12.687 0.4995	17.450 0.6870	17.475 0.6880	
6.23 1 400	8.01 1 800	14000	0.0210	14.288 0.5625	14.275 0.5620	19.037 0.7495	19.063 0.7505	9/16
8.18 1 840	11.4 2 560	14000	0.0229	14.288 0.5625	14.275 0.5620	19.037 0.7495	19.063 0.7505	
6.72 1 510	9.12 2 050	12000	0.0227	15.875 0.6250	15.862 0.6245	20.625 0.8120	20.650 0.8130	5/8
8.81 1 980	12.9 2 910	12000	0.0247	15.875 0.6250	15.862 0.6245	20.625 0.8120	20.650 0.8130	
11.7 2 640	18.9 4 240	12000	0.0272	15.875 0.6250	15.862 0.6245	20.625 0.8120	20.650 0.8130	
12.5 2 800	20.9 4 700	11000	0.0290	17.463 0.6875	17.450 0.6870	22.212 0.8745	22.238 0.8755	11/16
9.92 2 230	12.2 2 740	10000	0.0250	19.050 0.7500	19.037 0.7495	25.387 0.9995	25.413 1.0005	3/4
12.5 2 810	16.3 3 670	10000	0.0269	19.050 0.7500	19.037 0.7495	25.387 0.9995	25.413 1.0005	
15.5 3 490	21.6 4 860	10000	0.0288	19.050 0.7500	19.037 0.7495	25.387 0.9995	25.413 1.0005	
10.9 2 460	14.5 3 260	8700	0.0278	22.225 0.8750	22.212 0.8745	28.562 1.1245	28.588 1.1255	7/8
23.7 5 320	39.0 8 760	8700	0.0356	22.225 0.8750	22.212 0.8745	28.562 1.1245	28.588 1.1255	
18.1 4 080	28.8 6 480	7600	0.035	25.400 1.0000	25.387 0.9995	31.737 1.2495	31.763 1.2505	1
19.0 4 280	31.8 7 140	6800	0.0377	28.575 1.125	28.562 1.1245	34.912 1.3745	34.938 1.3755	1 1/8
19.8 4 460	34.7 7 800	6100	0.0404	31.750 1.2500	31.737 1.2495	38.087 1.4995	38.113 1.5005	1 1/4
28.8 6 480	56.5 12 700	6100	0.0455	31.750 1.2500	31.737 1.2495	38.087 1.4995	38.113 1.5005	
49.4 11 100	89.9 20 200	5100	0.0523	38.100 1.5000	38.087 1.4995	47.612 1.8745	47.638 1.8755	1 1/2



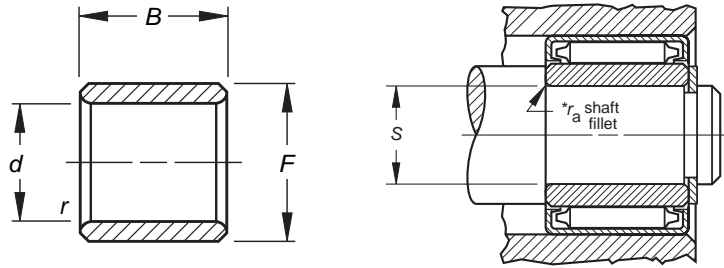


## INNER RINGS FOR INCH SERIES DRAWN CUP BEARINGS

- Check for availability.
- Ideal choice where shaft not practical to use as inner raceway.
- Provided in inch (IR, IRA) nominal dimensions for use with inch series drawn cup bearings.
- Designed to meet established inch tolerances.
- Designed to be wider than matching drawn cup bearing.
- Maximum shaft fillet radius ( $r_{as-max}$ ) cannot exceed inner ring bore chamfer ( $r_{s-min}$ ) as shown.
- Optional centralized lubrication groove (bore) or thru-hole available – specify when ordering.
- Designed to be axially clamped against shoulder for loose transition fit on shaft.
- After mounting, for tight transition fit (keeping inner ring from rotating relative to shaft), inner ring O.D. must not exceed raceway diameter on matching bearing.
- See tables for required bearing dimensions raceway diameter.
- After mounting, if O.D. of inner ring exceeds required raceway diameter for matching bearing, ring should be ground to proper diameter while mounted on shaft.
- Unmarked end of inner ring to be assembled against shaft shoulder to assure clearing maximum allowable shaft fillet ( $r_{as max}$ ) as indicated in tables shown.

Shaft Diameter	Dimensions mm/in.							Inner Ring Designation	Transition Fit				Wt. mm/lbs. Approx.
	Min.	Max.	Max.	Min.	Max.	Min.	Min.		Loose Max.	Transition Fit Min.	Tight Max.	Tight Min.	
in.	d		F		B		$r_{s min}$		S				
3/16	4.813	4.826	9.525	9.512	13.614	13.360	0.64	IRA-3	4.818	4.806	4.829	4.816	0.053
	0.1895	0.1900	0.3750	0.3745	0.5360	0.5260	0.025		0.1897	0.1892	0.1901	0.1896	
1/4	6.337	6.350	11.113	11.100	13.614	13.360	0.64	IRA-4	6.342	6.330	6.353	6.340	0.062
	0.2495	0.2500	0.4375	0.4370	0.5360	0.5260	0.025		0.2497	0.2492	0.2501	0.2496	
5/16	7.925	7.938	12.700	12.687	13.614	13.360	0.64	IRA-5	7.930	7.917	7.940	7.927	0.076
	0.3120	0.3125	0.5000	0.4995	0.5360	0.5260	0.025		0.3122	0.3117	0.3126	0.3121	
3/8	9.512	9.525	14.288	14.275	13.081	12.827	0.64	IR-68	9.517	9.505	9.528	9.515	0.085
	0.3745	0.3750	0.5625	0.5620	0.5150	0.5050	0.025		0.3747	0.3742	0.3751	0.3746	
	9.512	9.525	14.288	14.275	19.431	19.177	0.64	IR-612	9.517	9.505	9.528	9.515	0.125
	0.3745	0.3750	0.5625	0.5620	0.7650	0.7550	0.025		0.3747	0.3742	0.3751	0.3746	
	9.512	9.525	14.288	14.275	19.964	19.710	0.64	IRA-6	9.517	9.505	9.528	9.515	0.129
	0.3745	0.3750	0.5625	0.5620	0.7860	0.7760	0.025		0.3747	0.3742	0.3751	0.3746	
	9.512	9.525	15.875	15.862	13.081	12.827	0.64	IR-68-1	9.517	9.505	9.528	9.515	0.120
	0.3745	0.3750	0.6250	0.6245	0.5150	0.5050	0.025		0.3747	0.3742	0.3751	0.3746	
	9.512	9.525	15.875	15.862	19.431	19.177	0.64	IR-612-1	9.517	9.505	9.528	9.515	0.178
	0.3745	0.3750	0.6250	0.6245	0.7650	0.7550	0.025		0.3747	0.3742	0.3751	0.3746	
7/16	11.100	11.113	15.875	15.862	19.964	19.710	0.64	IRA-7	11.105	11.092	11.115	11.102	0.147
	0.4370	0.4375	0.6250	0.6245	0.7860	0.7760	0.025		0.4372	0.4367	0.4376	0.4371	
1/2	12.687	12.700	19.050	19.037	13.081	12.827	1.02	IR-88	12.692	12.680	12.703	12.690	0.147
	0.4995	0.5000	0.7500	0.7495	0.5150	0.5050	0.040		0.4997	0.4992	0.5001	0.4996	
	12.687	12.700	19.050	19.037	19.431	19.177	1.02	IR-812	12.692	12.680	12.703	12.690	0.222
	0.4995	0.5000	0.7500	0.7495	0.7650	0.7550	0.040		0.4997	0.4992	0.5001	0.4996	
	12.687	12.700	19.050	19.037	19.964	19.710	1.02	IRA-8	12.692	12.680	12.703	12.690	0.227
	0.4995	0.5000	0.7500	0.7495	0.7860	0.7760	0.040		0.4997	0.4992	0.5001	0.4996	
5/8	15.862	15.875	22.225	22.212	19.431	19.177	1.02	IR-1012	15.867	15.855	15.878	15.865	0.267
	0.6245	0.6250	0.8750	0.8745	0.7650	0.7550	0.040		0.6247	0.6242	0.6251	0.6246	
	15.862	15.875	22.225	22.212	19.964	19.710	1.02	IRA-10	15.867	15.855	15.878	15.865	0.276
	0.6245	0.6250	0.8750	0.8745	0.7860	0.7760	0.040		0.6247	0.6242	0.6251	0.6246	
	15.862	15.875	22.225	22.212	25.781	25.527	1.02	IR-1016	15.867	15.855	15.878	15.865	0.356
	0.6245	0.6250	0.8750	0.8745	1.0150	1.0050	0.040		0.6247	0.6242	0.6251	0.6246	
3/4	19.037	19.050	25.400	25.387	13.081	12.827	1.02	IR-128	19.042	19.030	19.053	19.040	0.209
	0.7495	0.7500	1.0000	0.9995	0.5150	0.5050	0.040		0.7497	0.7492	0.7501	0.7496	
	19.037	19.050	25.400	25.387	19.431	19.177	1.02	IR-1212	19.042	19.030	19.053	19.040	0.311
	0.7495	0.7500	1.0000	0.9995	0.7650	0.7550	0.040		0.7497	0.7492	0.7501	0.7496	
	19.037	19.050	25.400	25.387	25.781	25.527	1.02	IR-1216	19.042	19.030	19.053	19.040	0.414
	0.7495	0.7500	1.0000	0.9995	1.0150	1.0050	0.040		0.7497	0.7492	0.7501	0.7496	
	19.037	19.050	25.400	25.387	26.314	26.060	1.02	IRA-12	19.042	19.030	19.053	19.040	0.423
	0.7495	0.7500	1.0000	0.9995	1.0360	1.0260	0.040		0.7497	0.7492	0.7501	0.7496	
	19.037	19.050	25.400	25.387	32.131	31.877	1.02	IR-1220	19.042	19.030	19.053	19.040	0.516
	0.7495	0.7500	1.0000	0.9995	1.2650	1.2550	0.040		0.7497	0.7492	0.7501	0.7496	

Bore and O.D. tolerance limits correspond to the single mean diameter (the arithmetical mean of the largest and smallest diameters in a single radial plane).  
 $r_{as max}$  is equal to minimum inner ring bore chamfer ( $r_{s min}$ ) at unmarked end.



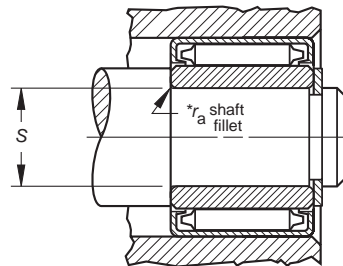
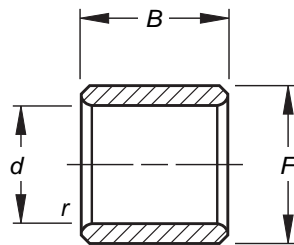
Shaft Diameter	Dimensions mm/in.							Inner Ring Designation	Transition Fit				Wt. mm/lbs. Approx.
	Min.	Max.	Max.	Min.	Max.	Min.	Min.		Loose Max.	Min.	Max.	Tight Min.	
in.	d		F		B		r <sub>s</sub> min.		S				
	19.037 0.7495	19.050 0.7500	25.400 1.0000	25.387 0.9995	38.481 1.5150	38.227 1.5050	1.02 0.040	IR-1224	19.042 0.7497	19.030 0.7492	19.053 0.7501	19.040 0.7496	0.618 0.139
13/16	20.625 0.8120	20.638 0.8125	25.400 1.0000	25.387 0.9995	19.431 0.7650	19.177 0.7550	1.02 0.040	IR-1312	20.630 0.8122	20.617 0.8117	20.640 0.8126	20.627 0.8121	0.240 0.054
	20.625 0.8120	20.638 0.8125	25.400 1.0000	25.387 0.9995	25.781 1.0150	25.527 1.0050	1.02 0.040	IR-1316	20.630 0.8122	20.617 0.8117	20.640 0.8126	20.627 0.8121	0.320 0.072
7/8	22.212 0.8745	22.225 0.8750	28.575 1.1250	28.562 1.1245	25.781 1.0150	25.527 1.0050	1.02 0.040	IR-1416	22.217 0.8747	22.205 0.8742	22.228 0.8751	22.215 0.8746	0.494 0.111
	22.212 0.8745	22.225 0.8750	28.575 1.1250	28.562 1.1245	26.314 1.0360	26.060 1.0260	1.02 0.040	IRA-14	22.217 0.8747	22.205 0.8742	22.228 0.8751	22.215 0.8746	0.480 0.108
15/16	23.800 0.9370	23.813 0.9375	28.575 1.1250	28.562 1.1245	25.781 1.0150	25.527 1.0050	1.02 0.040	IR-1516	23.805 0.9372	23.792 0.9367	23.815 0.9376	23.802 0.9371	0.365 0.082
1	25.387 0.9995	25.400 1.0000	31.750 1.2500	31.737 1.2495	19.431 0.7650	19.177 0.7550	1.02 0.040	IR-1612	25.392 0.9997	25.380 0.9992	25.403 1.0001	25.390 0.9996	0.400 0.090
	25.387 0.9995	25.400 1.0000	31.750 1.2500	31.737 1.2495	25.781 1.0150	25.527 1.0050	1.02 0.040	IR-1616	25.392 0.9997	25.380 0.9992	25.403 1.0001	25.390 0.9996	0.556 0.125
	25.387 0.9995	25.400 1.0000	31.750 1.2500	31.737 1.2495	26.314 1.0360	26.060 1.0260	1.02 0.040	IRA-16	25.392 0.9997	25.380 0.9992	25.403 1.0001	25.390 0.9996	0.543 0.122
1 1/8	28.562 1.1245	28.575 1.1250	34.925 1.3750	34.912 1.3745	19.431 0.7650	19.177 0.7550	1.02 0.040	IR-1812	28.567 1.1247	28.555 1.1242	28.578 1.1251	28.565 1.1246	0.445 0.100
	28.562 1.1245	28.575 1.1250	34.925 1.3750	34.912 1.3745	25.781 1.0150	25.527 1.0050	1.02 0.040	IR-1816	28.567 1.1247	28.555 1.1242	28.578 1.1251	28.565 1.1246	0.592 0.133
	28.562 1.1245	28.575 1.1250	34.925 1.3750	34.912 1.3745	32.131 1.2650	31.877 1.2550	1.02 0.040	IR-1820	28.567 1.1247	28.555 1.1242	28.578 1.1251	28.565 1.1246	0.738 0.166
1 3/16	30.150 1.1870	30.163 1.1875	38.100 1.5000	38.087 1.4995	25.781 1.0150	25.527 1.0050	1.02 0.040	IR-1916	30.155 1.1872	30.142 1.1867	30.165 1.1876	30.152 1.1871	0.827 0.186
	30.150 1.1870	30.163 1.1875	38.100 1.5000	38.087 1.4995	32.131 1.2650	31.877 1.2550	1.02 0.040	IR-1920	30.155 1.1872	30.142 1.1867	30.165 1.1876	30.152 1.1871	0.992 0.223
1 1/4	31.737 1.2495	31.750 1.2500	38.100 1.5000	38.087 1.4995	25.781 1.0150	25.527 1.0050	1.52 0.060	IR-2016	31.742 1.2497	31.730 1.2492	31.753 1.2501	31.740 1.2496	0.676 0.152
	31.737 1.2495	31.750 1.2500	38.100 1.5000	38.087 1.4995	32.131 1.2650	31.877 1.2550	1.52 0.060	IR-2020	31.742 1.2497	31.730 1.2492	31.753 1.2501	31.740 1.2496	0.845 0.190
	31.737 1.2495	31.750 1.2500	38.100 1.5000	38.087 1.4995	32.664 1.2860	32.410 1.2760	1.52 0.060	IRA-20	31.742 1.2497	31.730 1.2492	31.753 1.2501	31.740 1.2496	0.845 0.190
1 3/8	34.912 1.3745	34.925 1.3750	41.275 1.6250	41.262 1.6245	32.131 1.2650	31.877 1.2550	1.52 0.060	IR-2220	34.917 1.3747	34.905 1.3742	34.928 1.3751	34.915 1.3746	0.925 0.208
1 7/16	36.500 1.4370	36.513 1.4375	44.450 1.7500	44.437 1.7495	25.781 1.0150	25.527 1.0050	1.52 0.060	IR-2316	36.505 1.4372	36.492 1.4367	36.515 1.4376	36.502 1.4371	0.979 0.220

Continued on next page.



**INNER RINGS FOR INCH SERIES  
DRAWN CUP BEARINGS**

- Check for availability.
- Ideal choice where shaft not practical to use as inner raceway.
- Provided in inch (IR, IRA) nominal dimensions for use with inch series drawn cup bearings.
- Designed to meet established inch tolerances.
- Designed to be wider than matching drawn cup bearing.
- Maximum shaft fillet radius ( $r_{as-max}$ ) cannot exceed inner ring bore chamfer ( $r_{s-min}$ ) as shown.
- Optional centralized lubrication groove (bore) or thru-hole available – specify when ordering.
- Designed to be axially clamped against shoulder for loose transition fit on shaft.
- After mounting, for tight transition fit (keeping inner ring from rotating relative to shaft), inner ring O.D. must not exceed raceway diameter on matching bearing.
- See tables for required bearing dimensions raceway diameter.
- After mounting, if O.D. of inner ring exceeds required raceway diameter for matching bearing, ring should be ground to proper diameter while mounted on shaft.
- Unmarked end of inner ring to be assembled against shaft shoulder to assure clearing maximum allowable shaft fillet ( $r_{as max}$ ) as indicated in tables shown.



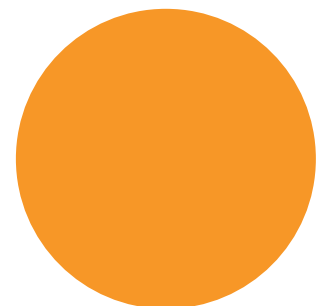
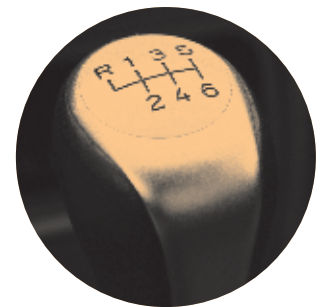
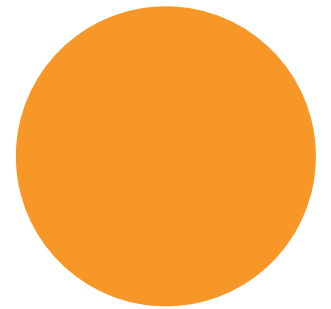
Shaft Diameter	Dimensions mm/in.							Inner Ring Designation	Transition Fit				Wt. mm/lbs. Approx.
	Min.	Max.	Max.	Min.	Max.	Min.	Min.		Loose Max.	Loose Min.	Tight Max.	Tight Min.	
in.	d		F		B		$r_{s min.}$	S					
	36.500 1.4370	36.513 1.4375	44.450 1.7500	44.437 1.7495	38.481 1.5150	38.227 1.5050	1.52 0.060	IR-2324	36.505 1.4372	36.492 1.4367	36.515 1.4376	36.502 1.4371	1.472 0.331
1 1/2	38.087 1.4995	38.100 1.5000	44.450 1.7500	44.437 1.7495	25.781 1.0150	25.527 1.0050	1.52 0.060	IR-2416	38.092 1.4997	38.080 1.4992	38.103 1.5001	38.090 1.4996	0.770 0.173
	38.087 1.4995	38.100 1.5000	44.450 1.7500	44.437 1.7495	38.481 1.5150	38.227 1.5050	1.52 0.060	IR-2424	38.092 1.4997	38.080 1.4992	38.103 1.5001	38.090 1.4996	1.201 0.270
1 11/16	42.850 1.6870	42.863 1.6875	52.388 2.0625	52.375 2.0620	38.481 1.5150	38.227 1.5050	1.52 0.060	IR-2724	42.855 1.6872	42.842 1.6867	42.865 1.6876	42.852 1.6871	2.082 0.468
1 3/4	44.437 1.7495	44.450 1.7500	52.388 2.0625	52.375 2.0620	38.481 1.5150	38.227 1.5050	1.52 0.060	IR-2824	44.442 1.7497	44.430 1.7492	44.453 1.7501	44.440 1.7496	1.761 0.396
1 13/16	46.025 1.8120	46.038 1.8125	52.388 2.0625	52.375 2.0620	25.781 1.0150	25.527 1.0050	1.52 0.060	IR-2916	46.030 1.8122	46.017 1.8117	46.040 1.8126	46.027 1.8121	0.952 0.214
	46.025 1.8120	46.038 1.8125	52.388 2.0625	52.375 2.0620	38.481 1.5150	38.227 1.5050	1.52 0.060	IR-2924	46.030 1.8122	46.017 1.8117	46.040 1.8126	46.027 1.8121	1.432 0.322
1 7/8	47.612 1.8745	47.625 1.8750	53.975 2.1250	53.962 2.1245	38.481 1.5150	38.227 1.5050	1.52 0.060	IR-3024	47.617 1.8747	47.605 1.8742	47.628 1.8751	47.615 1.8746	1.419 0.319
2 1/2	63.487 2.4995	63.500 2.5000	69.850 2.7500	69.837 2.7495	25.781 1.0150	25.527 1.0050	1.52 0.060	IR-4016	63.495 2.4998	63.477 2.4991	63.505 2.5002	63.487 2.4995	1.290 0.290

Bore and O.D. tolerance limits correspond to the single mean diameter (the arithmetical mean of the largest and smallest diameters in a single radial plane).  
 $*r_{as max}$  is equal to minimum inner ring bore chamfer ( $r_{s min}$ ) at unmarked end.

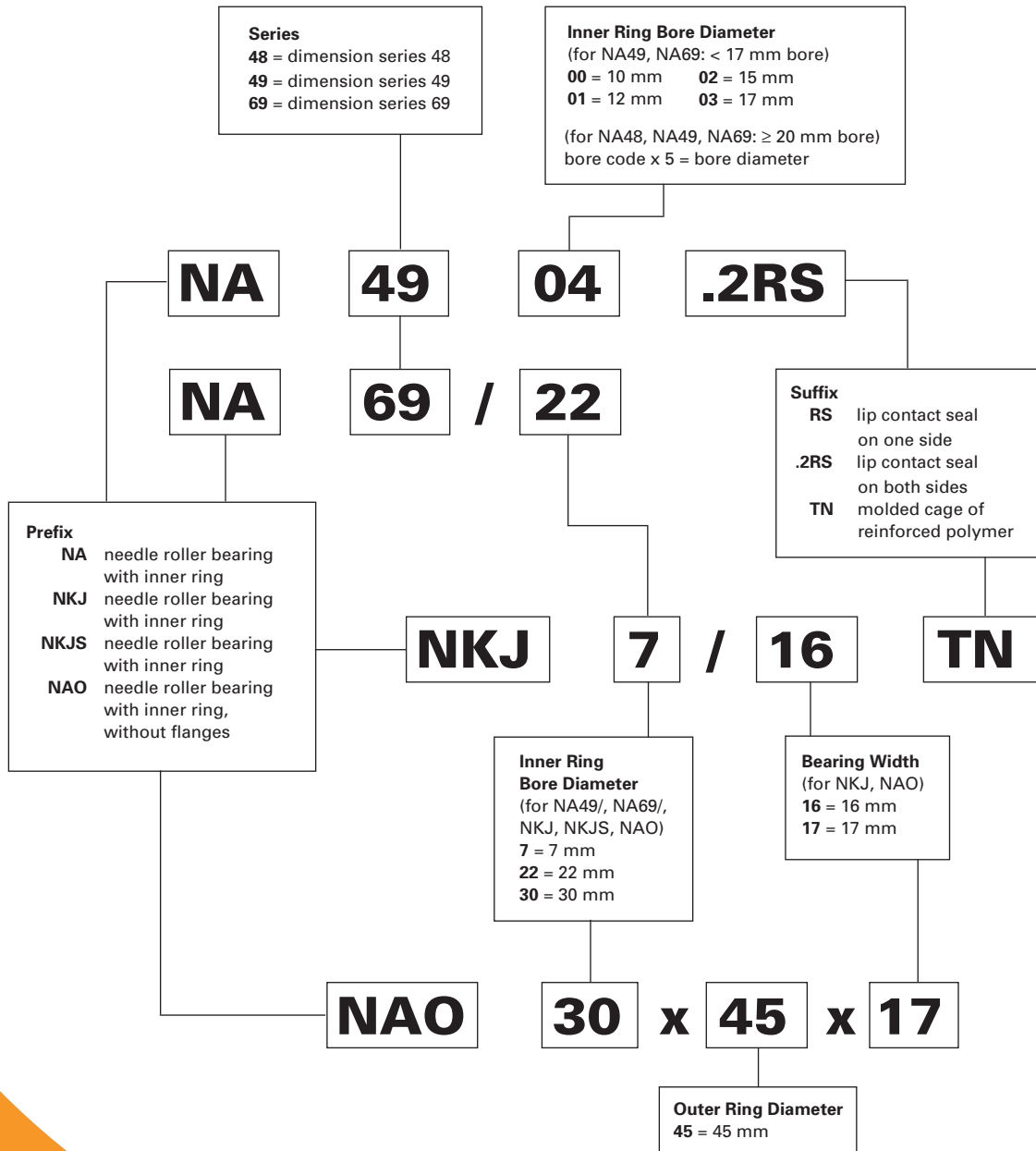
## HEAVY-DUTY NEEDLE ROLLER BEARINGS

**Overview:** Heavy-duty needle roller bearings consist of a machined and ground channel-shaped outer ring with a complement of needle rollers retained and guided by a cage. The high-strength cage retains and guides the rollers. An optional lubrication groove and hole in the outer ring facilitate relubrication. These bearings can be used with or without a machined and ground inner ring, depending on the suitability of the shaft as a raceway surface.

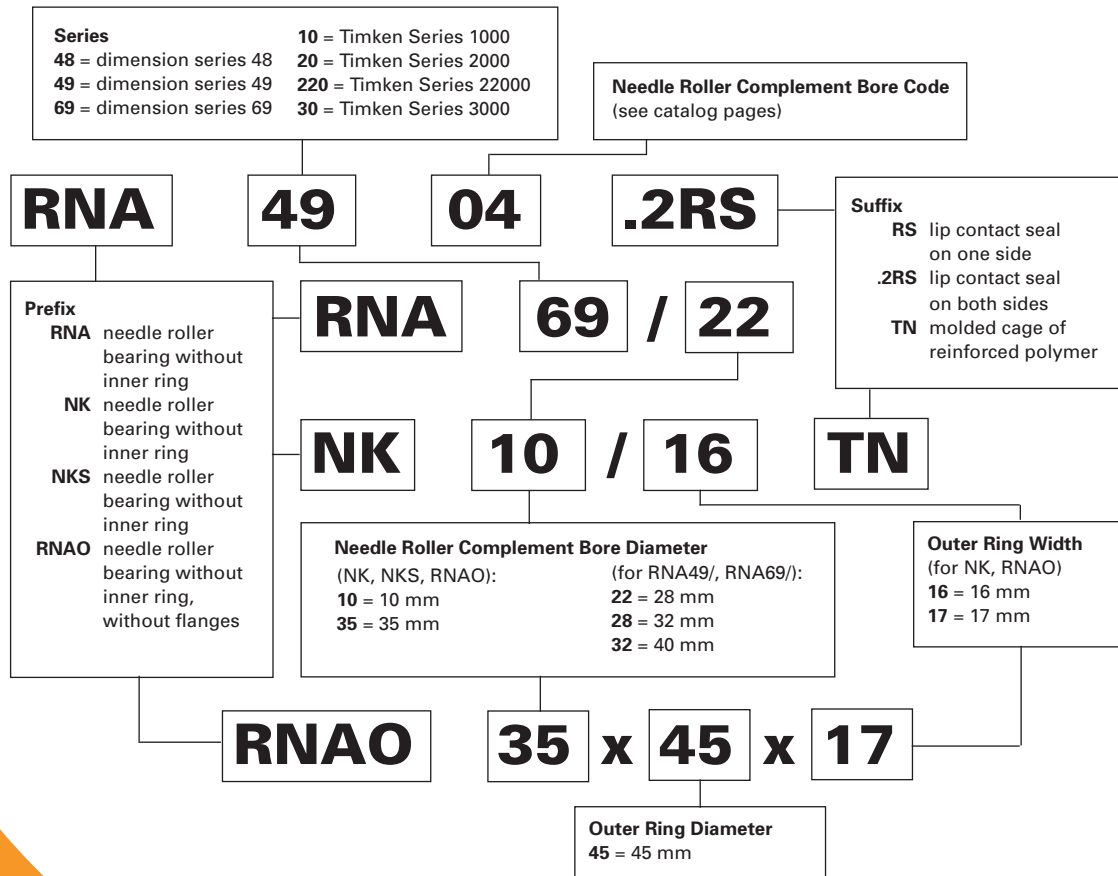
- **Sizes: Metric:** 5 mm - 175 mm bore (0.19685 in. - 6.88976 in.).
- **Markets:** Gear pumps, sheaves, automotive transmissions and two-cycle engines.
- **Features:** Thick outer ring provides maximum load capacity and shock resistance with a relatively small radial cross section.
- **Benefits:** Optimum speed and lubrication-retention capability.



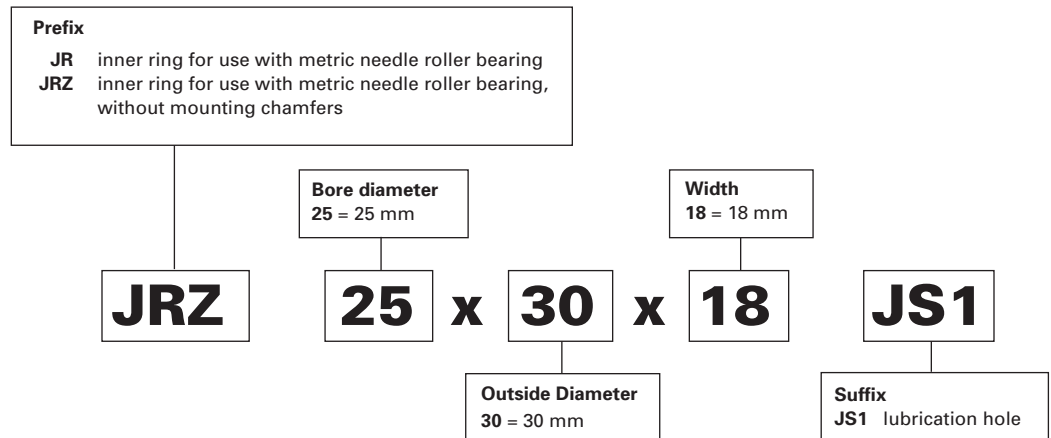
## Needle Roller Bearings with Inner Rings – Metric Nominal Dimensions



## Needle Roller Bearings without Inner Rings – Metric Nominal Dimensions



## Inner Rings for Needle Roller Bearings – Metric Nominal Dimensions



C





# Heavy-Duty Needle Roller

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## NEEDLE ROLLER BEARINGS

### METRIC SERIES

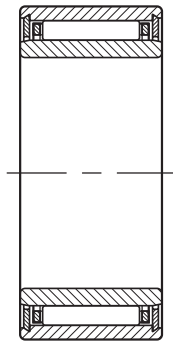
When applications involve very heavy dynamic, static or even shock load conditions the needle roller bearing may be found to give best results.

### REFERENCE STANDARDS ARE:

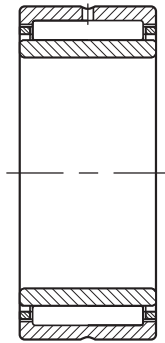
- ISO 1206 – Needle roller bearings – Light and medium series – Dimensions and tolerances.
- DIN 617 – Rolling bearings – Needle roller bearings with cage – Dimension Series 48 and 49.

### TYPES OF METRIC SERIES NEEDLE ROLLER BEARINGS

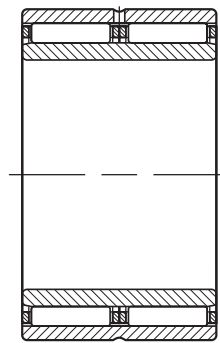
#### Needle roller bearings with inner rings



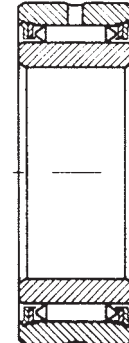
**NKJ**  
( $d \leq 7$  mm)



**NKJ, NKJS**  
( $d \geq 9$  mm)  
**NA48, NA49**  
**NA69** ( $d \leq 30$  mm)

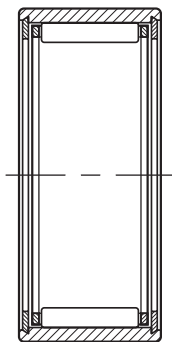


**NA69**  
( $d \geq 32$  mm)

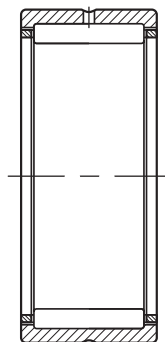


**Full Complement**

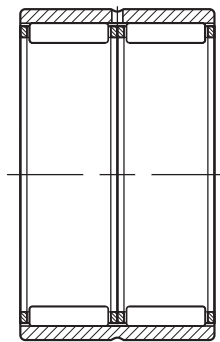
#### Needle roller bearings without inner rings



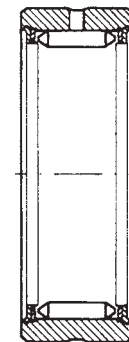
**NK**  
( $F_w \leq 10$  mm)



**NK** ( $F_w \geq 12$  mm)  
**NKS, RNA48, RNA49**  
**RNA69** ( $F_w \leq 35$  mm)

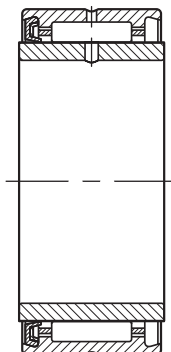


**RNA69**  
( $F_w \geq 40$  mm)

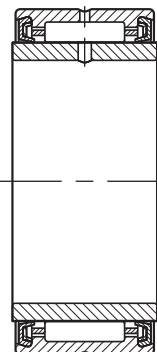


**Full Complement**

#### Sealed needle roller bearings with inner rings

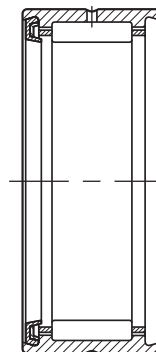


**NA49RS**

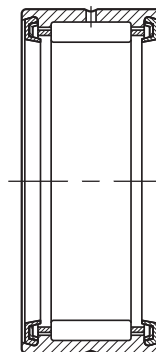


**NA49.2RS**

#### Sealed needle roller bearings without inner rings



**RNA49RS**



**RNA49.2RS**





# NEEDLE ROLLER BEARINGS

TABLE 1. A – FULL COMPLEMENT METRIC NEEDLE ROLLER COMPLEMENT BORE DIAMETER FOR BEARINGS WITHOUT INNER RINGS

mm		µm	
>	≤	low	high
F <sub>w</sub>		ΔF <sub>us</sub> min	
5	15	+20	+40
15	25	+20	+43
25	30	+25	+48
30	35	+30	+53
35	60	+35	+58
60	80	+45	+73
80	115	+50	+78
115	180	+60	+88
180	220	+70	+103
220	270	+80	+113
270	350	+90	+128

## METRIC SERIES NEEDLE ROLLER BEARINGS WITH INTEGRAL FLANGES

The Timken® Torrington® needle roller bearing has a one-piece channel-shaped outer ring of bearing quality steel, heat treated to yield maximum load rating. The integral end flanges provide axial location for the needle rollers. The bores of the end flanges serve as piloting surfaces for the cage.

A steel cage provides inward retention for the needle rollers and the design assures roller stability and minimizes friction between the cage and the needle rollers. The cage has maximum strength consistent with the inherent high load ratings of needle roller bearings.

Needle roller bearings of series NKJ, NKJS, NA48, and NA49 contain one needle roller and cage assembly, bearings of series NA69 with bearing bores of 32 mm and above have two needle roller and cage assemblies.

The outer ring has a lubricating groove and a lubricating hole for more convenient lubrication of the bearing. However, the smaller bearings of series NKJ and NK have not have a lubricating groove or a lubricating hole. (F<sub>w</sub> ≤ 10 mm)

## METRIC SERIES NEEDLE ROLLER BEARINGS WITH INSERTED END WASHERS

Some metric series needle roller bearings have inserted end washers to provide axial retention of the needle roller and cage assembly. The needle roller and cage radial assemblies, consistent with other Timken Torrington designs, provide inward and outward retention for the needle rollers.

## METRIC SERIES NEEDLE ROLLER BEARINGS WITHOUT FLANGES

The needle roller and cage radial assembly used in the metric series needle roller bearings without flanges is slightly narrower than the inner and outer rings to ensure unobstructed operation. Separate end washers are required to provide axial retention of the needle roller and cage radial assembly. Wide needle roller bearings using two needle roller and cage assemblies have a lubricating

groove and one lubricating hole in the outer ring to facilitate relubrication of the bearing. Narrow needle roller bearings do not have a lubricating groove or a lubricating hole in the outer ring.

## SEALED METRIC SERIES NEEDLE ROLLER BEARINGS OF DIMENSION SERIES 49

Needle roller bearings of Series 49 are available with one or two integral lip contact seals as listed on page C118. One seal is designated by suffix letters RS. Two seals are designated by .2RS. When combining sealed metric series needle roller bearings with inner rings it is suggested to use inner rings shown on page C340 with designation JRZ because they are wider than the outer rings to ensure positive seal contact.

These seals limit the bearing operating temperature between -30° C and 110° C. If the operating temperature must be outside the above range or if the seals are exposed to unusual fluids, external seals using suitable seal materials or other solutions should be investigated. Sealed bearings are normally packed with a high quality lithium soap base grease suitable up to 120° C for short periods of operation.

The limiting speeds specified for sealed bearings listed in the bearing tables are based on operating conditions determined by testing. Optimum performance may be expected providing the bearing is properly installed, with appropriate internal clearances, and be subjected to a load of low magnitude. Care should be taken that overheating will not occur, thus preventing breakdown of the grease and eventual bearing failure.

## METRIC SERIES FULL COMPLEMENT NEEDLE ROLLER BEARINGS

Series NA and RNA 1000, 2000, 22000 and 3000 are available with possible options of extra wide and/or crowned inner ring raceways. Consult your local Timken representative for application details.

## BEARING MOUNTING

### MOUNTING DIMENSIONS

It is suggested that needle roller bearings are mounted in their housings with a clearance fit if the load is stationary relative to the housing, or with a tight transition fit if the load rotates relative to the housing. Table 2 lists the suggested tolerances for the housing bore and the shaft raceway for metric series bearings without inner rings. Table 3 lists the suggested shaft tolerances for the above two mounting conditions when the metric series bearings are used with inner rings. The suggested housing bore tolerances for metric series bearings with inner rings is the same as the housing bore tolerance listed in Table 2 for metric series bearings without inner rings. Other quality requirements for shafts and housings are given in the engineering section of this catalog.

Other mounting dimensions may be required for special operating conditions such as:

1. Extremely heavy radial loads
2. Shock loads
3. Temperature gradient across bearing
4. Housing material with heat expansion coefficient different than that of the bearing
5. Oscillating motion applications

Regardless of the fit of the bearing outer ring in the housing, the outer ring should be axially located by housing shoulders or other positive means. The bearing rings should closely fit against the shaft and housing shoulders and must not contact the fillet radius. The maximum shaft or housing fillet  $r_{as\ max}$  should be no greater than the minimum bearing chamfer  $r_{s\ min}$  as shown in Table 4.

In order to permit mounting and dismounting of the shaft, the maximum diameter  $D_1$  in Table 5 must not be exceeded.  $F_w$  is shown in the bearing tables.

TABLE 2 – MOUNTING TOLERANCES FOR METRIC SERIES BEARINGS WITHOUT INNER RING

Rotation conditions	Nominal housing bore diameter D mm	ISO tolerance zone for housing		Nominal shaft diameter F mm	ISO tolerance zone for shaft	
		caged	full		caged	full
Load stationary relative to housing	all diameters	H7	J6	all diameters	h6	h5
General work with larger clearance	all diameters	K7	—	all diameters	g6	—
Load rotates relative to housing	all diameters	N7	M6	all diameters	f6	g5

NOTE: Care should be taken that the selected bearing internal clearance is appropriate for the operating conditions. Details of shaft and housing quality requirements are given in the engineering section of this catalog.

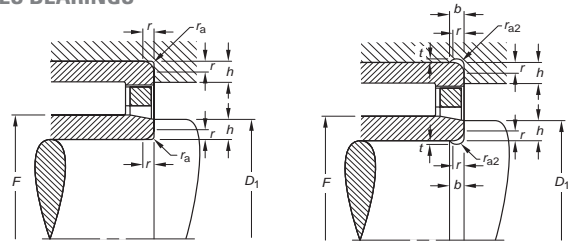
TABLE 3 – SHAFT TOLERANCES FOR METRIC SERIES BEARINGS WITH INNER RINGS (USE HOUSING TOLERANCE SHOWN IN TABLE 2)

Rotation conditions	Nominal shaft diameter d, mm		ISO tolerance zone for shaft	
	>	≤	caged	full
load rotates relative to housing	all diameters		g6	h5 (h6)
load stationary relative to housing	>	40	k6	k5
	40	100	M6	M5
	100	140	M6	M5
	140		n6	n6

NOTE: Care should be taken that the selected bearing internal clearance is appropriate for the operating conditions. Details of shaft and housing quality requirements are given in the engineering section of this catalog.

Needle roller bearings without flanges of series RNAO and NAO must have the needle roller and cage radial assembly properly end guided by shoulders as shown in Table 6, or other suitable means such as the spring steel washers (SNSH) shown on page C349. These end guiding surfaces should be hardened and precision turned or ground to minimize wear and should properly fit against the outer rings and the inner rings to provide the desired end clearance for the needle roller and cage assembly.

TABLE 4 – FILLETS, UNDERCUTS, AND SHOULDER HEIGHTS FOR METRIC SERIES BEARINGS



$r_s$ Min. mm	$r_{as}$ Max.	t	$r_{a2s}$ Min.	b	h Min.
0.15	0.15				0.6
0.3	0.3				1
0.6	0.6				2
1	1	0.2	1.3	2	2.5
1.1	1	0.3	2	3	3.25
1.5	1.5	0.4	2	3.2	4
2	2	0.5	2.5	4	5
2.1	2.1	0.5	3	4.7	5.5
3	2.5	0.5	3.5	5.3	6

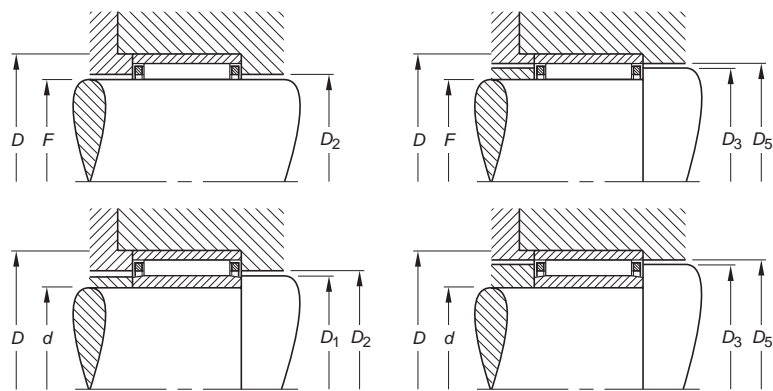
TABLE 5 – SHOULDER DIAMETER  $D_{1MAX}$  FOR METRIC SERIES BEARINGS

		Dimensions in mm				
Needle roller complement bore diameter $F_w$	>	20	55	100	250	
	≤	20	55	100	250	
Diameter	$D_{1max}$	$F_w - 0.3$	$F_w - 0.5$	$F_w - 0.7$	$F_w - 1$	$F_w - 1.5$



# NEEDLE ROLLER BEARINGS

**TABLE 6 –  
MOUNTING DIMENSIONS FOR  
METRIC SERIES NEEDLE ROLLER  
BEARINGS WITHOUT FLANGES**



**Guidance in the housing**

**Guidance on the shaft**

Dimensions mm	Bearing Series RNAO		
	Min.	Max.	Min.
FxD	D <sub>2</sub>	D <sub>3</sub>	D <sub>5</sub>
10x17	10.3	12.7	13.3
12x19	12.3	14.7	15.3
14x22	14.4	17.6	18.3
15x23	15.4	18.6	19.3
16x24	16.4	19.6	20.3
17x25	17.4	20.6	21.3
18x26	18.4	21.6	22.3
18x30	18.6	23.6	24.5
20x28	20.4	23.6	24.3
20x32	20.6	25.6	26.5
22x30	22.4	25.6	26.3
22x35	22.8	28.4	29.5
25x35	25.6	29.4	30.5
25x37	25.8	31.4	32.5
28x40	28.8	34.4	35.5
30x40	30.6	34.4	35.5
30x42	30.8	36.4	37.5
35x45	35.6	39.4	40.5
35x47	35.8	41.4	42.5
40x50	40.6	44.4	45.5
40x55	41	47.2	48.5
45x55	45.6	49.4	50.5
45x62	46	52.2	53.5
50x62	50.6	54.4	55.8
50x65	51	57.2	58.5
55x68	55.6	59.4	60.8
55x72	56	62.2	63.8
60x78	61	67.2	68.8
65x85	66	72.2	73.8
70x90	71	77.2	78.8
75x95	76	82.2	84
80x100	81	87.2	89
85x105	86	92.2	94
90x110	91	97.2	99
95x115	96	102.2	104
100x120	101	107.2	109

Dimensions mm	Bearing Series NAO			
	Max.	Min.	Max.	Min.
dxD	D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>	D <sub>5</sub>
6x17	9.7	10.3	12.7	13.3
8x19	11.7	12.3	14.7	15.3
10x22	13.7	14.4	17.6	18.3
10x26	13.7	14.6	19.6	20.3
12x24	15.7	16.4	19.6	20.3
12x28	15.7	16.6	21.6	22.3
15x28	19.5	20.4	23.6	24.3
15x32	19.5	20.6	25.6	26.5
17x30	21.5	22.4	25.6	26.3
17x35	21.5	22.8	28.4	29.5
20x35	24.5	25.6	29.4	30.5
20x37	24.5	25.8	31.4	32.5
25x40	29.5	30.6	34.4	35.5
25x42	29.5	30.8	36.4	37.5
30x45	34.5	35.6	39.4	40.5
30x47	34.5	35.8	41.4	42.5
35x50	39.5	40.6	44.4	45.5
35x55	39.5	41	47.2	48.5
40x55	44.5	45.6	49.4	50.5
40x62	44.5	46	52.2	53.5
45x62	49.5	50.6	54.4	55.8
45x72	54.5	56	62.2	63.8
50x68	54.5	55.6	59.4	60.8
50x78	59.3	61	67.2	68.8
55x85	64.3	66	72.2	73.8
60x90	69.3	71	77.2	78.8
65x95	74.3	76	82.2	84
70x100	79.3	81	87.2	89
75x105	84.3	86	92.2	94
80x110	89.3	91	97.2	99
85x115	94.3	96	102.2	104
90x120	99.3	101	107.2	109

## LOAD RATING FACTORS

### DYNAMIC LOADS

Needle roller bearings can accommodate only radial loads.

$$P = F_r \quad (\text{kN})$$

P = The maximum dynamic radial load that may be applied to a needle roller bearing based on the dynamic load rating C given in the tabular pages. This load should be  $\leq C/3$ .

### STATIC LOADS

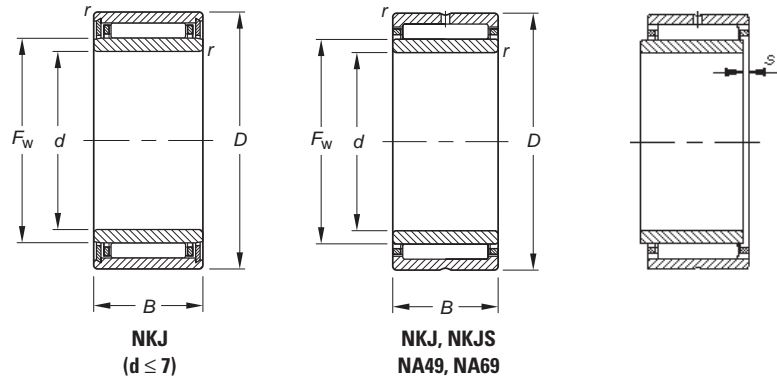
Needle roller bearings can accommodate only radial loads.

$$P_0 = F_r \quad (\text{kN})$$

### MOUNTING IN SETS

Needle roller bearings which are mounted side by side or must have the same cross-section and radial internal clearances, after mounting.

**NEEDLE ROLLER BEARINGS  
WITH INNER RINGS  
METRIC SERIES**



Shaft Diameter	Dimensions mm/in.						Bearing Designation	Load Ratings kN/lbf.		Limiting Speeds		Approx. Wt. kg/lbs.	
	d	D	B	F <sub>w</sub>	r <sub>s min</sub>	s <sup>1</sup>		Dynamic C	Static C <sub>0</sub>	Oil RPM	Grease RPM		C <sub>g</sub>
5	5	15	12	8	0.3	1.5	NKJ5/12	4.57	4.89	41000	26000	0.0148	0.014
	0.1969	0.5906	0.472	0.3150	0.012	0.059		1030	1100				
5	5	15	16	8	0.3	1.5	NKJ5/16	5.22	5.78	41000	26000	0.0154	0.017
	0.1969	0.5906	0.630	0.3150	0.012	0.059		1170	1300				
6	6	16	12	9	0.3	1.5	NKJ6/12	4.27	4.60	40000	26000	0.0153	0.015
	0.2362	0.6299	0.472	0.3543	0.012	0.059		960	1030				
6	6	16	16	9	0.3	1.5	NKJ6/16	5.57	6.47	40000	26000	0.0167	0.019
	0.2362	0.6299	0.630	0.3543	0.012	0.059		1250	1450				
7	7	17	12	11.5	0.3	1.5	NKJ7/12	5.40	6.43	39000	25000	0.0174	0.017
	0.2756	0.6693	0.472	0.4528	0.012	0.059		1210	1450				
7	7	17	16	11.5	0.3	1.5	NKJ7/16TN	5.30	6.27	39000	25000	0.0173	0.021
	0.2756	0.6693	0.630	0.4528	0.012	0.059		1190	1410				
9	9	19	12	12	0.3	1.5	NKJ9/12	6.86	7.60	30000	19000	0.0189	0.018
	0.3543	0.7480	0.472	0.4724	0.012	0.059		1540	1710				
9	9	19	16	12	0.3	1.5	NKJ9/16	6.78	9.03	30000	19000	0.0204	0.024
	0.3543	0.7480	0.630	0.4724	0.012	0.059		1520	2030				
10	10	22	13	14	0.3	1.0	NA4900	9.39	10.3	24000	16000	0.0211	0.025
	0.3937	0.8661	0.512	0.5512	0.012	0.039		2110	2320				
10	10	22	16	14	0.6	1.5	NKJ10/16	12.4	14.8	24000	16000	0.0231	0.032
	0.3937	0.8661	0.630	0.5512	0.024	0.059		2790	3330				
10	10	22	20	14	0.3	1.5	NKJ10/20	14.7	18.4	24000	16000	0.0244	0.040
	0.3937	0.8661	0.787	0.5512	0.012	0.059		3300	4140				
12	12	24	13	16	0.3	1.0	NA4901	10.5	12.0	28000	18000	0.0233	0.028
	0.4724	0.9449	0.512	0.6299	0.012	0.039		2360	2700				
12	12	24	16	16	0.3	1.5	NKJ12/16	13.0	16.2	28000	18000	0.0250	0.036
	0.4724	0.9449	0.630	0.6299	0.012	0.059		2920	3640				
12	12	24	20	16	0.3	1.5	NKJ12/20	15.4	20.2	28000	18000	0.0264	0.046
	0.4724	0.9449	0.787	0.6299	0.012	0.059		3460	4540				
12	12	24	22	16	0.3	1.0	NA6901	16.1	21.3	28000	18000	0.0267	0.051
	0.4724	0.9449	0.866	0.6299	0.012	0.039		3620	4790				
15	15	27	16	19	0.3	1.5	NKJ15/16	14.1	19.0	24000	15000	0.0279	0.042
	0.5906	1.0630	0.630	0.7480	0.012	0.059		3170	4270				
15	15	27	20	19	0.3	1.5	NKJ15/20	16.8	23.6	24000	15000	0.0295	0.054
	0.5906	1.0630	0.787	0.7480	0.012	0.059		3780	5310				
15	15	28	13	20	0.3	1.0	NA4902	11.8	15.3	22000	14000	0.0270	0.037
	0.5906	1.1024	0.512	0.7874	0.012	0.039		2650	3440				
15	15	28	23	20	0.3	1.5	NA6902	18.4	26.9	22000	14000	0.0311	0.067
	0.5906	1.1024	0.906	0.7874	0.012	0.059		4140	6050				
17	17	29	16	21	0.3	2.0	NKJ17/16	15.3	21.6	21000	14000	0.0301	0.047
	0.6693	1.1417	0.630	0.8268	0.012	0.079		3440	4860				
17	17	29	20	21	0.3	1.5	NKJ17/20	18.1	23.9	21000	14000	0.0317	0.059
	0.6693	1.1417	0.787	0.8268	0.012	0.059		4070	5370				
17	17	30	13	22	0.3	1.0	NA4903	12.2	16.4	20000	13000	0.0286	0.040
	0.6693	1.1811	0.512	0.8661	0.012	0.039		2740	3690				

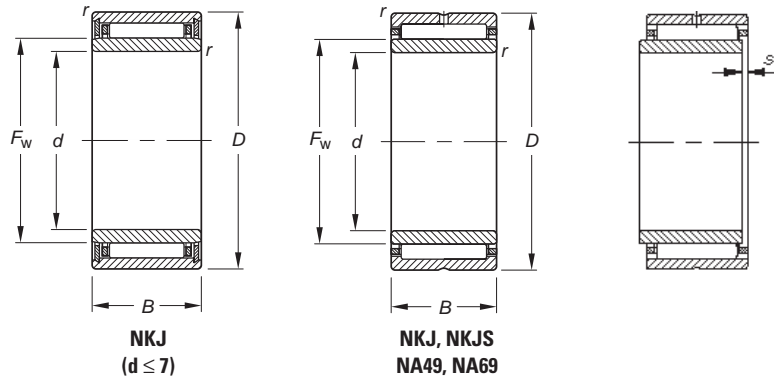
<sup>(1)</sup> Max. axial displacement

Continued on next page.



# NEEDLE ROLLER BEARINGS

## NEEDLE ROLLER BEARINGS WITH INNER RINGS – *continued* METRIC SERIES



Shaft Diameter	Dimensions mm/in.						Bearing Designation	Load Ratings kN/lbf.		Limiting Speeds		Approx. Wt. kg/lbs.	
	mm	d	D	B	F <sub>w</sub>	r <sub>s</sub> min		s <sup>1</sup>	Dynamic C	Static C <sub>0</sub>	Oil Grease RPM		C <sub>g</sub>
	17	30	23	22	0.6	1.0	NA6903	19.8	30.6	20000	13000	0.0334	0.084
	0.6693	1.1811	0.906	0.8661	0.024	0.039		4450	6880			0.185	
	17	37	20	24	0.6	1.0	NKJS17	29.1	32.8	20000	13000	0.0325	0.108
	0.6693	1.4567	0.787	0.9449	0.024	0.039		6540	7370			0.238	
20	20	32	16	24	0.3	1.5	NKJ20/16	16.2	24.3	18000	12000	0.0328	0.053
	0.7874	1.2598	0.630	0.9449	0.012	0.059		3640	5460			0.117	
	20	32	20	24	0.3	1.5	NKJ20/20	19.3	30.3	18000	12000	0.0346	0.067
	0.7874	1.2598	0.787	0.9449	0.012	0.059		4340	6810			0.148	
	20	37	17	25	0.3	1.5	NA4904	21.3	25.5	18000	12000	0.0318	0.084
	0.7874	1.4567	0.669	0.9843	0.012	0.059		4790	5730			0.185	
	20	37	30	25	0.3	1.5	NA6904	36.6	51.0	18000	12000	0.0378	0.133
	0.7874	1.4567	1.181	0.9843	0.012	0.059		8230	11500			0.293	
	20	42	20	28	0.6	1.0	NKJS20	30.3	38.4	16000	11000	0.0364	0.130
	0.7874	1.6535	0.787	1.1024	0.024	0.039		6810	8630			0.287	
22	22	34	16	26	0.3	1.5	NKJ22/16	16.6	25.7	17000	11000	0.0344	0.058
	0.8661	1.3386	0.630	1.0236	0.012	0.059		3730	5780			0.128	
	22	34	20	26	0.3	2.0	NKJ22/20	19.7	32.0	17000	11000	0.0363	0.071
	0.8661	1.3386	0.787	1.0236	0.012	0.079		4430	7190			0.157	
	22	39	17	28	0.3	1.5	NA49/22	23.3	29.6	16000	10000	0.0346	0.089
	0.8661	1.5354	0.669	1.1024	0.012	0.059		5240	6650			0.196	
	22	39	30	28	0.3	1.0	NA69/22	30.6	50.7	16000	10000	0.0487	0.163
	0.8661	1.5354	1.181	1.1024	0.012	0.039		6880	11400			0.359	
25	25	38	20	29	0.3	2.0	NKJ25/20	23.4	36.4	15000	9800	0.0383	0.086
	0.9843	1.4961	0.787	1.1417	0.012	0.079		5260	8180			0.190	
	25	38	30	29	0.3	2.0	NKJ25/30	29.8	56.4	15000	9800	0.0438	0.130
	0.9843	1.4961	1.181	1.1417	0.012	0.079		6700	12700			0.287	
	25	42	17	30	0.3	1.5	NA4905	24.3	31.7	15000	9700	0.0362	0.099
	0.9843	1.6535	0.669	1.1811	0.012	0.059		5460	7130			0.218	
	25	42	30	30	0.3	1.5	NA6905	39.7	59.6	15000	9700	0.0424	0.178
	0.9843	1.6535	1.181	1.1811	0.012	0.059		8920	13400			0.392	
	25	47	22	32	0.6	1.5	NKJS25	36.0	36.2	14000	9200	0.0398	0.174
	0.9843	1.8504	0.866	1.2598	0.024	0.059		8090	8140			0.384	
28	28	42	20	32	0.3	2.0	NKJ28/20	24.8	40.4	14000	8800	0.0411	0.104
	1.1024	1.6535	0.787	1.2598	0.012	0.079		5580	9080			0.229	
	28	42	30	32	0.3	2.0	NKJ28/30	35.6	64.3	14000	8800	0.0461	0.156
	1.1024	1.6535	1.181	1.2598	0.012	0.079		8000	14500			0.344	
	28	45	17	32	0.3	1.5	NA49/28	25.1	33.8	14000	9000	0.0378	0.108
	1.1024	1.7717	0.669	1.2598	0.012	0.059		5640	7600			0.238	
	28	45	30	32	0.3	1.5	NA69/28	37.1	55.4	14000	9000	0.0434	0.190
	1.1024	1.7717	1.181	1.2598	0.012	0.059		8340	12500			0.419	
30	30	45	20	35	0.3	1.5	NKJ30/20	26.1	44.4	12000	8000	0.0437	0.120
	1.1811	1.7717	0.787	1.3780	0.012	0.059		5870	9980			0.265	
	30	45	30	35	0.3	1.5	NKJ30/30	37.4	70.6	12000	8000	0.0491	0.179
	1.1811	1.7717	1.181	1.3780	0.012	0.059		8410	15900			0.395	

<sup>(1)</sup> Max. axial displacement

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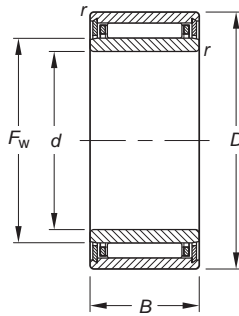
Shaft Diameter	Dimensions mm/in.						Bearing Designation	Load Ratings kN/lbf.		Limiting Speeds		Approx. Wt. kg/lbs.	
	mm	d	D	B	F <sub>w</sub>	r <sub>s</sub> min		s <sup>1</sup>	Dynamic C	Static C <sub>0</sub>	Oil RPM		Grease RPM
30	30	47	17	35	0.3	1.5	NA4906	25.9	36.0	13000	8200	0.0399	0.114
	1.1811	1.8504	0.669	1.3780	0.012	0.059		5820	8090			0.251	
30	30	47	30	35	0.3	1.0	NA6906	42.6	68.2	13000	8200	0.0467	0.205
	1.1811	1.8504	1.181	1.3780	0.012	0.039		9580	15300			0.452	
30	30	52	22	37	0.6	1.5	NKJS30	39.0	53.4	12000	7900	0.0438	0.198
	1.1811	2.0472	0.866	1.4567	0.024	0.059		8770	12000			0.437	
32	32	47	20	37	0.3	2.0	NKJ32/20	26.6	46.4	12000	7600	0.0453	0.127
	1.2598	1.8504	0.787	1.4567	0.012	0.079		5980	10400			0.280	
32	32	47	30	37	0.3	1.5	NKJ32/30	38.2	73.9	12000	7600	0.0508	0.192
	1.2598	1.8504	1.181	1.4567	0.012	0.059		8590	16600			0.423	
32	32	52	20	40	0.6	1.5	NA49/32	32.0	49.3	11000	7100	0.0457	0.169
	1.2598	2.0472	0.787	1.5748	0.024	0.059		7190	11100			0.373	
32	32	52	36	40	0.6	1.0	NA69/32	48.6	84.5	11000	7100	0.0620	0.313
	1.2598	2.0472	1.417	1.5748	0.024	0.039		10900	19000			0.690	
35	35	50	20	40	0.3	2.0	NKJ35/20	27.8	50.4	11000	7000	0.0479	0.135
	1.3780	1.9685	0.787	1.5748	0.012	0.079		6250	11300			0.298	
35	35	50	30	40	0.3	1.5	NKJ35/30	40.0	80.2	11000	7000	0.0537	0.208
	1.3780	1.9685	1.181	1.5748	0.012	0.059		8990	18000			0.459	
35	35	55	20	42	0.6	1.5	NA4907	32.8	51.7	10000	6700	0.0472	0.179
	1.3780	2.1654	0.787	1.6535	0.024	0.059		7370	11600			0.395	
35	35	55	36	42	0.6	1.0	NA6907	49.9	88.7	10000	6700	0.0540	0.340
	1.3780	2.1654	1.417	1.6535	0.024	0.039		11200	19900			0.750	
35	35	58	22	43	0.6	1.0	NKJS35	41.6	60.7	10000	6700	0.0481	0.235
	1.3780	2.2835	0.866	1.6929	0.024	0.039		9350	13600			0.518	
38	38	53	20	43	0.3	2.0	NKJ38/20	29.0	54.4	9900	6400	0.0504	0.146
	1.4961	2.0866	0.787	1.6929	0.012	0.079		6520	12200			0.322	
38	38	53	30	43	0.3	1.5	NKJ38/30	41.6	86.6	9900	6400	0.0565	0.196
	1.4961	2.0866	1.181	1.6929	0.012	0.059		9350	19500			0.432	
40	40	55	20	45	0.3	2.0	NKJ40/20	29.5	56.4	9400	6100	0.0519	0.152
	1.5748	2.1654	0.787	1.7717	0.012	0.079		6630	12700			0.335	
40	40	55	30	45	0.3	1.5	NKJ40/30	42.3	89.8	9400	6100	0.0582	0.229
	1.5748	2.1654	1.181	1.7717	0.012	0.059		9510	20200			0.505	
40	40	62	22	48	0.6	1.5	NA4908	44.2	67.8	9100	5900	0.0519	0.248
	1.5748	2.4409	0.866	1.8898	0.024	0.059		9940	15200			0.547	
40	40	62	40	48	0.6	1.5	NA6908	70.8	124	9100	5900	0.0717	0.473
	1.5748	2.4409	1.575	1.8898	0.024	0.059		15900	27900			1.043	
40	40	65	22	50	1.0	1.0	NKJS40	45.5	71.3	8700	5700	0.0535	0.292
	1.5748	2.5591	0.866	1.9685	0.039	0.039		10200	16000			0.644	
42	42	57	20	47	0.3	2.0	NKJ42/20	30.0	58.5	9000	5900	0.0534	0.159
	1.6535	2.2441	0.787	1.8504	0.012	0.079		6740	13200			0.351	
42	42	57	30	47	0.3	1.5	NKJ42/30	39.9	84.1	9000	5900	0.0584	0.241
	1.6535	2.2441	1.181	1.8504	0.012	0.059		8970	18900			0.531	
45	45	62	25	50	0.6	3.0	NKJ45/25	40.7	79.3	8500	5500	0.0580	0.223
	1.7717	2.4409	0.984	1.9685	0.024	0.118		9150	17800			0.492	
45	45	62	35	50	0.6	3.0	NKJ45/35	55.0	117	8500	5500	0.0636	0.345
	1.7717	2.4409	1.378	1.9685	0.024	0.118		12400	26300			0.761	
45	45	68	22	52	0.6	2.0	NA4909	46.8	74.8	8400	5400	0.0550	0.291
	1.7717	2.6772	0.866	2.0472	0.024	0.079		10500	16800			0.642	
45	45	68	40	52	0.6	1.5	NA6909	74.7	137	8400	5400	0.0759	0.55
	1.7717	2.6772	1.575	2.0472	0.024	0.059		16800	30800			1.232	
45	45	72	22	55	1.0	1.0	NKJS45	47.9	78.4	7900	5100	0.0571	0.360
	1.7717	2.8346	0.866	2.1654	0.039	0.039		10800	17600			0.794	
50	50	68	25	55	0.6	3.0	NKJ50/25	46.1	87.3	7800	5000	0.0605	0.288
	1.9685	2.6772	0.984	2.1654	0.024	0.118		10400	19600			0.635	
50	50	68	35	55	0.6	3.0	NKJ50/35	62.3	129	7800	5000	0.0667	0.406
	1.9685	2.6772	1.378	2.1654	0.024	0.118		14000	29000			0.895	
50	50	72	22	58	0.6	2.0	NA4910	48.9	82.0	7400	4800	0.0591	0.296
	1.9685	2.8346	0.866	2.2835	0.024	0.079		11000	18400			0.653	

<sup>(1)</sup> Max. axial displacement

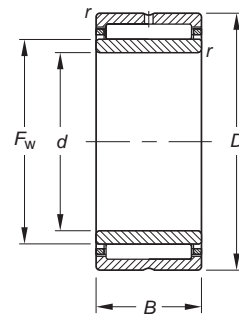
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## NEEDLE ROLLER BEARINGS WITH INNER RINGS — *continued* METRIC SERIES



**NKJ**  
( $d \leq 7$ )



**NKJ, NKJS**  
**NA49, NA69**



Shaft Diameter	Dimensions mm/in.						Bearing Designation	Load Ratings kN/lbf.		Limiting Speeds		Approx. Wt. kg/lbs.	
	mm	d	D	B	F <sub>w</sub>	r <sub>s</sub> min		s <sup>1</sup>	Dynamic C	Static C <sub>0</sub>	Oil Grease RPM		C <sub>g</sub>
	50	72	40	58	0.6	1.5	NA6910	75.7	144	7400	4800	0.0806	0.577
	1.9685	2.8346	1.575	2.2835	0.024	0.059		17000	32400				
	50	80	28	60	1.1	1.5	NKJS50	66.9	103	7300	4800	0.0612	0.523
	1.9685	3.1496	1.102	2.3622	0.043	0.059		15000	23200				
55	55	72	25	60	0.6	3.0	NKJ55/25	44.3	94.0	7000	4600	0.0654	0.290
	2.1654	2.8346	0.984	2.3622	0.024	0.118		9960	21100				
	55	72	35	60	0.6	3.0	NKJ55/35	59.9	139	7000	4600	0.0721	0.410
	2.1654	2.8346	1.378	2.3622	0.024	0.118		13500	31200				
	55	80	25	63	1.0	2.5	NA4911	62.0	107	6900	4500	0.0645	0.426
	2.1654	3.1496	0.984	2.4803	0.039	0.098		13900	24100				
	55	80	45	63	1.0	2.5	NA6911	94.2	172	6900	4500	0.0852	0.800
	2.1654	3.1496	1.772	2.4803	0.039	0.098		21200	38700				
	55	85	28	65	1.1	1.5	NKJS55	71.0	114	6700	4400	0.0650	0.569
	2.1654	3.3465	1.102	2.5591	0.043	0.059		16000	25600				
60	60	82	25	68	0.6	2.0	NKJ60/25	49.0	101	6200	4000	0.0691	0.440
	2.3622	3.2283	0.984	2.6772	0.024	0.079		11000	22700				
	60	82	35	68	0.6	2.5	NKJ60/35	66.2	149	6200	4000	0.0760	0.520
	2.3622	3.2283	1.378	2.6772	0.024	0.098		14900	33500				
	60	85	25	68	1.0	1.5	NA4912	64.8	116	6300	4100	0.0681	0.457
	2.3622	3.3465	0.984	2.6772	0.039	0.059		14600	26100				
	60	85	45	68	1.0	2.0	NA6912	99.3	189	6400	4100	0.0901	0.829
	2.3622	3.3465	1.772	2.6772	0.039	0.079		22300	42500				
	60	90	28	70	1.1	1.5	NKJS60	72.6	120	6200	4000	0.0679	0.607
	2.3622	3.5433	1.102	2.7559	0.043	0.059		16300	27000				
65	65	90	25	72	1.0	1.5	NA4913	66.0	121	5900	3900	0.0705	0.489
	2.5591	3.5433	0.984	2.8346	0.039	0.059		14800	27200				
	65	90	25	73	0.6	2.0	NKJ65/25	61.5	119	5800	3800	0.0717	0.500
	2.5591	3.5433	0.984	2.8740	0.024	0.079		13800	26800				
	65	90	35	73	0.6	2.0	NKJ65/35	82.5	173	5800	3800	0.0787	0.690
	2.5591	3.5433	1.378	2.8740	0.024	0.079		18500	38900				
	65	90	45	72	1.0	2.0	NA6913	107	213	6000	3900	0.0952	0.945
	2.5591	3.5433	1.772	2.8346	0.039	0.079		24100	47900				
	65	95	28	75	1.1	1.5	NKJS65	76.5	132	5800	3700	0.0716	0.655
	2.5591	3.7402	1.102	2.9528	0.043	0.059		17200	29700				
70	70	95	25	80	1.0	2.0	NKJ70/25	65.0	131	5300	3400	0.0766	0.561
	2.7559	3.7402	0.984	3.1496	0.039	0.079		14600	29400				
	70	95	35	80	1.0	3.5	NKJ70/35	79.7	184	5300	3400	0.0846	0.779
	2.7559	3.7402	1.378	3.1496	0.039	0.138		17900	41400				
	70	100	28	80	1.1	1.5	NKJS70	80.1	143	5400	3500	0.0752	0.772
	2.7559	3.9370	1.102	3.1496	0.043	0.059		18000	32100				
	70	100	30	80	1.0	2.5	NA4914	86.3	157	5400	3500	0.0770	0.772
	2.7559	3.9370	1.181	3.1496	0.039	0.098		19400	35300				
	70	100	54	80	1.0	2.0	NA6914	137	286	5400	3500	0.1061	1.450
	2.7559	3.9370	2.126	3.1496	0.039	0.079		30800	64300				

<sup>(1)</sup> Max. axial displacement

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Shaft Diameter	Dimensions mm/in.						Bearing Designation	Load Ratings kN/lbf.		Limiting Speeds		Approx. Wt. kg/lbs.	
	mm	d	D	B	F <sub>w</sub>	r <sub>s min</sub>		s <sup>1</sup>	Dynamic C	Static C <sub>0</sub>	Oil RPM		Grease RPM
75	75	105	25	85	1.0	2.0	NKJ75/25	76.4	137	5000	3300	0.0764	0.640
	2.9528	4.1339	0.984	3.3465	0.039	0.079		17200	30800				1.411
75	75	105	30	85	1.0	2.5	NA4915	92.4	175	5000	3300	0.0812	0.817
	2.9528	4.1339	1.181	3.3465	0.039	0.098		20800	39300				1.801
75	75	105	32	90	1.1	1.5	NKJS75	91.5	176	4700	3100	0.0834	1.060
	2.9528	4.1339	1.260	3.5433	0.043	0.059		20600	39600				2.337
75	75	105	35	85	1.0	2.0	NKJ75/35	108	214	5000	3300	0.0854	1.050
	2.9528	4.1339	1.378	3.3465	0.039	0.079		24300	48100				2.315
75	75	105	54	85	1.0	2.0	NA6915	143	308	5000	3300	0.1110	1.554
	2.9528	4.1339	2.126	3.3465	0.039	0.079		32100	69200				3.426
80	80	110	25	90	1.0	2.0	NKJ80/25	79.5	147	4700	3100	0.0798	0.790
	3.1496	4.3307	0.984	3.5433	0.039	0.079		17900	33000				1.742
80	80	110	30	90	1.0	2.5	NA4916	91.5	176	4700	3100	0.0834	0.862
	3.1496	4.3307	1.181	3.5433	0.039	0.098		20600	39600				1.900
80	80	110	32	95	1.1	2.0	NKJS80	95.1	188	4500	2900	0.0869	1.140
	3.1496	4.3307	1.260	3.7402	0.043	0.079		21400	42300				2.513
80	80	110	35	90	1.0	2.0	NKJ80/35	113	230	4700	3100	0.0891	0.980
	3.1496	4.3307	1.378	3.5433	0.039	0.079		25400	51700				2.161
80	80	110	54	90	1.0	2.0	NA6916	126	320	4700	3000	0.1197	1.615
	3.1496	4.3307	2.126	3.5433	0.039	0.079		28300	71900				3.560
85	85	115	26	95	1.0	3.0	NKJ85/26	49.3	114	4400	2800	0.0839	0.862
	3.3465	4.5276	1.024	3.7402	0.039	0.118		11100	25600				1.900
85	85	115	36	95	1.0	2.0	NKJ85/36	114	238	4400	2800	0.0921	1.040
	3.3465	4.5276	1.417	3.7402	0.039	0.079		25600	53500				2.293
85	85	120	30	100	1.1	2.5	NA4917	110	230	4200	2800	0.0935	1.310
	3.3465	4.7244	1.181	3.9370	0.043	0.098		24700	51700				2.888
85	85	120	63	100	1.1	2.0	NA6917	150	416	4200	2700	0.1340	2.427
	3.3465	4.7244	2.480	3.9370	0.043	0.079		33700	93500				5.351
90	90	120	26	100	1.0	3.0	NKJ90/26	83.6	163	4200	2800	0.0857	0.780
	3.5433	4.7244	1.024	3.9370	0.039	0.118		18800	36600				1.720
90	90	120	36	100	1.0	2.5	NKJ90/36	118	254	4200	2800	0.0958	1.080
	3.5433	4.7244	1.417	3.9370	0.039	0.098		26500	57100				2.381
90	90	125	35	105	1.1	2.5	NA4918	114	245	4000	2600	0.0970	1.370
	3.5433	4.9213	1.378	4.1339	0.043	0.098		25600	55100				3.020
90	90	125	63	105	1.1	2.0	NA6918	175	427	4000	2600	0.1323	2.640
	3.5433	4.9213	2.480	4.1339	0.043	0.079		39300	96000				5.820
95	95	125	26	105	1.0	2.5	NKJ95/26	52.2	127	3900	2600	0.0892	0.935
	3.7402	4.9213	1.024	4.1339	0.039	0.098		11700	28600				2.061
95	95	125	36	105	1.0	3.5	NKJ95/36	72.8	195	3900	2600	0.0992	1.300
	3.7402	4.9213	1.417	4.1339	0.039	0.138		16400	43800				2.866
95	95	130	35	110	1.1	2.5	NA4919	115	253	3800	2500	0.0999	1.430
	3.7402	5.1181	1.378	4.3307	0.043	0.098		25900	56900				3.153
95	95	130	63	110	1.1	2.0	NA6919	158	458	3800	2500	0.1434	2.670
	3.7402	5.1181	2.480	4.3307	0.043	0.079		35500	103000				5.88
100	100	130	30	110	1.1	2.0	NKJ100/30	103	220	3800	2500	0.0965	0.984
	3.9370	5.1181	1.181	4.3307	0.043	0.079		23200	49500				2.169
100	100	130	40	110	1.1	2.0	NKJ100/40	132	301	3800	2500	0.1043	1.410
	3.9370	5.1181	1.575	4.3307	0.043	0.079		29700	67700				3.109
100	100	135	32	115	1.1	2.0	NKJS100	104	226	3700	2400	0.0991	2.010
	3.9370	5.3150	1.260	4.5276	0.043	0.079		23400	50800				4.431
100	100	140	40	115	1.1	3.5	NA4920	139	296	3700	2400	0.1037	2.010
	3.9370	5.5118	1.575	4.5276	0.043	0.138		31200	66500				4.431
110	110	140	30	120	1.0	0.5	NA4822	90.3	230	3500	2300	0.1059	1.210
	4.3307	5.5118	1.181	4.7244	0.039	0.020		20300	51700				2.668
110	110	150	40	125	1.1	3.5	NA4922	147	325	3400	2200	0.1101	2.190
	4.3307	5.9055	1.575	4.9213	0.043	0.138		33000	73100				4.828
120	120	150	30	130	1.0	0.5	NA4824	94.2	249	3200	2100	0.1121	1.310
	4.7244	5.9055	1.181	5.1181	0.039	0.020		21200	56000				2.888

<sup>(1)</sup> Max. axial displacement

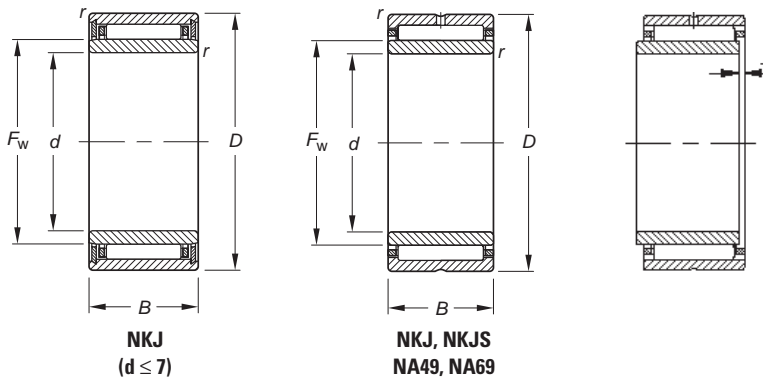
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# NEEDLE ROLLER BEARINGS

## NEEDLE ROLLER BEARINGS WITH INNER RINGS – *continued*

### METRIC SERIES

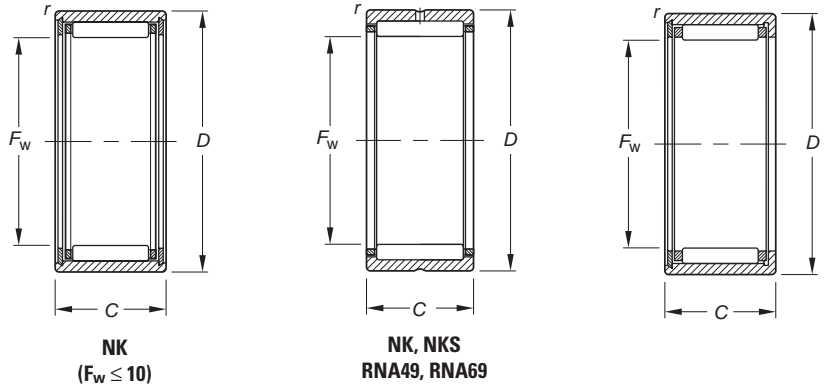


C

Shaft Diameter	Dimensions mm/in.						Bearing Designation	Load Ratings kN/lbf.		Limiting Speeds		Approx. Wt. kg/lbs.	
	mm	d	D	B	F <sub>w</sub>	r <sub>s min</sub>		s <sup>1</sup>	Dynamic C	Static C <sub>0</sub>	Oil Grease RPM		C <sub>g</sub>
120	120	165	45	135	1.1	3.5	NA4924	177	407	3100	2000	0.1193	3.040
	4.7244	6.4961	1.772	5.3150	0.043	0.138		39800	91500				6.702
130	130	165	35	145	1.1	1.0	NA4826	112	323	2900	1900	0.1258	1.990
	5.1181	6.4961	1.378	5.7087	0.043	0.039		25200	72600				4.387
130	130	180	45	150	1.5	3.0	NA4926	201	495	2800	1800	0.1314	4.140
	5.1181	7.0866	1.772	5.9055	0.059	0.118		45200	111000				9.127
140	140	175	35	155	1.1	1.0	NA4828	116	346	2700	1700	0.1320	2.120
	5.5118	6.8898	1.378	6.1024	0.043	0.039		26100	77800				4.674
140	140	190	50	160	1.5	3.0	NA4928	214	549	2600	1700	0.1389	4.410
	5.5118	7.4803	1.969	6.2992	0.059	0.118		48100	123000				9.72
150	150	190	40	165	1.1	2.0	NA4830	142	402	2500	1600	0.1367	2.700
	5.9055	7.4803	1.575	6.4961	0.043	0.079		31900	90400				5.952
160	160	200	40	175	1.1	2.0	NA4832	146	425	2400	1500	0.1425	3.150
	6.2992	7.8740	1.575	6.8898	0.043	0.079		32800	95500				6.944

<sup>(1)</sup> Max. axial displacement

**NEEDLE ROLLER BEARINGS  
WITHOUT INNER RINGS** — *continued*  
**METRIC SERIES**



Shaft Diameter	Dimensions mm/in.				Bearing Designation	Load Ratings kN/lbf.		Limiting Speeds		Approx. Wt. kg/lbs.	
	F <sub>w</sub>	D	C	r <sub>s min</sub>		Dynamic	Static	Oil	Grease		
mm	F <sub>w</sub>	D	C	r <sub>s min</sub>		C	C <sub>0</sub>	RPM		C <sub>g</sub>	
5	5	10	10	0.2	NK5/10TN	2.18	1.71	47000	31000	0.0095	0.004
	0.1969	0.3937	0.394	0.006		490	384				
5	5	10	12	0.2	NK5/12TN	3.04	2.63	47000	31000	0.0106	0.004
	0.1969	0.3937	0.472	0.006		683	591				
6	6	12	10	0.2	NK6/10	3.19	2.90	44000	29000	0.0116	0.005
	0.2362	0.4724	0.394	0.006		717	652				
6	6	12	12	0.2	NK6/12TN	3.07	2.74	44000	29000	0.0115	0.006
	0.2362	0.4724	0.472	0.006		690	616				
7	7	14	10	0.3	NK7/10TN	2.74	2.44	42000	28000	0.0118	0.007
	0.2756	0.5512	0.394	0.012		616	549				
7	7	14	12	0.3	NK7/12TN	3.40	3.22	42000	28000	0.0127	0.009
	0.2756	0.5512	0.472	0.012		764	724				
8	8	15	12	0.3	NK8/12	4.57	4.89	41000	26000	0.0148	0.011
	0.3150	0.5906	0.472	0.012		1030	1100				
8	8	15	12	0.3	NK8/12ASR1	4.57	4.89	41000	26000	0.0148	0.011
	0.3150	0.5906	0.472	0.012		1030	1100				
8	8	15	16	0.3	NK8/16	5.22	5.78	41000	26000	0.0154	0.013
	0.3150	0.5906	0.630	0.012		1170	1300				
9	9	16	12	0.3	NK9/12	4.27	4.60	40000	26000	0.0153	0.012
	0.3543	0.6299	0.472	0.012		960	1030				
9	9	16	16	0.3	NK9/16	5.57	6.47	40000	26000	0.0170	0.015
	0.3543	0.6299	0.630	0.012		1250	1450				
10	10	17	12	0.3	NK10/12	5.40	6.43	39000	25000	0.0174	0.013
	0.3937	0.6693	0.472	0.012		1210	1450				
10	10	17	16	0.3	NK10/16TN	5.30	6.27	39000	25000	0.0173	0.015
	0.3937	0.6693	0.630	0.012		1190	1410				
12	12	19	12	0.3	NK12/12	6.86	7.60	30000	19000	0.0195	0.013
	0.4724	0.7480	0.472	0.012		1540	1710				
12	12	19	12	0.3	NK12/16	6.78	9.03	37000	24000	0.0204	0.018
	0.4724	0.7480	0.472	0.012		1520	2030				
14	14	22	13	0.3	RNA4900	9.39	10.3	24000	16000	0.0211	0.018
	0.5512	0.8661	0.512	0.012		2110	2320				
14	14	22	16	0.3	NK14/16	12.4	14.8	24000	16000	0.0231	0.023
	0.5512	0.8661	0.630	0.012		2790	3330				
14	14	22	20	0.3	NK14/20	14.7	18.4	24000	16000	0.0244	0.028
	0.5512	0.8661	0.787	0.012		3300	4140				
15	15	23	16	0.3	NK15/16	12.4	15.0	24000	15000	0.0238	0.024
	0.5906	0.9055	0.630	0.012		2790	3370				
15	15	23	20	0.3	NK15/20	14.7	18.6	24000	15000	0.0252	0.031
	0.5906	0.9055	0.787	0.012		3300	4180				
16	16	24	13	0.3	RNA4901	10.5	12.3	28000	18000	0.0233	0.020
	0.6299	0.9449	0.512	0.012		2360	2770				
16	16	24	16	0.3	NK16/16	15.4	20.2	28000	18000	0.0250	0.025
	0.6299	0.9449	0.630	0.012		3460	4540				

(1) Max. axial displacement

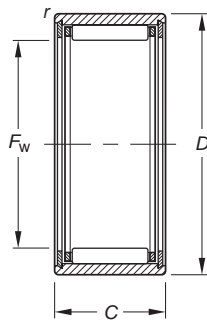
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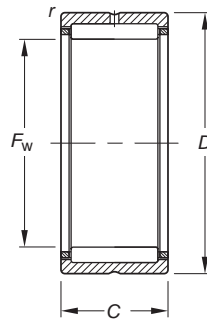
# NEEDLE ROLLER BEARINGS

## NEEDLE ROLLER BEARINGS WITHOUT INNER RINGS — *continued*

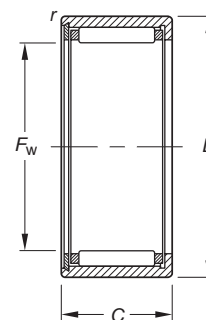
### METRIC SERIES



**NK**  
( $F_w \leq 10$ )



**NK, NKS**  
RNA49, RNA69



**NKTN**

Shaft Diameter	Dimensions mm/in.				Bearing Designation	Load Ratings kN/lbf.		Limiting Speeds		Approx. Wt. kg/lbs.	
	$F_w$	D	C	$r_s$ min		C	$C_0$	Oil	Grease		
mm	$F_w$	D	C	$r_s$ min			RPM		$C_g$		
16	16	24	20	0.3	NK16/20	16.1	21.3	28000	18000	0.0264	0.036
	0.6299	0.9449	0.787	0.012		3620	4790				
16	16	24	22	0.3	RNA6901	16.1	21.3	28000	18000	0.0267	0.036
	0.6299	0.9449	0.866	0.012		3620	4790				
17	17	25	16	0.3	NK17/16	13.6	17.5	27000	17000	0.0261	0.027
	0.6693	0.9843	0.630	0.012		3060	3930				
17	17	25	20	0.3	NK17/20	15.4	20.4	27000	17000	0.0271	0.034
	0.6693	0.9843	0.787	0.012		3460	4590				
18	18	26	16	0.3	NK18/16	13.6	17.7	25000	16000	0.0268	0.028
	0.7087	1.0236	0.630	0.012		3060	3980				
18	18	26	20	0.3	NK18/20	16.1	22.0	25000	16000	0.0283	0.035
	0.7087	1.0236	0.787	0.012		3620	4950				
19	19	27	16	0.3	NK19/16	14.1	19.0	24000	15000	0.0279	0.029
	0.7480	1.0630	0.630	0.012		3170	4270				
19	19	27	20	0.3	NK19/20	18.8	23.6	24000	15000	0.0295	0.037
	0.7480	1.0630	0.787	0.012		4230	5310				
19	19	30	16	0.3	NKS18	15.9	16.2	26000	17000	0.0255	0.045
	0.7480	1.1811	0.630	0.012		3570	3640				
20	20	28	13	0.3	RNA4902	11.8	15.3	22000	14000	0.0270	0.023
	0.7874	1.1024	0.512	0.012		2650	3440				
20	20	28	16	0.3	NK20/16	14.1	19.1	22000	14000	0.0285	0.030
	0.7874	1.1024	0.630	0.012		3170	4290				
20	20	28	20	0.3	NK20/20	17.5	25.3	22000	14000	0.0306	0.038
	0.7874	1.1024	0.787	0.012		3930	5690				
20	20	28	23	0.3	RNA6902	18.4	26.9	22000	14000	0.0311	0.042
	0.7874	1.1024	0.906	0.012		4140	6050				
20	20	32	20	0.6	NKS20	24.4	26.7	24000	15000	0.0290	0.058
	0.7874	1.2598	0.787	0.024		5490	6000				
21	21	29	16	0.3	NK21/16	15.3	21.6	21000	14000	0.0301	0.032
	0.8268	1.1417	0.630	0.012		3440	4860				
21	21	29	20	0.3	NK21/20	18.1	26.9	21000	14000	0.0317	0.040
	0.8268	1.1417	0.787	0.012		4070	6050				
22	22	30	13	0.3	RNA4903	12.2	16.4	20000	13000	0.0286	0.025
	0.8661	1.1811	0.512	0.012		2740	3690				
22	22	30	16	0.3	NK22/16	15.2	21.7	20000	13000	0.0307	0.033
	0.8661	1.1811	0.630	0.012		3420	4880				
22	22	30	20	0.3	NK22/20	18.0	27.0	20000	13000	0.0324	0.041
	0.8661	1.1811	0.787	0.012		4050	6070				
22	22	30	23	0.3	RNA6903	19.8	30.6	20000	13000	0.0334	0.056
	0.8661	1.1811	0.906	0.012		4450	6880				
22	22	35	20	0.6	NKS22	22.9	27.1	21000	14000	0.0310	0.069
	0.8661	1.3780	0.787	0.024		5150	6090				
24	24	32	16	0.3	NK24/16	16.2	24.3	18000	12000	0.0328	0.035
	0.9449	1.2598	0.630	0.012		3640	5460				

(1) Max. axial displacement

*Continued on next page.*

Shaft Diameter	Dimensions mm/in.				Bearing Designation	Load Ratings kN/lbf.		Limiting Speeds		Approx. Wt. kg/lbs.	
	F <sub>w</sub>	D	C	r <sub>s</sub> min		C	C <sub>0</sub>	Oil	Grease		
mm							RPM		C <sub>g</sub>		
25	24	32	20	0.3	NK24/20	19.3	30.3	18000	12000	0.0346	0.045
	0.9449	1.2598	0.787	0.012		4340	6810				0.099
	24	37	20	0.6	NKS24	29.1	32.8	20000	13000	0.0325	0.073
	0.9449	1.4567	0.787	0.024		6540	7370				0.161
	25	33	16	0.3	NK25/16	16.1	24.4	17000	11000	0.0334	0.037
	0.9843	1.2992	0.630	0.012		3620	5490				0.082
26	25	33	20	0.3	NK25/20	19.1	30.4	17000	11000	0.0353	0.047
	0.9843	1.2992	0.787	0.012		4290	6830				0.104
	25	37	17	0.3	RNA4904	21.3	25.5	18000	12000	0.0318	0.061
	0.9843	1.4567	0.669	0.012		4790	5730				0.134
	25	37	30	0.3	RNA6904	36.6	51.0	18000	12000	0.0378	0.091
	0.9843	1.4567	1.181	0.012		8230	11500				0.201
28	25	38	20	0.6	NKS25	29.1	33.0	19000	12000	0.0331	0.076
	0.9843	1.4961	0.787	0.024		6540	7420				0.168
	26	34	16	0.3	NK26/16	16.6	25.7	17000	11000	0.0344	0.039
	1.0236	1.3386	0.630	0.012		3730	5780				0.086
	26	34	20	0.3	NK26/20	19.7	32.0	17000	11000	0.0363	0.048
	1.0236	1.3386	0.787	0.012		4430	7190				0.106
29	28	37	20	0.3	NK28/20	22.6	34.4	16000	10000	0.0373	0.057
	1.1024	1.4567	0.787	0.012		5080	7730				0.126
	28	37	30	0.3	NK28/30	29.0	53.8	16000	10000	0.0427	0.088
	1.1024	1.4567	1.181	0.012		6520	12100				0.194
	28	39	17	0.3	RNA49/22	23.3	29.6	16000	10000	0.0346	0.059
	1.1024	1.5354	0.669	0.012		5240	6650				0.130
30	28	39	30	0.3	RNA69/22	30.6	50.7	16000	10000	0.0487	0.107
	1.1024	1.5354	1.181	0.012		6880	11400				0.236
	28	42	20	0.6	NKS28	30.3	38.4	16000	11000	0.0364	0.094
	1.1024	1.6535	0.787	0.024		6810	8630				0.207
	29	38	20	0.3	NK29/20	23.4	36.4	15000	9800	0.0383	0.059
	1.1417	1.4961	0.787	0.012		5260	8180				0.130
32	29	38	30	0.3	NK29/30	29.8	56.4	15000	9700	0.0438	0.090
	1.1417	1.4961	1.181	0.012		6700	12700				0.198
	30	40	20	0.3	NK30/20	24.2	38.3	15000	9500	0.0394	0.071
	1.1811	1.5748	0.787	0.012		5440	8610				0.157
	30	40	30	0.3	NK30/30	34.7	61.0	15000	9500	0.0442	0.107
	1.1811	1.5748	1.181	0.012		7800	13700				0.236
35	30	42	17	0.3	RNA4905	24.3	31.7	15000	9700	0.0362	0.071
	1.1811	1.6535	0.669	0.012		5460	7130				0.157
	30	42	30	0.3	RNA6905	39.7	59.6	15000	9700	0.0424	0.127
	1.1811	1.6535	1.181	0.012		8920	13400				0.280
	30	45	20	0.6	NKS30	34.3	42.8	15000	9900	0.0380	0.114
	1.1811	1.7717	0.787	0.024		7710	9620				0.251
35	32	42	20	0.3	NK32/20	24.8	40.4	14000	8800	0.0411	0.074
	1.2598	1.6535	0.787	0.012		5580	9080				0.163
	32	42	30	0.3	NK32/30	35.6	64.3	14000	8800	0.0461	0.112
	1.2598	1.6535	1.181	0.012		8000	14500				0.247
	32	45	17	0.3	RNA49/28	25.1	33.8	14000	9000	0.0378	0.080
	1.2598	1.7717	0.669	0.012		5640	7600				0.176
35	32	45	30	0.3	RNA69/28	43.2	62.5	14000	9100	0.0612	0.140
	1.2598	1.7717	1.181	0.012		9710	14100				0.309
	32	47	22	0.6	NKS32	36.0	46.2	14000	9200	0.0398	0.120
	1.2598	1.8504	0.866	0.024		8090	10400				0.265
	35	45	20	0.3	NK35/20	26.1	44.4	12000	8000	0.0437	0.081
	1.3780	1.7717	0.787	0.012		5870	9980				0.179
35	35	45	30	0.3	NK35/30	37.4	70.6	12000	8000	0.0491	0.122
	1.3780	1.7717	1.181	0.012		8410	15900				0.269
	35	47	18	0.3	RNA4906	25.9	36.0	13000	8200	0.0399	0.081
1.3780	1.8504	0.709	0.012		5820	8090				0.179	

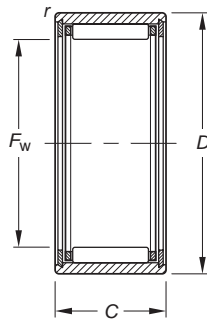
(1) Max. axial displacement

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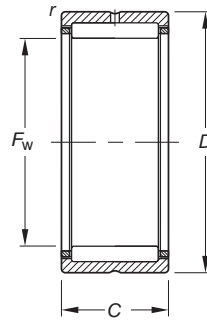


# NEEDLE ROLLER BEARINGS

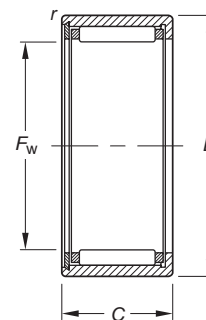
## NEEDLE ROLLER BEARINGS WITHOUT INNER RINGS — *continued* METRIC SERIES



**NK**  
( $F_w \leq 10$ )



**NK, NKS**  
RNA49, RNA69



**NKTN**

Shaft Diameter	Dimensions mm/in.				Bearing Designation	Load Ratings kN/lbf.		Limiting Speeds		Approx. Wt. kg/lbs.	
	$F_w$	D	C	$r_s$ min		Dynamic	Static	Oil	Grease		
mm	$F_w$	D	C	$r_s$ min		$C$	$C_0$	RPM		$C_g$	
	<b>35</b>	<b>47</b>	<b>30</b>	<b>0.3</b>	<b>RNA6906</b>	<b>42.6</b>	<b>68.2</b>	<b>13000</b>	<b>8200</b>	<b>0.0467</b>	<b>0.148</b>
	1.3780	1.8504	1.181	0.012		9580	15300				
	<b>35</b>	<b>50</b>	<b>22</b>	<b>0.6</b>	<b>NKS35</b>	<b>37.5</b>	<b>49.9</b>	<b>13000</b>	<b>8400</b>	<b>0.0421</b>	<b>0.130</b>
	1.3780	1.9685	0.866	0.024		8430	11200				
<b>37</b>	<b>37</b>	<b>47</b>	<b>20</b>	<b>0.3</b>	<b>NK37/20</b>	<b>26.6</b>	<b>46.4</b>	<b>12000</b>	<b>7600</b>	<b>0.0453</b>	<b>0.084</b>
	1.4567	1.8504	0.787	0.012		5980	10400				
	<b>37</b>	<b>47</b>	<b>30</b>	<b>0.3</b>	<b>NK37/30</b>	<b>38.2</b>	<b>73.9</b>	<b>12000</b>	<b>7600</b>	<b>0.0508</b>	<b>0.128</b>
	1.4567	1.8504	1.181	0.012		8590	16600				
	<b>37</b>	<b>52</b>	<b>22</b>	<b>0.6</b>	<b>NKS37</b>	<b>39.0</b>	<b>53.4</b>	<b>12000</b>	<b>7900</b>	<b>0.0438</b>	<b>0.134</b>
	1.4567	2.0472	0.866	0.024		8770	12000				
<b>38</b>	<b>38</b>	<b>48</b>	<b>20</b>	<b>0.3</b>	<b>NK38/20</b>	<b>21.7</b>	<b>40.9</b>	<b>11000</b>	<b>7300</b>	<b>0.0456</b>	<b>0.087</b>
	1.4961	1.8898	0.787	0.012		4880	9190				
	<b>38</b>	<b>48</b>	<b>30</b>	<b>0.3</b>	<b>NK38/30</b>	<b>31.9</b>	<b>67.0</b>	<b>11000</b>	<b>7300</b>	<b>0.0516</b>	<b>0.131</b>
	1.4961	1.8898	1.181	0.012		7170	15100				
<b>40</b>	<b>40</b>	<b>50</b>	<b>20</b>	<b>0.3</b>	<b>NK40/20</b>	<b>27.8</b>	<b>50.4</b>	<b>11000</b>	<b>7000</b>	<b>0.0479</b>	<b>0.089</b>
	1.5748	1.9685	0.787	0.012		6250	11300				
	<b>40</b>	<b>50</b>	<b>30</b>	<b>0.3</b>	<b>NK40/30</b>	<b>40.0</b>	<b>80.2</b>	<b>11000</b>	<b>7000</b>	<b>0.0537</b>	<b>0.137</b>
	1.5748	1.9685	1.181	0.012		8990	18000				
	<b>40</b>	<b>52</b>	<b>20</b>	<b>0.6</b>	<b>RNA49/32</b>	<b>32.0</b>	<b>49.3</b>	<b>11000</b>	<b>7100</b>	<b>0.0457</b>	<b>0.100</b>
	1.5748	2.0472	0.787	0.024		7190	11100				
	<b>40</b>	<b>52</b>	<b>36</b>	<b>0.6</b>	<b>RNA69/32</b>	<b>48.6</b>	<b>84.5</b>	<b>11000</b>	<b>7100</b>	<b>0.0620</b>	<b>0.185</b>
	1.5748	2.0472	1.417	0.024		10900	19000				
	<b>40</b>	<b>55</b>	<b>22</b>	<b>0.6</b>	<b>NKS40</b>	<b>40.3</b>	<b>57.0</b>	<b>11000</b>	<b>7200</b>	<b>0.0460</b>	<b>0.140</b>
	1.5748	2.1654	0.866	0.024		9060	12800				
<b>42</b>	<b>42</b>	<b>52</b>	<b>20</b>	<b>0.3</b>	<b>NK42/20</b>	<b>28.3</b>	<b>52.4</b>	<b>10000</b>	<b>6600</b>	<b>0.0494</b>	<b>0.085</b>
	1.6535	2.0472	0.787	0.012		6360	11800				
	<b>42</b>	<b>52</b>	<b>30</b>	<b>0.3</b>	<b>NK42/30</b>	<b>40.7</b>	<b>83.5</b>	<b>10000</b>	<b>6600</b>	<b>0.0554</b>	<b>0.141</b>
	1.6535	2.0472	1.181	0.012		9150	18800				
	<b>42</b>	<b>55</b>	<b>20</b>	<b>0.6</b>	<b>RNA4907</b>	<b>32.8</b>	<b>51.7</b>	<b>10000</b>	<b>6700</b>	<b>0.0454</b>	<b>0.114</b>
	1.6535	2.1654	0.787	0.024		7370	11600				
	<b>42</b>	<b>55</b>	<b>36</b>	<b>0.6</b>	<b>RNA6907</b>	<b>49.9</b>	<b>88.7</b>	<b>10000</b>	<b>6700</b>	<b>0.0641</b>	<b>0.218</b>
	1.6535	2.1654	1.417	0.024		11200	19900				
<b>43</b>	<b>43</b>	<b>53</b>	<b>20</b>	<b>0.3</b>	<b>NK43/20</b>	<b>29.0</b>	<b>54.4</b>	<b>9900</b>	<b>6400</b>	<b>0.0504</b>	<b>0.096</b>
	1.6929	2.0866	0.787	0.012		6520	12200				
	<b>43</b>	<b>53</b>	<b>30</b>	<b>0.3</b>	<b>NK43/30</b>	<b>41.6</b>	<b>86.6</b>	<b>9900</b>	<b>6400</b>	<b>0.0565</b>	<b>0.134</b>
	1.6929	2.0866	1.181	0.012		9350	19500				
	<b>43</b>	<b>58</b>	<b>22</b>	<b>0.6</b>	<b>NKS43</b>	<b>41.6</b>	<b>60.7</b>	<b>10000</b>	<b>6700</b>	<b>0.0481</b>	<b>0.150</b>
	1.6929	2.2835	0.866	0.024		9350	13600				
<b>45</b>	<b>45</b>	<b>55</b>	<b>20</b>	<b>0.3</b>	<b>NK45/20</b>	<b>29.5</b>	<b>56.4</b>	<b>9400</b>	<b>6100</b>	<b>0.0519</b>	<b>0.100</b>
	1.7717	2.1654	0.787	0.012		6630	12700				
	<b>45</b>	<b>55</b>	<b>30</b>	<b>0.3</b>	<b>NK45/30</b>	<b>42.3</b>	<b>89.8</b>	<b>9400</b>	<b>6100</b>	<b>0.0582</b>	<b>0.151</b>
	1.7717	2.1654	1.181	0.012		9510	20200				
	<b>45</b>	<b>60</b>	<b>22</b>	<b>0.6</b>	<b>NKS45</b>	<b>43.0</b>	<b>64.2</b>	<b>9800</b>	<b>6400</b>	<b>0.0498</b>	<b>0.156</b>
	1.7717	2.3622	0.866	0.024		9670	14400				

(1) Max. axial displacement

*Continued on next page.*



Shaft Diameter	Dimensions mm/in.				Bearing Designation	Load Ratings kN/lbf.		Limiting Speeds		Approx. Wt. kg/lbs.	
	F <sub>w</sub>	D	C	r <sub>s min</sub>		Dynamic C	Static C <sub>0</sub>	Oil RPM	Grease RPM		C <sub>g</sub>
47	47	57	20	0.3	NK47/20	30.0	58.5	9000	5900	0.0534	0.104
	1.8504	2.2441	0.787	0.012		6740	13200				
47	47	57	30	0.3	NK47/30	43.0	93.1	9000	5900	0.0599	0.158
	1.8504	2.2441	1.181	0.012		9670	20900				
48	48	62	22	0.6	RNA4908	44.2	67.8	9100	5900	0.0519	0.154
	1.8898	2.4409	0.866	0.024		9940	15200				
48	48	62	40	0.6	RNA6908	70.8	124	9100	5900	0.0717	0.300
	1.8898	2.4409	1.575	0.024		15900	27900				
50	50	62	25	0.3	NK50/25	40.7	79.3	8500	5500	0.0578	0.171
	1.9685	2.4409	0.984	0.012		9150	17800				
50	50	62	35	0.6	NK50/35	55.0	117	8500	5500	0.0636	0.242
	1.9685	2.4409	1.378	0.024		12400	26300				
50	50	65	22	1.0	NKS50	45.5	71.3	8700	5700	0.0535	0.170
	1.9685	2.5591	0.866	0.039		10200	16000				
52	52	68	22	0.6	RNA4909	46.8	74.8	8400	5400	0.0550	0.201
	2.0472	2.6772	0.866	0.024		10500	16800				
52	52	68	40	0.6	RNA6909	74.7	137	8400	5400	0.0759	0.392
	2.0472	2.6772	1.575	0.024		16800	30800				
55	55	68	25	0.6	NK55/25	46.1	87.3	7800	5000	0.0605	0.207
	2.1654	2.6772	0.984	0.024		10400	19600				
55	55	68	35	0.6	NK55/35	62.3	129	7800	5000	0.0667	0.293
	2.1654	2.6772	1.378	0.024		14000	29000				
55	55	72	22	1.0	NKS55	47.9	78.4	7900	5100	0.0571	0.225
	2.1654	2.8346	0.866	0.039		10800	17600				
58	58	72	22	0.6	RNA4910	48.9	82.0	7400	4800	0.0591	0.179
	2.2835	2.8346	0.866	0.024		11000	18400				
58	58	72	40	0.6	RNA6910	75.7	144	7400	4800	0.0806	0.364
	2.2835	2.8346	1.575	0.024		17000	32400				
60	60	72	25	0.6	NK60/25	44.3	94.0	7000	4400	0.0654	0.202
	2.3622	2.8346	0.984	0.024		9960	21100				
60	60	72	35	0.6	NK60/35	59.9	139	7000	4400	0.0721	0.286
	2.3622	2.8346	1.378	0.024		13500	31200				
60	60	80	28	1.1	NKS60	66.9	103	7300	4800	0.0612	0.337
	2.3622	3.1496	1.102	0.043		15000	23200				
63	63	80	25	1.0	RNA4911	62.0	107	6900	4500	0.0645	0.285
	2.4803	3.1496	0.984	0.039		13900	24100				
63	63	80	45	1.0	RNA6911	94.2	172	6900	4500	0.0852	0.540
	2.4803	3.1496	1.772	0.039		21200	38700				
65	65	78	25	0.6	NK65/25	48.2	97.7	6500	4200	0.0671	0.257
	2.5591	3.0709	0.984	0.024		10800	22000				
65	65	78	35	0.6	NK65/35	65.2	144	6500	4200	0.0739	0.298
	2.5591	3.0709	1.378	0.024		14700	32400				
65	65	85	28	1.1	NKS65	71.0	114	6700	4200	0.0650	0.362
	2.5591	3.3465	1.102	0.043		16000	25600				
68	68	82	25	0.6	NK68/25	49.0	101	6200	4000	0.0691	0.287
	2.6772	3.2283	0.984	0.024		11000	22700				
68	68	82	35	0.6	NK68/35	66.2	149	6200	4000	0.0760	0.350
	2.6772	3.2283	1.378	0.024		14900	33500				
68	68	85	25	1.0	RNA4912	64.8	116	6300	4100	0.0681	0.304
	2.6772	3.3465	0.984	0.039		14600	26100				
68	68	85	45	1.0	RNA6912	99.3	189	6300	4100	0.0901	0.546
	2.6772	3.3465	1.772	0.039		22300	42500				
70	70	85	25	0.6	NK70/25	43.6	87.9	6000	3900	0.0705	0.298
	2.7559	3.3465	0.984	0.024		9800	19800				
70	70	85	35	0.6	NK70/35	62.2	139	6000	3900	0.0757	0.411
	2.7559	3.3465	1.378	0.024		14000	31200				
70	70	90	28	1.1	NKS70	72.6	120	6200	4000	0.0679	0.383
	2.7559	3.5433	1.102	0.043		16300	27000				

(1) Max. axial displacement

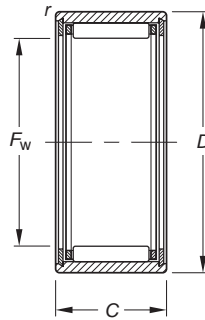
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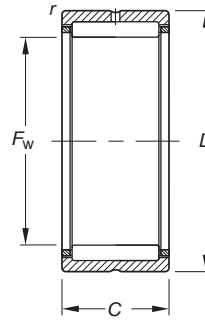
# NEEDLE ROLLER BEARINGS

## NEEDLE ROLLER BEARINGS WITHOUT INNER RINGS – *continued*

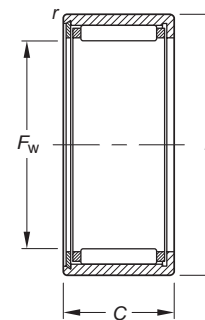
### METRIC SERIES



**NK**  
( $F_w \leq 10$ )



**NK, NKS**  
RNA49, RNA69



**NKTN**

Shaft Diameter	Dimensions mm/in.				Bearing Designation	Load Ratings kN/lbf.		Limiting Speeds		Approx. Wt. kg/lbs.	
	$F_w$	D	C	$r_s$ min		Dynamic	Static	Oil	Grease		
mm	$F_w$	D	C	$r_s$ min		$C$	$C_0$	RPM		$C_g$	
72	72	90	25	1.0	RNA4913	66.0	121	5900	3900	0.0705	0.346
	2.8346	3.5433	0.984	0.039		14800	27200				
	72	90	45	1.0	RNA6913	107	213	5900	3900	0.0952	0.679
	2.8346	3.5433	1.772	0.039		24100	47900				
73	73	90	25	0.6	NK73/25	61.5	119	5800	3800	0.0717	0.320
	2.8740	3.5433	0.984	0.024		13800	26800				
	73	90	35	0.6	NK73/35	82.5	173	5800	3800	0.0787	0.450
	2.8740	3.5433	1.378	0.024		18500	38900				
75	75	92	25	0.6	NK75/25	43.7	90.2	5600	3600	0.0702	0.364
	2.9528	3.6220	0.984	0.024		9820	20300				
	75	92	35	0.6	NK75/35	60.9	138	5600	3600	0.0780	0.518
	2.9528	3.6220	1.378	0.024		13700	31000				
	75	95	28	1.1	NKS75	76.5	132	5800	3700	0.0716	0.413
	2.9528	3.7402	1.102	0.043		17200	29700				
80	80	95	25	1.0	NK80/25	65.0	131	5300	3400	0.0766	0.331
	3.1496	3.7402	0.984	0.039		14600	29400				
	80	95	35	1.0	NK80/35	79.7	184	5300	3400	0.0846	0.380
	3.1496	3.7402	1.378	0.039		17900	41400				
	80	100	30	1.0	RNA4914	86.3	157	5400	3500	0.0770	0.502
	3.1496	3.9370	1.181	0.039		19400	35300				
	80	100	54	1.0	RNA6914	137	286	5400	6500	0.1061	0.946
	3.1496	3.9370	2.126	0.039		30800	64300				
85	85	105	25	1.0	NK85/25	76.4	137	5000	3300	0.0764	0.506
	3.3465	4.1339	0.984	0.039		17200	30800				
	85	105	30	1.0	RNA4915	92.4	175	5000	3300	0.0812	0.528
	3.3465	4.1339	1.181	0.039		20800	39300				
	85	105	35	1.0	NK85/35	108	214	5000	3300	0.0854	0.610
	3.3465	4.1339	1.378	0.039		24300	48100				
	85	105	54	1.0	RNA6915	143	308	5000	3300	0.1110	1.020
	3.3465	4.1339	2.126	0.039		32100	69200				
90	90	110	25	1.0	NK90/25	79.5	147	4700	3100	0.0798	0.450
	3.5433	4.3307	0.984	0.039		17900	33000				
	90	110	30	1.0	RNA4916	91.5	176	4700	3100	0.0834	0.556
	3.5433	4.3307	1.181	0.039		20600	39600				
	90	110	35	1.0	NK90/35	113	230	4700	3100	0.0891	0.745
	3.5433	4.3307	1.378	0.039		25400	51700				
	90	110	54	1.0	RNA6916	126	320	4700	3100	0.1197	1.050
	3.5433	4.3307	2.126	0.039		28300	71900				
95	95	115	26	1.0	NK95/26	49.3	114	4400	2800	0.0829	0.572
	3.7402	4.5276	1.024	0.039		11100	25600				
	95	115	36	1.0	NK95/36	114	238	4500	2900	0.0921	0.803
	3.7402	4.5276	1.417	0.039		25600	53500				
100	100	120	26	1.0	NK100/26	83.6	163	4200	2800	0.0857	0.530
	3.9370	4.7244	1.024	0.039		18800	36600				

(1) Max. axial displacement

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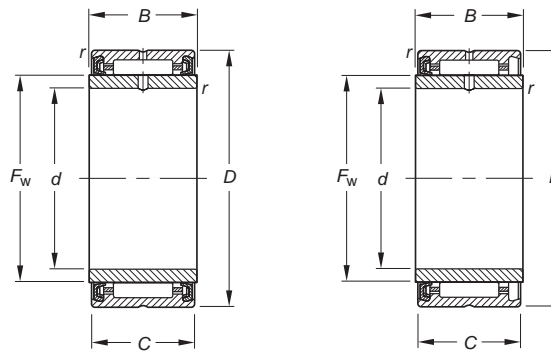
Shaft Diameter	Dimensions mm/in.				Bearing Designation	Load Ratings kN/lbf.		Limiting Speeds		C <sub>g</sub>	Approx. Wt. kg/lbs.
	F <sub>w</sub>	D	C	r <sub>s</sub> min		C	C <sub>0</sub>	Oil	Grease		
mm							RPM				
100	100	120	35	1.1	RNA4917	110	230	4200	2800	0.0935	0.715
	3.9370	4.7244	1.378	0.043		24700	51700				
100	100	120	36	1.0	NK100/36	118	254	4200	2800	0.0958	0.658
	3.9370	4.7244	1.417	0.039		26500	57100				
100	100	120	63	1.1	RNA6917	150	416	4200	2800	0.1340	1.350
	3.9370	4.7244	2.480	0.043		33700	93500				
105	105	125	26	1.0	NK105/26	52.2	127	3900	2600	0.0892	0.595
	4.1339	4.9213	1.024	0.039		11700	28600				
105	105	125	35	1.1	RNA4918	114	245	4000	2600	0.0970	0.746
	4.1339	4.9213	1.378	0.043		25600	55100				
105	105	125	63	1.1	RNA6918	154	437	4000	2600	0.1323	1.500
	4.1339	4.9213	2.480	0.043		34600	98200				
110	110	130	30	1.1	NK110/30	103	220	3800	2500	0.0965	0.660
	4.3307	5.1181	1.181	0.043		23200	49500				
110	110	130	35	1.1	RNA4919	115	253	3800	2500	0.0999	0.777
	4.3307	5.1181	1.378	0.043		25900	56900				
110	110	130	40	1.1	NK110/40	132	132	3800	2500	0.1043	0.900
	4.3307	5.1181	1.575	0.043		29700	29700				
110	110	130	63	1.1	RNA6919	158	458	3800	2500	0.1434	1.470
	4.3307	5.1181	2.480	0.043		35500	103000				
115	115	140	40	1.1	RNA4920	139	296	3700	2400	0.1037	1.220
	4.5276	5.5118	1.575	0.043		31200	66500				
120	120	140	30	1.0	RNA4822	90.3	230	3500	2300	0.1059	0.785
	4.7244	5.5118	1.181	0.039		20300	51700				
125	125	150	40	1.1	RNA4922	147	325	3400	2200	0.1101	1.320
	4.9213	5.9055	1.575	0.043		33000	73100				
130	130	150	30	1.0	RNA4824	94.1	249	3200	2100	0.1121	0.850
	5.1181	5.9055	1.181	0.039		21200	56000				
135	135	165	45	1.1	RNA4924	177	407	3100	2000	0.1193	1.980
	5.3150	6.4961	1.772	0.043		39800	91500				
145	145	165	35	1.0	RNA4826	112	323	2900	1900	0.1258	1.100
	5.7087	6.4961	1.378	0.039		25200	72600				
150	150	180	50	1.5	RNA4926	201	495	2800	1800	0.1314	2.420
	5.9055	7.0866	1.969	0.059		45200	111000				
155	155	175	35	1.1	RNA4828	116	346	2700	1700	0.1320	1.170
	6.1024	6.8898	1.378	0.043		26100	77800				
160	160	190	50	1.5	RNA4928	214	549	2600	1700	0.1389	2.560
	6.2992	7.4803	1.969	0.059		48100	123000				
165	165	190	40	1.1	RNA4830	142	402	2500	1600	0.1367	1.540
	6.4961	7.4803	1.575	0.043		31900	90400				
175	175	200	40	1.1	RNA4832	146	425	2400	1500	0.1425	1.910
	6.8898	7.8740	1.575	0.043		32800	95500				

(1) Max. axial displacement



**SEALED NEEDLE ROLLER BEARINGS  
WITH INNER RINGS**

**METRIC SERIES**



**NA49RS**

Shaft Diameter	Dimensions mm/in.						Bearing Designation	Load Ratings kN/lbf.		Limiting Speeds		Approx. Wt. kg/lbs.		
	mm	d	D	B	F <sub>w</sub>	C		r <sub>s</sub> min	Dynamic C	Static C <sub>0</sub>	Oil RPM		Grease RPM	C <sub>g</sub>
10	10	10	22	14	13	14	0.3	NA4900RS	7.76	8.06	28000	18000	0.0199	0.027
	0.3937	0.3937	0.8661	0.551	0.512	0.5512	0.012	NA4900.2RS	7.76	8.06	24000	16000	0.0199	0.027
12	12	12	24	14	13	16	0.3	NA4901RS	8.64	9.59	28000	18000	0.0219	0.031
	0.4724	0.4724	0.9449	0.551	0.512	0.6299	0.012	NA4901.2RS	8.64	9.59	28000	18000	0.0219	0.031
15	15	15	28	14	13	20	0.3	NA4902RS	9.77	12.0	22000	14000	0.0254	0.041
	0.5906	0.5906	1.1024	0.551	0.512	0.7874	0.012	NA4902.2RS	9.77	12.0	22000	14000	0.0254	0.041
17	17	17	30	14	13	22	0.3	NA4903RS	10.1	12.8	20000	13000	0.0269	0.044
	0.6693	0.6693	1.1811	0.551	0.512	0.8661	0.012	NA4903.2RS	10.1	12.8	20000	13000	0.0269	0.044
20	20	20	37	18	17	25	0.3	NA4904RS	18.5	21.2	18000	12000	0.0309	0.087
	0.7874	0.7874	1.4567	0.709	0.669	0.9843	0.012	NA4904.2RS	18.5	21.2	18000	12000	0.0304	0.087
25	25	25	42	18	17	30	0.3	NA4905RS	21.0	26.4	15000	9700	0.0346	0.106
	0.9843	0.9843	1.6535	0.709	0.669	1.1811	0.012	NA4905.2RS	21.0	26.4	15000	9700	0.0346	0.106
30	30	30	47	18	17	35	0.3	NA4906RS	22.5	30.0	13000	8200	0.0381	0.119
	1.1811	1.1811	1.8504	0.709	0.669	1.3780	0.012	NA4906.2RS	22.5	30.0	13000	8200	0.0381	0.119
35	35	35	55	21	20	42	0.6	NA4907RS	29.1	44.4	10000	6700	0.0454	0.198
	1.3780	1.3780	2.1654	0.827	0.787	1.6535	0.024	NA4907.2RS	29.1	44.4	10000	6700	0.0454	0.198
40	40	40	62	23	22	48	0.6	NA4908RS	38.6	57.0	9100	5900	0.0497	0.263
	1.5748	1.5748	2.4409	0.906	0.866	1.8898	0.024	NA4908.2RS	38.6	57.0	9100	5900	0.0497	0.263
45	45	45	68	23	22	52	0.6	NA4909.2RS	39.4	60.0	8400	5400	0.0521	0.303
1.7717	1.7717	2.6772	0.906	0.866	2.0472	0.024		8860	13500			0.668		
50	50	50	72	23	22	58	0.6	NA4910RS	41.2	65.8	7400	4800	0.0559	0.309
	1.9685	1.9685	2.8346	0.906	0.866	2.2835	0.024	NA4910.2RS	41.2	65.8	7400	4800	0.0559	0.309
1.9685	1.9685	2.8346	0.906	0.866	2.2835	0.024		9260	14800			0.681		

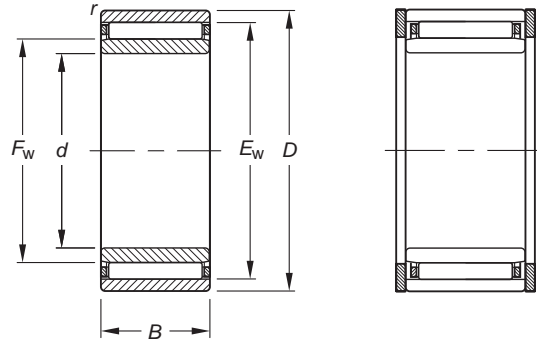




# NEEDLE ROLLER BEARINGS

## NEEDLE ROLLER BEARINGS WITHOUT FLANGES WITH INNER RINGS

### METRIC SERIES



NAO

SNSH

Shaft Dia.	Dimensions mm/in.								Bearing Designation	End Washer Designation	Load Ratings kN/lbf.		Limiting Speeds		Approx. Wt. kg/lbs.
	mm	d	D	B	F <sub>w</sub>	E <sub>w</sub>	r <sub>s min</sub>	s <sup>1</sup>			Dynamic C	Static C <sub>0</sub>	Oil RPM	Grease RPM	
6	6	17	10	10	13	0.3	0.5	NAO6X17X10	SNSH10,5X17X0,5	5.40	6.43	39000	25000	0.0174	0.014
	0.2362	0.6693	0.394	0.3937	0.5118	0.012	0.020			1210	1450				0.031
	8	19	10	12	15	0.3	0.5	NAO8X19X10	SNSH12,5X19X0,5	5.85	7.51	37000	24000	0.0195	0.017
	0.3150	0.7480	0.394	0.4724	0.5906	0.012	0.020			1320	1690				0.037
10	10	22	13	14	18	0.3	1.0	NAO10X22X13	SNSH14,5X22X0,5	9.73	12.5	29000	19000	0.0227	0.026
	0.3937	0.8661	0.512	0.5512	0.7087	0.012	0.039			2190	2810				0.057
	10	22	20	14	18	0.3	0.5	NAO10X22X20	SNSH14,5X22X0,5	12.3	16.8	29000	19000	0.0291	0.041
	0.3937	0.8661	0.787	0.5512	0.7087	0.012	0.020			2770	3780				0.090
	10	26	12	14	20	0.3	0.7	NAO10X26X12	SNSH14,5X26X0,5	10.5	10.6	21000	14000	0.0209	0.036
	0.3937	1.0236	0.472	0.5512	0.7874	0.012	0.028			2360	2380				0.079
12	12	24	13	16	20	0.3	1.0	NAO12X24X13	SNSH16,5X24X0,5	10.1	13.5	28000	18000	0.0245	0.030
	0.4724	0.9449	0.512	0.6299	0.7874	0.012	0.039			2270	3030				0.066
	12	24	20	16	20	0.3	0.5	NAO12X24X20	SNSH16,5X24X0,5	13.4	19.5	28000	18000	0.0319	0.046
	0.4724	0.9449	0.787	0.6299	0.7874	0.012	0.020			3010	4380				0.101
	12	28	12	16	22	0.3	0.7	NAO12X28X12	SNSH16,5X28X0,5	11.2	11.9	29000	19000	0.0227	0.041
	0.4724	1.1024	0.472	0.6299	0.8661	0.012	0.028			2520	2680				0.090
15	15	28	13	20	24	0.3	1.0	NAO15X28X13	SNSH20,5X28X0,5	11.5	17.3	22000	14000	0.0287	0.039
	0.5906	1.1024	0.512	0.7874	0.9449	0.012	0.039			2590	3890				0.086
	15	28	26	20	24	0.3	1.0	NAO15X28X26	SNSH20,5X28X0,5	19.8	34.6	22000	14000	0.0405	0.078
	0.5906	1.1024	1.024	0.7874	0.9449	0.012	0.039			4450	7780				0.172
	15	32	12	20	26	0.3	0.7	NAO15X32X12	SNSH20,5X32X0,5	13.0	15.0	23000	15000	0.0264	0.050
	0.5906	1.2598	0.472	0.7874	1.0236	0.012	0.028			2920	3370				0.110
17	17	30	13	22	26	0.3	1.0	NAO17X30X13	SNSH22,5X30X0,5	11.8	18.3	20000	13000	0.0303	0.043
	0.6693	1.1811	0.512	0.8661	1.0236	0.012	0.039			2650	4110				0.095
	17	30	26	22	26	0.3	1.0	NAO17X30X26	SNSH22,5X30X0,5	20.2	36.6	20000	13000	0.0428	0.084
	0.6693	1.1811	1.024	0.8661	1.0236	0.012	0.039			4540	8230				0.185
	17	35	16	22	29	0.3	1.5	NAO17X35X16	SNSH22,5X35X0,5	19.0	23.3	20000	13000	0.0299	0.078
	0.6693	1.3780	0.630	0.8661	1.1417	0.012	0.059			4270	5240				0.172
	17	35	32	22	29	0.3	1.5	NAO17X35X32	SNSH22,5X35X0,5	32.7	46.5	20000	13000	0.0423	0.154
	0.6693	1.3780	1.260	0.8661	1.1417	0.012	0.059			7350	10500				0.340
20	20	35	17	25	30	0.3	1.2	NAO20X35X17	SNSH25,5X35X0,5	18.8	29.8	17000	11000	0.0351	0.073
	0.7874	1.3780	0.669	0.9843	1.1811	0.012	0.047			4230	6700				0.161
	20	35	26	25	30	0.3	1.2	NAO20X35X26	SNSH25,5X35X0,5	25.0	42.8	17000	11000	0.0456	0.112
	0.7874	1.3780	1.024	0.9843	1.1811	0.012	0.047			5620	9620				0.247
	20	37	16	25	32	0.3	1.5	NAO20X37X16	SNSH25,5X37X0,5	19.8	25.3	17000	11000	0.0323	0.080
	0.7874	1.4567	0.630	0.9843	1.2598	0.012	0.059			4450	5690				0.176
	20	37	32	25	32	0.3	1.5	NAO20X37X32	SNSH25,5X37X0,5	34.0	50.7	17000	11000	0.0455	0.162
	0.7874	1.4567	1.260	0.9843	1.2598	0.012	0.059			7640	11400				0.357
25	25	40	17	30	35	0.3	1.2	NAO25X40X17	SNSH30,5X40X0,5	20.2	34.9	14000	9300	0.0394	0.088
	0.9843	1.5748	0.669	1.1811	1.3780	0.012	0.047			4540	7850				0.194
	25	40	26	30	35	0.3	1.2	NAO25X40X26	SNSH30,5X40X0,5	26.8	49.7	14000	9300	0.0512	0.132
	0.9843	1.5748	1.024	1.1811	1.3780	0.012	0.047			6020	11200				0.291
	25	42	16	30	37	0.3	1.5	NAO25X42X16		22.4	31.0	15000	9600	0.0366	0.096
	0.9843	1.6535	0.630	1.1811	1.4567	0.012	0.059			5040	6970				0.212

<sup>(1)</sup> Max. axial displacement

Continued on next page.

Shaft Dia.	Dimensions mm/in.								Bearing Designation	End Washer Designation	Load Ratings kN/lbf.		Limiting Speeds		C <sub>g</sub>	Approx. Wt. kg/lbs.
	mm	d	D	B	F <sub>w</sub>	E <sub>w</sub>	r <sub>s min</sub>	s <sup>1</sup>			C	C <sub>0</sub>	Oil RPM	Grease RPM		
30	25	42	32	30	37	0.3	1.5	NAO25X42X32		38.2	62.1	15000	9600	0.0517	0.185	
	0.9843	1.6535	1.260	1.1811	1.4567	0.012	0.059			8590	14000					0.408
30	30	45	17	35	40	0.3	1.2	NAO30X45X17		22.1	40.8	12000	7900	0.0440	0.102	
	1.1811	1.7717	0.669	1.3780	1.5748	0.012	0.047			4970	9170					0.225
30	30	45	26	35	40	0.3	1.2	NAO30X45X26		27.7	54.5	12000	7900	0.0561	0.155	
	1.1811	1.7717	1.024	1.3780	1.5748	0.012	0.047			6230	12300					0.342
30	30	47	16	35	42	0.3	1.5	NAO30X47X16	SNSH35,5X47X0,5	24.5	36.8	12000	8100	0.0408	0.106	
	1.1811	1.8504	0.630	1.3780	1.6535	0.012	0.059			5510	8270					0.234
30	30	47	32	35	42	0.3	1.5	NAO30X47X32	SNSH35,5X47X0,5	42.0	73.5	12000	8100	0.0576	0.218	
	1.1811	1.8504	1.260	1.3780	1.6535	0.012	0.059			9440	16500					0.481
35	35	50	17	35	40	0.3	1.2	NAO35X50X17		23.8	47.0	11000	6900	0.0484	0.126	
	1.3780	1.9685	0.669	1.3780	1.5748	0.012	0.047			5350	10600					0.278
35	35	50	34	35	40	0.3	0.7	NAO35X50X34	SNSH40,5X50X0,5	40.9	94.1	11000	6900	0.0682	0.232	
	1.3780	1.9685	1.339	1.3780	1.5748	0.012	0.028			9190	21200					0.511
35	35	55	20	35	43	0.3	1.5	NAO35X55X20	SNSH41X55X1	35.5	56.3	11000	7100	0.0472	0.185	
	1.3780	2.1654	0.787	1.3780	1.6929	0.012	0.059			7980	12700					0.408
35	35	55	40	35	43	0.3	1.7	NAO35X55X40		60.8	113	11000	7100	0.0666	0.370	
	1.3780	2.1654	1.575	1.3780	1.6929	0.012	0.067			13700	25400					0.816
40	40	55	17	45	50	0.3	0.7	NAO40X55X17	SNSH45,5X55X0,5	24.9	51.8	9400	6100	0.0523	0.133	
	1.5748	2.1654	0.669	1.7717	1.9685	0.012	0.028			5600	11600					0.293
40	40	55	34	45	50	0.3	0.7	NAO40X55X34	SNSH45,5X55X0,5	42.7	104	9400	6100	0.0737	0.257	
	1.5748	2.1654	1.339	1.7717	1.9685	0.012	0.028			9600	23400					0.567
40	40	62	20	45	53	0.3	1.5	NAO40X62X20	SNSH46X62X1	36.0	59.5	9600	6200	0.0504	0.215	
	1.5748	2.4409	0.787	1.7717	2.0866	0.012	0.059			8090	13400					0.474
40	40	62	40	45	53	0.3	1.7	NAO40X62X40	SNSH46X62X1	61.7	119	9600	6200	0.0711	0.440	
	1.5748	2.4409	1.575	1.7717	2.0866	0.012	0.067			13900	26800					0.970
45	45	62	20	50	55	0.3	0.7	NAO45X62X20		30.2	68.5	8400	5400	0.0588	0.200	
	1.7717	2.4409	0.787	1.9685	2.1654	0.012	0.028			6790	15400					0.441
45	45	62	40	50	55	0.3	0.5	NAO45X62X40		50.7	137	8400	5400	0.0829	0.386	
	1.7717	2.4409	1.575	1.9685	2.1654	0.012	0.020			11400	30800					0.851
45	45	72	20	55	63	1.0	1.5	NAO45X72X20	SNSH56X72X1	40.3	73.5	7800	5000	0.0580	0.345	
	1.7717	2.8346	0.787	2.1654	2.4803	0.039	0.059			9060	16500					0.761
45	45	72	40	55	63	1.0	1.7	NAO45X72X40	SNSH56X72X1	69.1	147	7800	5000	0.0818	0.680	
	1.7717	2.8346	1.575	2.1654	2.4803	0.039	0.067			15500	33000					1.499
50	50	68	20	55	60	0.3	0.7	NAO50X68X20		30.7	72.4	7600	4900	0.0622	0.230	
	1.9685	2.6772	0.787	2.1654	2.3622	0.012	0.028			6900	16300					0.507
50	50	68	40	55	60	0.3	0.5	NAO50X68X40		52.7	145	7600	4900	0.0878	0.450	
	1.9685	2.6772	1.575	2.1654	2.3622	0.012	0.020			11800	32600					0.992
50	50	78	20	60	68	1.0	1.5	NAO50X78X20	SNSH61X78X1	41.8	79.2	7100	4600	0.0614	0.385	
	1.9685	3.0709	0.787	2.3622	2.6772	0.039	0.059			9400	17800					0.849
50	50	78	40	60	68	1.0	1.7	NAO50X78X40	SNSH61X78X1	71.7	158	7100	4600	0.0867	0.746	
	1.9685	3.0709	1.575	2.3622	2.6772	0.039	0.067			16100	35500					1.645
55	55	85	30	65	73	1.0	2.0	NAO55X85X30	SNSH66X85X1	60.1	129	6500	4200	0.0719	0.690	
	2.1654	3.3465	1.181	2.5591	2.8740	0.039	0.079			13500	29000					1.521
55	55	85	60	65	73	1.0	1.5	NAO55X85X60	SNSH66X85X1	103	259	6500	4200	0.1015	1.320	
	2.1654	3.3465	2.362	2.5591	2.8740	0.039	0.059			23200	58200					2.910
60	60	90	30	70	78	1.0	2.0	NAO60X90X30		62.2	139	6000	3900	0.0757	0.745	
	2.3622	3.5433	1.181	2.7559	3.0709	0.039	0.079			14000	31200					1.642
60	60	90	60	70	78	1.0	1.7	NAO60X90X60		107	277	6000	3900	0.1068	1.405	
	2.3622	3.5433	2.362	2.7559	3.0709	0.039	0.067			24100	62300					3.097
65	65	95	30	75	83	1.0	2.0	NAO65X95X30		60.9	138	5600	3600	0.0780	0.770	
	2.5591	3.7402	1.181	2.9528	3.2677	0.039	0.079			13700	31000					1.698
65	65	95	60	75	83	1.0	1.7	NAO65X95X60		116	277	5600	3600	0.1101	1.500	
	2.5591	3.7402	2.362	2.9528	3.2677	0.039	0.067			26100	62300					3.307
70	70	100	30	80	88	1.0	2.0	NAO70X100X30		67.5	161	5200	3400	0.0835	0.850	
	2.7559	3.9370	1.181	3.1496	3.4646	0.039	0.079			15200	36200					1.874
70	70	100	60	80	88	1.0	1.7	NAO70X100X60		116	322	5200	3400	0.1178	1.600	
	2.7559	3.9370	2.362	3.1496	3.4646	0.039	0.067			26100	72400					3.527

(1) Max. axial displacement

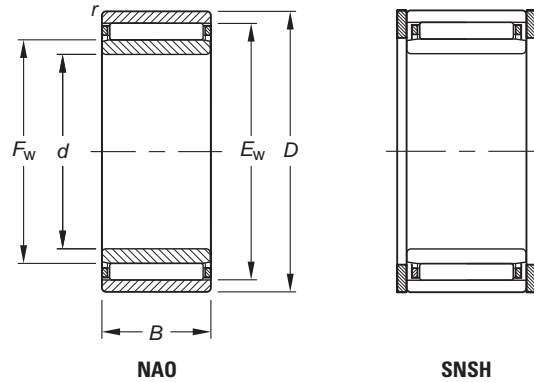
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# NEEDLE ROLLER BEARINGS

## NEEDLE ROLLER BEARINGS WITHOUT FLANGES WITH INNER RINGS – *continued*

### METRIC SERIES



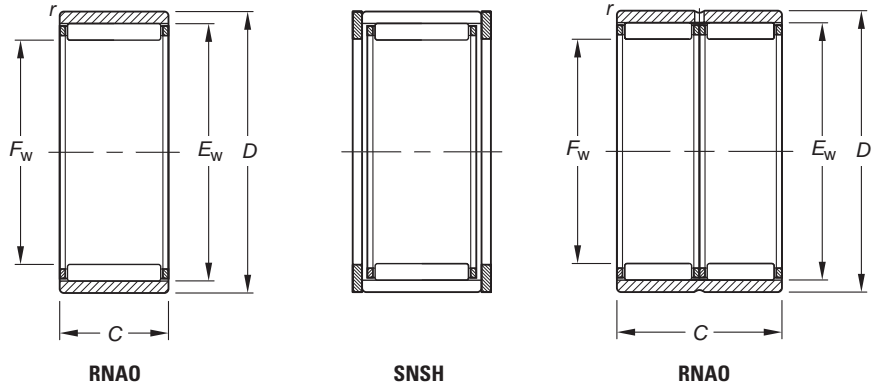
C

Shaft Dia.	Dimensions mm/in.								Bearing Designation	End Washer Designation	Load Ratings kN/lbf.		Limiting Speeds		Approx. Wt. kg/lbs.
	mm	d	D	B	F <sub>w</sub>	E <sub>w</sub>	r <sub>s min</sub>	s <sup>1</sup>			Dynamic C	Static C <sub>0</sub>	Oil RPM	Grease RPM	
80	80	110	30	90	98	1.0	2.0	NAO80X110X30		63.6	155	4600	3000	0.0873	0.920
	3.1496	4.3307	1.181	3.5433	3.8583	0.039	0.079			14300	34800				
85	85	115	30	95	103	1.0	2.0	NAO85X115X30		71.0	183	4400	2800	0.0932	0.985
	3.3465	4.5276	1.181	3.7402	4.0551	0.039	0.079			16000	41100				
90	90	120	30	100	108	1.0	2.0	NAO90X120X30		72.4	191	4200	2700	0.0965	1.010
	3.5433	4.7244	1.181	3.9370	4.2520	0.039	0.079			16300	42900				

<sup>(1)</sup> Max. axial displacement



**NEEDLE ROLLER BEARINGS  
WITHOUT FLANGES  
WITHOUT INNER RINGS  
METRIC SERIES**



Shaft Dia.	Dimensions mm/in.					Bearing Designation	End Washer Designation	Load Ratings kN/lbf.		Limiting Speeds		Approx. Wt. kg/lbs.	
	F <sub>w</sub>	D	C	E <sub>w</sub>	r <sub>s min</sub>			Dynamic	Static	Oil	Grease		C <sub>g</sub>
mm	F <sub>w</sub>	D	C	E <sub>w</sub>	r <sub>s min</sub>			C	C <sub>0</sub>	RPM			
6	6	13	8	9	0.3	RNA06X13X8TN		2.47	2.07	44000	29000	0.0107	0.005
	0.2362	0.5118	0.315	0.3543	0.012			560	470				
7	7	14	8	10	0.3	RNA07X14X8TN		2.74	2.44	42000	28000	0.0118	0.007
	0.2756	0.5512	0.315	0.3937	0.012			620	550				
8	8	15	10	11	0.3	RNA08X15X10	SNSH8,5X15X0,5	4.57	4.89	41000	26000	0.0148	0.008
	0.3150	0.5906	0.394	0.4331	0.012			1030	1100				
9	9	16	10	12	0.3	RNA09X16X10		4.27	4.60	40000	26000	0.0153	0.009
	0.3543	0.6299	0.394	0.4724	0.012			960	1030				
10	10	17	10	13	0.3	RNA010X17X10	SNSH10,5X17X0,5	5.40	6.43	39000	25000	0.0174	0.010
	0.3937	0.6693	0.394	0.5118	0.012			1210	1450				
10	10	17	20	13	0.3	RNA010X17X20	SNSH10,5X17X0,5	9.25	12.9	39000	25000	0.0245	0.019
	0.3937	0.6693	0.787	0.5118	0.012			2080	2900				
12	12	19	10	15	0.3	RNA012X19X10	SNSH12,5X19X0,5	5.85	7.51	37000	24000	0.0195	0.012
	0.4724	0.7480	0.394	0.5906	0.012			1320	1690				
14	14	22	13	18	0.3	RNA014X22X13	SNSH14,5X22X0,5	9.73	12.5	29000	19000	0.0227	0.018
	0.5512	0.8661	0.512	0.7087	0.012			2190	2810				
14	14	22	20	18	0.3	RNA014X22X20	SNSH14,5X22X0,5	12.3	16.8	29000	19000	0.0291	0.029
	0.5512	0.8661	0.787	0.7087	0.012			2770	3780				
14	14	26	12	20	0.3	RNA014X26X12	SNSH14,5X26X0,5	10.5	10.6	21000	14000	0.0209	0.029
	0.5512	1.0236	0.472	0.7874	0.012			2360	2380				
15	15	23	13	19	0.3	RNA015X23X13	SNSH15,5X23X0,5	9.66	12.6	28000	18000	0.0235	0.019
	0.5906	0.9055	0.512	0.7480	0.012			2170	2830				
15	15	23	20	19	0.3	RNA015X23X20	SNSH15,5X23X0,5	13.5	19.4	28000	18000	0.0310	0.029
	0.5906	0.9055	0.787	0.7480	0.012			3030	4360				
16	16	24	13	20	0.3	RNA016X24X13	SNSH16,5X24X0,5	10.1	13.5	28000	18000	0.0245	0.022
	0.6299	0.9449	0.512	0.7874	0.012			2270	3030				
16	16	24	20	20	0.3	RNA016X24X20	SNSH16,5X24X0,5	13.4	19.5	28000	18000	0.0319	0.032
	0.6299	0.9449	0.787	0.7874	0.012			3010	4380				
16	16	28	12	22	0.3	RNA016X28X12	SNSH16,5X28X0,5	11.2	11.9	29000	19000	0.0227	0.033
	0.6299	1.1024	0.472	0.8661	0.012			2520	2680				
17	17	25	13	21	0.3	RNA017X25X13	SNSH17,5X25X0,5	10.5	14.5	26000	17000	0.0256	0.022
	0.6693	0.9843	0.512	0.8268	0.012			2360	3260				
17	17	25	20	21	0.3	RNA017X25X20	SNSH17,5X25X0,5	14.7	22.5	26000	17000	0.0333	0.032
	0.6693	0.9843	0.787	0.8268	0.012			3300	5060				
18	18	26	13	22	0.3	RNA018X26X13	SNSH18,5X26X0,5	10.8	15.4	24000	16000	0.0266	0.024
	0.7087	1.0236	0.512	0.8661	0.012			2430	3460				
18	18	26	13	22	0.3	RNA018X26X13ASR1	SNSH18,5X26X0,5	10.8	15.4	24000	16000	0.0266	0.024
	0.7087	1.0236	0.512	0.8661	0.012			2430	3460				
18	18	26	20	22	0.3	RNA018X26X20	SNSH18,5X26X0,5	14.4	22.2	24000	16000	0.0347	0.034
	0.7087	1.0236	0.787	0.8661	0.012			3240	4990				
18	18	30	24	24	0.3	RNA018X30X24		20.2	26.2	25000	17000	0.0343	0.070
	0.7087	1.1811	0.945	0.9449	0.012			4540	5890				
20	20	28	13	24	0.3	RNA020X28X13	SNSH20,5X28X0,5	11.5	17.3	22000	14000	0.0287	0.025
	0.7874	1.1024	0.512	0.9449	0.012			2590	3890				

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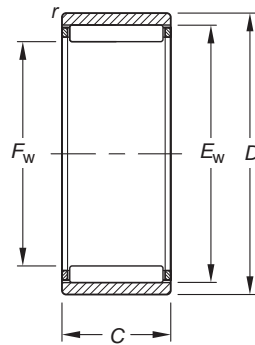


# NEEDLE ROLLER BEARINGS

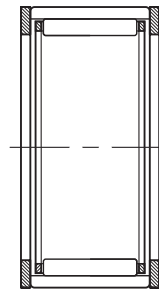
## NEEDLE ROLLER BEARINGS WITHOUT FLANGES WITHOUT INNER RINGS

### METRIC SERIES

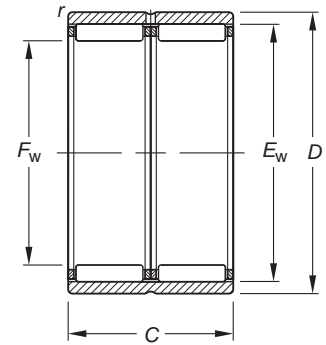
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RNAO



SNSH



RNAO

Shaft Dia. mm	Dimensions mm/in.					Bearing Designation	End Washer Designation	Load Ratings kN/lbf.		Limiting Speeds		Approx. Wt. kg/lbs.	
	F <sub>w</sub>	D	C	E <sub>w</sub>	r <sub>s</sub> min			Dynamic	Static	Oil	Grease		
								C	C <sub>0</sub>	RPM	C <sub>g</sub>		
20	20	28	26	24	0.3	RNAO20X28X26	SNSH20,5X28X0,5	19.8	34.6	22000	14000	0.0405	0.050
	0.7874	1.1024	1.024	0.9449	0.012			4450	7780				0.110
	20	32	12	26	0.3	RNAO20X32X12	SNSH20,5X32X0,5	13.0	15.3	23000	15000	0.0264	0.038
20	20	32	24	26	0.3	RNAO20X32X24	SNSH20,5X32X0,5	22.3	30.6	23000	15000	0.0373	0.080
	0.7874	1.2598	0.945	1.0236	0.012			5010	6880				0.176
	22	22	30	13	26	0.3	RNAO22X30X13	SNSH22,5X30X0,5	11.8	18.3	20000	13000	0.0303
22	22	30	26	26	0.3	RNAO22X30X26	SNSH22,5X30X0,5	20.2	36.6	20000	13000	0.0428	0.053
	0.8661	1.1811	1.024	1.0236	0.012			4540	8230				0.117
	22	35	16	29	0.3	RNAO22X35X16	SNSH22,5X35X0,5	19.1	23.3	21000	13000	0.0299	0.059
22	22	35	32	29	0.3	RNAO22X35X32	SNSH22,5X35X0,5	32.7	46.5	21000	13000	0.0423	0.116
	0.8661	1.3780	1.260	1.1417	0.012			7350	10500				0.256
	25	25	35	17	30	0.3	RNAO25X35X17	SNSH25,5X35X0,5	18.8	29.8	17000	11000	0.0351
25	25	35	26	30	0.3	RNAO25X35X26	SNSH25,5X35X0,5	25.0	42.8	17000	11000	0.0456	0.076
	0.9843	1.3780	1.024	1.1811	0.012			5620	9620				0.168
	25	37	16	32	0.3	RNAO25X37X16	SNSH25,5X37X0,5	19.8	25.3	18000	12000	0.0323	0.058
25	25	37	32	32	0.3	RNAO25X37X32	SNSH25,5X37X0,5	19.2	23.6	18000	12000	0.0455	0.118
	0.9843	1.4567	1.260	1.2598	0.012			4320	5310				0.260
	28	28	40	16	35	0.3	RNAO28X40X16	SNSH28,5X40X0,5	20.9	27.9	16000	10000	0.0347
28	28	40	32	35	0.3	RNAO28X40X32	SNSH28,5X40X0,5	35.8	55.9	16000	10000	0.0489	0.128
	1.1024	1.5748	1.260	1.3780	0.012			8050	12600				0.282
	30	30	40	17	35	0.3	RNAO30X40X17	SNSH30,5X40X0,5	20.2	34.6	14000	9300	0.0394
30	30	40	26	35	0.3	RNAO30X40X26	SNSH30,5X40X0,5	26.8	49.7	14000	9300	0.0512	0.088
	1.1811	1.5748	1.024	1.3780	0.012			6020	11200				0.194
	30	42	16	37	0.3	RNAO30X42X16		22.3	31.0	15000	9600	0.0366	0.069
30	30	42	32	37	0.3	RNAO30X42X32		38.2	62.1	15000	9600	0.0517	0.131
	1.1811	1.6535	1.260	1.4567	0.012			8590	14000				0.289
	35	35	45	17	40	0.3	RNAO35X45X17		22.1	40.8	12000	7900	0.0440
35	35	45	26	40	0.3	RNAO35X45X26		27.7	54.5	12000	7900	0.0561	0.091
	1.3780	1.7717	1.024	1.5748	0.012			6230	12300				0.201
	35	47	16	41	0.3	RNAO35X47X16	SNSH35,5X47X0,5	24.5	36.8	12000	8100	0.0404	0.075
35	35	47	32	42	0.3	RNAO35X47X32	SNSH35,5X47X0,5	42.0	73.5	12000	8100	0.0576	0.156
	1.3780	1.8504	1.260	1.6535	0.012			9440	16500				0.344
	40	40	50	17	45	0.3	RNAO40X50X17	SNSH40,5X50X0,5	23.8	47.0	11000	6900	0.0484
40	1.5748	1.9685	0.669	1.7717	0.012			5350	10600				0.190

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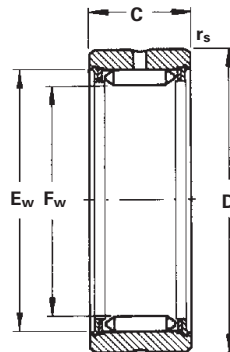
Shaft Dia.	Dimensions mm/in.					Bearing Designation	End Washer Designation	Load Ratings kN/lbf.		Limiting Speeds		C <sub>g</sub>	Approx. Wt. kg/lbs.
	F <sub>w</sub>	D	C	E <sub>w</sub>	r <sub>s</sub> min			Dynamic	Static	Oil	Grease		
mm								C	C <sub>0</sub>	RPM			
40	40	50	34	45	0.3	RNAO40X50X34	SNSH40,5X50X0,5	40.9	94.1	11000	6900	0.0575	0.152 0.335
	1.5748	1.9685	1.339	1.7717	0.012			9190	21200				
40	40	55	20	48	0.3	RNAO40X55X20	SNSH41X55X1	35.5	56.3	11000	7100	0.0472	0.139 0.306
	1.5748	2.1654	0.787	1.8898	0.012			7980	12700				
40	40	55	40	48	0.3	RNAO40X55X40	SNSH41X55X1	60.8	113	11000	7100	0.0666	0.276 0.608
	1.5748	2.1654	1.575	1.8898	0.012			13700	25400				
45	45	55	17	50	0.3	RNAO45X55X17	SNSH45,5X55X0,5	24.9	51.8	9400	6100	0.0523	0.089 0.196
	1.7717	2.1654	0.669	1.9685	0.012			5600	11600				
45	45	55	34	50	0.3	RNAO45X55X34	SNSH45,5X55X0,5	42.7	104	9400	6100	0.0737	0.168 0.370
	1.7717	2.1654	1.339	1.9685	0.012			9600	23400				
45	45	62	20	53	0.3	RNAO45X62X20	SNSH46X62X1	30.8	68.1	9400	6100	0.0504	0.163 0.359
	1.7717	2.4409	0.787	2.0866	0.012			6920	15300				
45	45	62	40	53	0.3	RNAO45X62X40	SNSH46X62X1	61.7	119	9600	6200	0.0711	0.325 0.717
	1.7717	2.4409	1.575	2.0866	0.012			13900	26800				
50	50	62	20	55	0.3	RNAO50X62X20		30.2	68.5	8400	5400	0.0588	0.142 0.313
	1.9685	2.4409	0.787	2.1654	0.012			6790	15400				
50	50	62	40	55	0.3	RNAO50X62X40		51.7	137	8400	5400	0.0829	0.269 0.593
	1.9685	2.4409	1.575	2.1654	0.012			11600	30800				
50	50	65	20	58	0.3	RNAO50X65X20	SNSH51X65X1	38.8	67.8	8600	5600	0.0545	0.167 0.368
	1.9685	2.5591	0.787	2.2835	0.012			8720	15200				
50	50	65	40	58	0.3	RNAO50X65X40		66.5	136	8600	5600	0.0769	0.342 0.754
	1.9685	2.5591	1.575	2.2835	0.012			14900	30600				
55	55	68	20	60	0.3	RNAO55X68X20		30.7	72.4	7600	4900	0.0622	0.165 0.364
	2.1654	2.6772	0.787	2.3622	0.012			6900	16300				
55	55	68	40	60	0.3	RNAO55X68X40		52.7	145	7600	4900	0.0878	0.320 0.705
	2.1654	2.6772	1.575	2.3622	0.012			11800	32600				
55	55	72	20	63	1.0	RNAO55X72X20	SNSH56X72X1	40.3	73.5	7800	5000	0.0580	0.212 0.467
	2.1654	2.8346	0.787	2.4803	0.039			9060	16500				
55	55	72	40	63	1.0	RNAO55X72X40	SNSH56X72X1	69.1	127	7800	5000	0.0818	0.433 0.955
	2.1654	2.8346	1.575	2.4803	0.039			15500	28600				
60	60	78	20	68	1.0	RNAO60X78X20	SNSH61X78X1	41.8	79.2	7100	4600	0.0614	0.230 0.507
	2.3622	3.0709	0.787	2.6772	0.039			9400	17800				
60	60	78	40	68	1.0	RNAO60X78X40	SNSH61X78X1	71.7	158	7100	4600	0.0867	0.436 0.961
	2.3622	3.0709	1.575	2.6772	0.039			16100	35500				
65	65	85	30	73	1.0	RNAO65X85X30	SNSH66X85X1	60.1	129	6500	4200	0.0719	0.468 1.032
	2.5591	3.3465	1.181	2.8740	0.039			13500	29000				
65	65	85	60	73	1.0	RNAO65X85X60	SNSH66X85X1	103	259	6500	4200	0.1015	0.876 1.931
	2.5591	3.3465	2.362	2.8740	0.039			23200	58200				
70	70	90	30	78	1.0	RNAO70X90X30		62.2	139	6000	3900	0.0757	0.505 1.113
	2.7559	3.5433	1.181	3.0709	0.039			14000	31200				
70	70	90	60	78	1.0	RNAO70X90X60		107	277	6000	3900	0.1068	0.925 2.039
	2.7559	3.5433	2.362	3.0709	0.039			24100	62300				
75	75	95	30	83	1.0	RNAO75X95X30		60.9	138	5600	3600	0.0780	0.510 1.124
	2.9528	3.7402	1.181	3.2677	0.039			13700	31000				
75	75	95	60	83	1.0	RNAO75X95X60		104	277	5600	3600	0.1101	0.980 2.161
	2.9528	3.7402	2.362	3.2677	0.039			23400	62300				
80	80	100	30	88	1.0	RNAO80X100X30		67.5	161	5200	3400	0.0835	0.580 1.279
	3.1496	3.9370	1.181	3.4646	0.039			15200	36200				
80	80	100	60	88	1.0	RNAO80X100X60		116	322	5200	3400	0.1178	1.044 2.30
	3.1496	3.9370	2.362	3.4646	0.039			26100	72400				
85	85	105	30	93	1.0	RNAO85X105X30		69.4	170	4600	3000	0.0870	0.586 1.292
	3.3465	4.1339	1.181	3.6614	0.039			15600	38200				
100	100	120	30	108	1.0	RNAO100X120X30		72.4	191	4200	2700	0.0965	0.660 1.455
	3.9370	4.7244	1.181	4.2520	0.039			16300	42900				





## NEEDLE ROLLER BEARINGS FULL COMPLEMENT WITHOUT INNER RINGS METRIC SERIES

- Check for availability.



Shaft Diameter	Dimensions mm/in.					Bearing Designation	Load Ratings kN/lbf.		Limiting Speeds		Approx. Wt. kg/lbs.	
	F <sub>w</sub>	D	C	E <sub>w</sub>	r <sub>s</sub> min		Dynamic C	Static C <sub>0</sub>	Oil RPM	Grease RPM		C <sub>g</sub>
7.3	7.3 0.2874	16 0.6299	12 0.472	12.3 0.4843	0.35 0.014	RNA 1005	3.95 888	4.45 1000	34000	52000	0.0134	0.010 0.022
9.7	9.7 0.3819	19 0.7480	12 0.472	14.7 0.5787	0.35 0.014	RNA 1007	4.80 1080	5.90 1330	25000	39000	0.0160	0.013 0.029
12.1	12.1 0.4764	22 0.8661	12 0.472	17.1 0.6732	0.35 0.014	RNA 1009	5.60 1260	7.40 1660	20000	31000	0.0184	0.018 0.040
14.4	14.4 0.5669	24 0.9449	12 0.472	19.4 0.7638	0.35 0.014	RNA 1010	6.35 1430	8.90 2000	17000	26000	0.0206	0.020 0.044
17.6	17.6 0.6929	28 1.1024	15 0.591	22.6 0.8898	0.35 0.014	RNA 1012	11.0 2470	16.5 3710	14000	22000	0.0261	0.034 0.075
20.8	20.8 0.8189	32 1.2598	15 0.591	25.8 1.0157	0.65 0.026	RNA 1015	12.4 2790	19.5 4380	12000	18000	0.0292	0.044 0.097
22.1	22.1 0.8701	35 1.3780	22 0.866	28.1 1.1063	0.65 0.026	RNA 2015	23.5 5280	37.5 8430	11000	17000	0.0345	0.082 0.181
23.9	23.9 0.9409	35 1.3780	15 0.591	28.9 1.1378	0.65 0.026	RNA 1017	13.7 3080	22.5 5060	10000	16000	0.0321	0.047 0.104
28.7	28.7 1.1299	42 1.6535	18 0.709	34.7 1.3661	0.65 0.026	RNA 1020	19.3 4340	33.5 7530	8600	13000	0.0374	0.084 0.185
	28.7 1.1299	42 1.6535	22 0.866	34.7 1.3661	0.65 0.026	RNA 2020	28.5 6410	49.0 11000	8600	13000	0.0411	0.104 0.229
33.5	33.5 1.3189	47 1.8504	18 0.709	39.5 1.5551	0.65 0.026	RNA 1025	21.5 4830	39.0 8770	7200	11000	0.0415	0.097 0.214
	33.5 1.3189	47 1.8504	22 0.866	39.5 1.5551	0.65 0.026	RNA 2025	33.0 7420	60.0 13500	7200	11000	0.0457	0.122 0.269
	33.5 1.3189	47 1.8504	30 1.181	39.5 1.5551	0.65 0.026	RNA 22025	52.0 11700	94.0 21100	7200	11000	0.0537	0.170 0.375
38.2	38.2 1.5039	52 2.0472	18 0.709	44.2 1.7402	0.65 0.026	RNA 1030	23.5 5280	44.5 10000	6500	10000	0.0455	0.107 0.236
	38.2 1.5039	52 2.0472	22 0.866	44.2 1.7402	0.65 0.026	RNA 2030	34.5 7760	66.0 14800	6500	10000	0.0501	0.139 0.306
	38.2 1.5039	52 2.0472	30 1.181	44.2 1.7402	0.65 0.026	RNA 22030	57.0 12800	108 24300	6500	10000	0.0588	0.193 0.425
44	44 1.7323	58 2.2835	18 0.709	50.0 1.9685	0.65 0.026	RNA 1035	26.0 5850	51.0 11500	5600	8600	0.0552	0.127 0.280
	44 1.7323	58 2.2835	22 0.866	50.0 1.9685	0.65 0.026	RNA 2035	38.0 8540	75.0 16900	5600	8600	0.0552	0.160 0.353
	44 1.7323	58 2.2835	30 1.181	50.0 1.9685	0.65 0.026	RNA 22035	63.0 14200	124 27900	5600	8600	0.0686	0.225 0.496
	44 1.7323	62 2.4409	30 1.181	51.0 2.0094	0.65 0.026	RNA 3030	64.0 14400	125 28100	5600	8600	0.0607	0.309 0.681
49.7	49.7 1.9567	65 2.5591	18 0.709	55.7 2.1929	0.85 0.033	RNA 1040	28.5 6410	58.0 13000	4900	7600	0.0546	0.160 0.353
	49.7 1.9567	65 2.5591	22 0.866	55.7 2.1929	0.65 0.026	RNA 2040	41.5 9330	85.0 19100	4900	7600	0.0601	0.200 0.441

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Shaft Diameter	Dimensions mm/in.					Bearing Designation	Load Ratings kN/lbf.		Limiting Speeds		Approx. Wt. kg/lbs.	
	mm	F <sub>w</sub>	D	C	E <sub>w</sub>		r <sub>s</sub> min	Dynamic C	Static C <sub>0</sub>	Oil RPM		Grease RPM
	49.7	65	30	55.7	0.65	RNA 22040	68.0	140	4900	7600	0.0707	0.278
	1.9567	2.5591	1.181	2.1929	0.026		15300	31500				
	49.7	72	36	56.8	0.65	RNA 3035	90.0	183	4900	7600	0.0704	0.545
	1.9567	2.8346	1.417	2.2346	0.026		20200	41100				
55.4	55.4	72	18	61.4	0.85	RNA 1045	30.5	65.0	4500	6900	0.0590	0.193
	2.1811	2.8346	0.709	2.4173	0.033		6860	14600				
	55.4	72	22	61.4	0.85	RNA 2045	45.0	95.0	4500	6900	0.0649	0.242
	2.1811	2.8346	0.866	2.4173	0.033		10100	21400				
	55.4	80	36	62.5	0.85	RNA 3040	97.0	204	4500	6900	0.0759	0.672
	2.1811	3.1496	1.417	2.4591	0.033		21800	45900				
62.1	62.1	80	20	68.1	0.85	RNA 1050	33.0	73.0	4000	6100	0.0639	0.255
	2.4449	3.1496	0.787	2.6811	0.033		7420	16400				
	62.1	80	28	68.1	0.85	RNA 2050	64.0	142	4000	6100	0.0754	0.375
	2.4449	3.1496	1.102	2.6811	0.033		14400	31900				
	62.1	85	38	69.2	0.85	RNA 3045	105	230	4000	6100	0.0823	0.710
	2.4449	3.3465	1.496	2.7228	0.033		23600	51700				
68.8	68.8	85	20	74.8	0.85	RNA 1055	35.5	80.0	3600	5500	0.0687	0.258
	2.7087	3.3465	0.787	2.9449	0.033		7980	18000				
	68.8	85	28	74.8	0.85	RNA 2055	69.0	157	3600	5500	0.0810	0.361
	2.7087	3.3465	1.102	2.9449	0.033		15500	35300				
	68.8	90	38	75.9	0.85	RNA 3050	113	255	3600	5500	0.0885	0.705
	2.7087	3.5433	1.496	2.9866	0.033		25400	57300				
72.6	72.6	90	20	78.6	0.85	RNA 1060	37.0	85.0	3400	5200	0.0714	0.283
	2.8583	3.5433	0.787	3.0945	0.033		8320	19100				
	72.6	90	28	78.6	0.85	RNA 2060	72.0	165	3400	5200	0.0842	0.413
	2.8583	3.5433	1.102	3.0945	0.033		16200	37100				
	72.6	95	38	79.6	0.85	RNA 3055	117	268	3400	5200	0.0811	0.782
	2.8583	3.7402	1.496	3.1339	0.033		26300	60200				
78.3	78.3	95	20	84.3	0.85	RNA 1065	41.5	97.0	3200	4900	0.0751	0.306
	3.0827	3.7402	0.787	3.3189	0.033		9330	21800				
	78.3	95	28	84.3	0.85	RNA 2065	78.0	184	3200	4900	0.0887	0.433
	3.0827	3.7402	1.102	3.3189	0.033		17500	41400				
	78.3	100	38	85.3	0.85	RNA 3060	123.0	290	3200	4900	0.0966	0.810
	3.0827	3.9370	1.496	3.3583	0.033		27700	65200				
83.1	83.1	100	20	89.1	0.85	RNA 1070	43.0	103	2900	4500	0.0784	0.322
	3.2717	3.9370	0.787	3.5079	0.033		9670	23200				
	83.1	100	28	89.1	0.85	RNA 2070	81.0	195	2900	4500	0.0926	0.470
	3.2717	3.9370	1.102	3.5079	0.033		18200	43800				
	83.1	105	38	90.2	0.85	RNA 3065	129	308	2900	4500	0.1012	0.865
	3.2717	4.1339	1.496	3.5496	0.033		29000	69200				
88	88	110	24	95.0	0.85	RNA 1075	64.0	155	2800	4300	0.0864	0.577
	3.4646	4.3307	0.945	3.7402	0.033		14400	34800				
	88	110	32	95.0	0.85	RNA 2075	104	253	2800	4300	0.0983	0.767
	3.4646	4.3307	1.260	3.7402	0.033		23400	56900				
	88	110	38	95.0	0.85	RNA 3070	134	325	2800	4300	0.1050	0.906
	3.4646	4.3307	1.496	3.7402	0.033		30100	73100				
96	96	115	24	103.0	0.85	RNA 1080	68.0	170	2600	4000	0.0918	0.510
	3.7795	4.5276	0.945	4.0551	0.033		15300	38200				
	96	115	32	103.0	0.85	RNA 2080	110	275	2600	4000	0.1045	0.694
	3.7795	4.5276	1.254	4.0551	0.033		24700	61800				
	96	120	38	103.0	0.85	RNA 3075	142	355	2600	4000	0.1117	1.098
	3.7795	4.7244	1.496	4.0551	0.033		31900	79800				
99.5	99.5	120	32	106.5	1.35	RNA 2085	113	285	2500	3800	0.1072	0.787
	3.9173	4.7244	1.260	4.1929	0.053		25400	64100				
	99.5	125	38	106.5	0.85	RNA 3080	145	365	2500	3800	0.1145	1.220
	3.9173	4.9213	1.496	4.1929	0.033		32600	82100				
104.7	104.7	125	32	111.7	1.35	RNA 2090	117	300	2300	3600	0.1113	0.837
	4.1220	4.9213	1.260	4.3976	0.053		26300	67400				

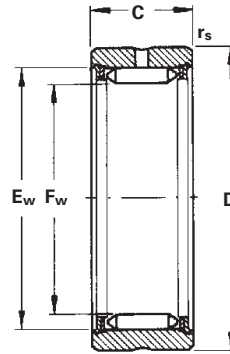
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## NEEDLE ROLLER BEARINGS FULL COMPLEMENT WITHOUT INNER RINGS — *continued*

### METRIC SERIES

- Check for availability.



Shaft Diameter	Dimensions mm/in.					Bearing Designation	Load Ratings kN/lbf.		Limiting Speeds		Approx. Wt. kg/lbs.	
	F <sub>w</sub>	D	C	E <sub>w</sub>	r <sub>s min</sub>		Dynamic C	Static C <sub>0</sub>	Oil Grease RPM	C <sub>g</sub>		
104.7	104.7	130	38	111.7	1.35	RNA 3085	150	390	2300	3600	0.1189	1.252
	4.1220	5.1181	1.496	4.3976	0.053		33700	87700				
109.1	109.1	130	32	116.1	1.35	RNA 2095	120	315	2300	3500	0.1225	0.882
	4.2953	5.1181	1.260	4.5709	0.053		27000	70800				
109.1	109.1	135	43	116.1	1.35	RNA 3090	185	480	2300	3500	0.1280	1.522
	4.2953	5.3150	1.693	4.5709	0.053		41600	108000				
114.7	114.7	135	32	121.7	1.35	RNA 2100	125	330	2100	3300	0.1188	0.677
	4.5157	5.3150	1.260	4.7913	0.053		28100	74200				
114.7	114.7	140	43	121.7	1.35	RNA 3095	190	505	2100	3300	0.1327	1.551
	4.5157	5.5118	1.693	4.7913	0.053		42700	114000				
119.2	119.2	140	32	126.2	1.35	RNA 2105	129	340	2100	3200	0.1221	0.941
	4.6929	5.5118	1.260	4.9685	0.053		29000	76400				
119.2	119.2	145	43	126.2	1.35	RNA 3100	195	520	2100	3200	0.1364	1.645
	4.6929	5.7087	1.693	4.9685	0.053		43800	117000				
124.5	124.5	145	34	131.5	1.35	RNA 2110	133	360	2000	3000	0.1260	1.015
	4.9016	5.7087	1.339	5.1772	0.053		29900	80900				
124.5	124.5	150	45	131.5	1.35	RNA 3105	203	550	2000	3000	0.1408	1.762
	4.9016	5.9055	1.772	5.1772	0.053		45600	124000				
132.5	132.5	155	34	139.5	1.35	RNA 2115	139	380	1900	2900	0.1318	1.205
	5.2165	6.1024	1.339	5.4921	0.053		31200	85400				
132.5	132.5	160	45	139.5	1.35	RNA 3110	210	580	1900	2900	0.1471	2.037
	5.2165	6.2992	1.772	5.4921	0.053		47200	130000				
137	137	160	34	144.0	1.35	RNA 2120	142	395	1800	2800	0.1350	1.265
	5.3937	6.2992	1.339	5.6693	0.053		31900	88800				
137	137	165	45	144.0	1.35	RNA 3115	215	600	1800	2800	0.1507	2.140
	5.3937	6.4961	1.772	5.6693	0.053		48300	135000				
143.5	143.5	165	34	150.5	1.35	RNA 2125	145	410	1800	2700	0.1403	1.218
	5.6496	6.4961	1.339	5.9268	0.053		32600	92200				
143.5	143.5	170	45	150.5	1.35	RNA 3120	224	630	1800	2700	0.1563	2.107
	5.6496	6.6929	1.772	5.9268	0.053		50400	142000				
148	148	170	34	155.0	1.35	RNA 2130	150	425	1700	2600	0.1435	1.292
	5.8268	6.6929	1.339	6.1039	0.053		33700	95500				
158	158	180	36	165.0	1.35	RNA 2140	157	455	1600	2400	0.1504	1.478
	6.2205	7.0866	1.417	6.4976	0.053		35300	102000				
158	158	190	52	166.0	1.35	RNA 3130	275	790	1600	2400	0.1691	3.285
	6.2205	7.4803	2.047	6.5354	0.053		61800	178000				
170.5	170.5	195	36	177.5	1.35	RNA 2150	165	490	1400	2200	0.1591	1.790
	6.7126	7.6772	1.417	6.9882	0.053		37100	110000				
170.5	170.5	205	52	178.5	1.35	RNA 3140	290	860	1400	2200	0.1787	3.840
	6.7126	8.0709	2.047	7.0276	0.053		65200	193000				
179.3	179.3	205	36	186.3	1.35	RNA 2160	170	515	1400	2100	0.1650	1.970
	7.0591	8.0709	1.417	7.3346	0.053		38200	116000				
179.3	179.3	215	52	187.3	1.35	RNA 3150	300	900	1400	2100	0.1904	4.185
	7.0591	8.4646	2.047	7.3756	0.053		67400	202000				

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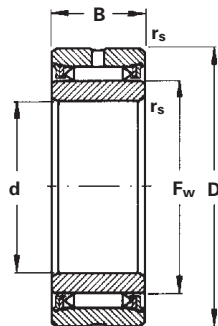




# NEEDLE ROLLER BEARINGS

## NEEDLE ROLLER BEARINGS FULL COMPLEMENT WITH INNER RINGS METRIC SERIES

- Check for availability.



Shaft Diameter	Dimensions mm/in.					Bearing Designation	Load Ratings kN/lbf.		Limiting Speeds		Approx. Wt. kg/lbs.	
	F <sub>w</sub>	D	B	E <sub>w</sub>	r <sub>s</sub> min		Dynamic C	Static C <sub>0</sub>	Oil Grease RPM	C <sub>B</sub>		
12	12	28	15	17.6	0.35	NA 1012*	11.0	16.5	14000	22000	0.0261	0.050
	0.4724	1.1024	0.591	0.6929	0.014		2470	3710				
15	15	32	15	20.8	0.65	NA 1015*	12.4	19.5	12000	18000	0.0292	0.044
	0.5906	1.2598	0.591	0.8189	0.026		2790	4380				
15	15	35	22	22.1	0.65	NA 2015	23.5	37.5	11000	17000	0.0345	0.082
	0.5906	1.3780	0.866	0.8701	0.026		5280	8430				
17	17	35	15	23.9	0.65	NA 1017*	13.7	22.5	10000	16000	0.0321	0.047
	0.6693	1.3780	0.591	0.9409	0.026		3080	5060				
20	20	42	18	28.7	0.65	NA 1020	19.3	33.5	8600	13000	0.0374	0.084
	0.7874	1.6535	0.709	1.1299	0.026		4340	7530				
20	20	42	22	28.7	0.65	NA 2020	28.5	49.0	8600	13000	0.0411	0.104
	0.7874	1.6535	0.866	1.1299	0.026		6410	11000				
25	25	47	18	33.5	0.65	NA 1025	21.5	39.0	7200	11000	0.0415	0.097
	0.9843	1.8504	0.709	1.3189	0.026		4830	8770				
25	25	47	22	33.5	0.65	NA 2025	33.0	60.0	7200	11000	0.0457	0.122
	0.9843	1.8504	0.866	1.3189	0.026		7420	13500				
25	25	47	30	33.5	0.65	NA 22025	52.0	94.0	7200	11000	0.0537	0.170
	0.9843	1.8504	1.181	1.3189	0.026		11700	21100				
30	30	52	18	38.2	0.65	NA 1030	23.5	44.5	6500	10000	0.0455	0.107
	1.1811	2.0472	0.709	1.5039	0.026		5280	10000				
30	30	52	22	38.2	0.65	NA 2030	34.5	66.0	6500	10000	0.0501	0.139
	1.1811	2.0472	0.866	1.5039	0.026		7760	14800				
30	30	52	30	38.2	0.65	NA 22030	57.0	108	6500	10000	0.0588	0.193
	1.1811	2.0472	1.181	1.5039	0.026		12800	24300				
30	30	62	30	44.0	0.65	NA 3030	64.0	125	5600	8600	0.0607	0.309
	1.1811	2.4409	1.181	1.7323	0.026		14400	28100				
35	35	58	18	44.0	0.65	NA 1035	26.0	51.0	5600	8600	0.0552	0.127
	1.3780	2.2835	0.709	1.7323	0.026		5850	11500				
35	35	58	22	44.0	0.65	NA 2035	38.0	75.0	5600	8600	0.0552	0.160
	1.3780	2.2835	0.866	1.7323	0.026		8540	16900				
35	35	58	30	44.0	0.65	NA 22035	63.0	124	5600	8600	0.0686	0.225
	1.3780	2.2835	1.181	1.7323	0.026		14200	27900				
35	35	72	36	50.0	0.65	NA 3035	90.0	183	4900	7600	0.0706	0.545
	1.3780	2.8346	1.417	1.9685	0.026		20200	41100				
40	40	65	18	49.7	0.85	NA 1040	28.5	58.0	4900	7600	0.0546	0.160
	1.5748	2.5591	0.709	1.9567	0.033		6410	13000				
40	40	65	22	49.7	0.85	NA 2040	41.5	85.0	4900	7600	0.0601	0.200
	1.5748	2.5591	0.866	1.9567	0.033		9330	19100				
40	40	65	30	49.7	0.85	NA 22040	68.0	140	4900	7600	0.0707	0.278
	1.5748	2.5591	1.181	1.9567	0.033		15300	31500				
40	40	80	36	55.4	0.85	NA 3040	97.0	204	4500	6900	0.0759	0.672
	1.5748	3.1496	1.417	2.1811	0.033		21800	45900				
45	45	72	18	55.4	0.85	NA 1045	30.5	65.0	4500	6900	0.0590	0.193
	1.7717	2.8346	0.709	2.1811	0.033		6860	14600				

\* No lubrication holes.

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Shaft Diameter	Dimensions mm/in.					Bearing Designation	Load Ratings kN/lbf.		Limiting Speeds		Approx. Wt. kg/lbs.	
	mm	F <sub>w</sub>	D	B	E <sub>w</sub>		r <sub>s</sub> min	Dynamic C	Static C <sub>0</sub>	Oil RPM		Grease RPM
	45	72	22	55.4	0.85	NA 2045	45.0	95.0	4500	6900	0.0649	0.242
	1.7717	2.8346	0.866	2.1811	0.033		10100	21400				0.534
	45	85	38	62.1	0.85	NA 3045	105.0	230	4000	6100	0.0823	0.710
	1.7717	3.3465	1.496	2.4449	0.033		23600	51700				1.565
50	50	80	20	62.1	0.85	NA 1050	33.0	73.0	4000	6100	0.0639	0.255
	1.9685	3.1496	0.787	2.4449	0.033		7420	16400				0.562
	50	80	28	62.1	0.85	NA 2050	64.0	142	4000	6100	0.0754	0.375
	1.9685	3.1496	1.102	2.4449	0.033		14400	31900				0.827
	50	90	38	68.8	0.85	NA 3050	113.0	255	3600	5500	0.0885	0.705
	1.9685	3.5433	1.496	2.7087	0.033		25400	57300				1.554
55	55	85	20	68.8	0.85	NA 1055	35.5	80.0	3600	5500	0.0687	0.258
	2.1654	3.3465	0.787	2.7087	0.033		7980	18000				0.569
	55	85	28	68.8	0.85	NA 2055	69.0	157	3600	5500	0.0810	0.361
	2.1654	3.3465	1.102	2.7087	0.033		15500	35300				0.796
	55	95	38	72.6	0.85	NA 3055	117.0	268	3400	5200	0.0811	0.782
	2.1654	3.7402	1.496	2.8583	0.033		26300	60200				1.724
60	60	90	20	72.6	0.85	NA 1060	37.0	85.0	3400	5200	0.0714	0.283
	2.3622	3.5433	0.787	2.8583	0.033		8320	19100				0.624
	60	90	28	72.6	0.85	NA 2060	72.0	165	3400	5200	0.0842	0.413
	2.3622	3.5433	1.102	2.8583	0.033		16200	37100				0.911
	60	100	38	78.3	0.85	NA 3060	123.0	290	3200	4900	0.0966	0.810
	2.3622	3.9370	1.496	3.0827	0.033		27700	65200				1.786
65	65	95	28	78.3	0.85	NA 2065	78.0	184	3200	4900	0.0887	0.433
	2.5591	3.7402	1.102	3.0827	0.033		17500	41400				0.955
	65	105	38	83.1	0.85	NA 3065	129.0	308	2900	4500	0.1012	0.865
	2.5591	4.1339	1.496	3.2717	0.033		29000	69200				1.907
70	70	100	20	83.1	0.85	NA 1070	43.0	103	2900	4500	0.0784	0.322
	2.7559	3.9370	0.787	3.2717	0.033		9670	23200				0.710
	70	100	28	83.1	0.85	NA 2070	81.0	195	2900	4500	0.0926	0.470
	2.7559	3.9370	1.102	3.2717	0.033		18200	43800				1.036
	70	110	38	88.0	0.85	NA 3070	134.0	325	2800	4300	0.1050	0.906
	2.7559	4.3307	1.496	3.4646	0.033		30100	73100				1.997
75	75	110	32	88.0	0.85	NA 2075	104.0	253	2800	4300	0.0983	0.767
	2.9528	4.3307	1.260	3.4646	0.033		23400	56900				1.691
	75	120	38	96.0	0.85	NA 3075	142.0	355	2600	4000	0.1117	1.098
	2.9528	4.7244	1.496	3.7795	0.033		31900	79800				2.421
80	80	115	24	96.0	0.85	NA 1080	68.0	170	2600	4000	0.0918	0.510
	3.1496	4.5276	0.945	3.7795	0.033		15300	38200				1.124
	80	115	32	96.0	0.85	NA 2080	110.0	275	2600	4000	0.1045	0.694
	3.1496	4.5276	1.254	3.7795	0.033		24700	61800				1.530
	80	125	38	99.5	0.85	NA 3080	145.0	365	2500	3800	0.1145	1.220
	3.1496	4.9213	1.496	3.9173	0.033		32600	82100				2.690
85	85	120	32	99.5	1.35	NA 2085	113.0	285	2500	3800	0.1072	0.787
	3.3465	4.7244	1.260	3.9173	0.053		25400	64100				1.735
	85	130	38	104.7	1.35	NA 3085	150.0	390	2300	3600	0.1189	1.252
	3.3465	5.1181	1.496	4.1220	0.053		33700	87700				2.760
90	90	125	32	104.7	1.35	NA 2090	117.0	300	2300	3600	0.1113	0.837
	3.5433	4.9213	1.260	4.1220	0.053		26300	67400				1.845
	90	135	43	109.7	1.35	NA 3090	185.0	480	2300	3500	0.1283	1.522
	3.5433	5.3150	1.693	4.3189	0.053		41600	108000				3.355
95	95	130	32	109.1	1.35	NA 2095	120.0	315	2300	3500	0.1225	0.882
	3.7402	5.1181	1.260	4.2953	0.053		27000	70800				1.944
	95	140	43	114.7	1.35	NA 3095	190.0	505	2100	3300	0.1327	1.551
	3.7402	5.5118	1.693	4.5157	0.053		42700	114000				3.419
100	100	135	32	114.7	1.35	NA 2100	125.0	330	2100	3300	0.1188	0.677
	3.9370	5.3150	1.260	4.5157	0.053		28100	74200				1.493
	100	145	43	119.2	1.35	NA 3100	195.0	520	2100	3200	0.1364	1.645
	3.9370	5.7087	1.693	4.6929	0.053		43800	117000				3.627

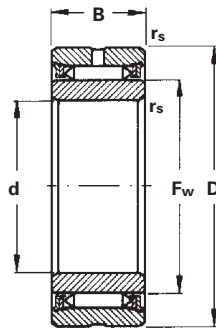
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## NEEDLE ROLLER BEARINGS FULL COMPLEMENT WITH INNER RINGS – *continued*

### METRIC SERIES

- Check for availability.



Shaft Diameter	Dimensions mm/in.					Bearing Designation	Load Ratings kN/lbf.		Limiting Speeds		Approx. Wt. kg/lbs.	
	F <sub>w</sub>	D	B	E <sub>w</sub>	r <sub>s min</sub>		Dynamic C	Static C <sub>0</sub>	Oil Grease RPM	C <sub>g</sub>		
105	105	140	32	119.2	1.35	NA 2105	129.0	340	2100	3200	0.1221	0.941
	4.1339	5.5118	1.260	4.6929	0.053		29000	76400				
105	105	150	45	124.7	1.35	NA 3105	203.0	550	2000	3000	0.1409	1.762
	4.1339	5.9055	1.772	4.9094	0.053		45600	124000				
110	110	145	34	124.7	1.35	NA 2110	133.0	360	2000	3000	0.1261	1.015
	4.3307	5.7087	1.339	4.9094	0.053		29900	80900				
110	110	160	45	132.5	1.35	NA 3110	210.0	580	1900	2900	0.1471	2.037
	4.3307	6.2992	1.772	5.2165	0.053		47200	130000				
115	115	155	34	132.5	1.35	NA 2115	139.0	380	1900	2900	0.1318	1.205
	4.5276	6.1024	1.339	5.2165	0.053		31200	85400				
115	115	165	45	137.0	1.35	NA 3115	215.0	600	1800	2800	0.1507	2.140
	4.5276	6.4961	1.772	5.3937	0.053		48300	135000				
120	120	160	34	137.0	1.35	NA 2120	142.0	395	1800	2800	0.1350	1.265
	4.7244	6.2992	1.339	5.3937	0.053		31900	88800				
120	120	170	45	143.5	1.35	NA 3120	224.0	630	1800	2700	0.1563	2.107
	4.7244	6.6929	1.772	5.6496	0.053		50400	142000				
125	125	165	34	143.5	1.35	NA 2125	145.0	410	1800	2700	0.1403	1.218
	4.9213	6.4961	1.339	5.6496	0.053		32600	92200				
130	130	170	34	148.0	1.35	NA 2130	150.0	425	1700	2600	0.1435	1.292
	5.1181	6.6929	1.339	5.8268	0.053		33700	95500				
140	140	180	36	158.0	1.35	NA 2140	157.0	455	1600	2400	0.1504	1.478
	5.5118	7.0866	1.417	6.2205	0.053		35300	102000				
140	140	205	52	170.5	1.35	NA 3140	290.0	860	1400	2200	0.1787	3.840
	5.5118	8.0709	2.047	6.7126	0.053		65200	193000				
150	150	195	36	170.5	1.35	NA 2150	165.0	490	1400	2200	0.1591	1.790
	5.9055	7.6772	1.417	6.7126	0.053		37100	110000				
160	160	205	36	179.3	1.35	NA 2160	170.0	515	1400	2100	0.1650	1.970
	6.2992	8.0709	1.417	7.0591	0.053		38200	116000				
170	170	220	42	193.8	1.35	NA 2170	233.0	720	1300	2000	0.1852	2.570
	6.6929	8.6614	1.654	7.6299	0.053		52400	162000				
180	180	230	42	202.6	1.35	NA 2180	240.0	750	1200	1900	0.2145	2.835
	7.0866	9.0551	1.654	7.9764	0.053		54000	169000				
190	190	245	42	216.0	1.35	NA 2190	250.0	800	1200	1800	0.2004	3.210
	7.4803	9.6457	1.654	8.5039	0.053		56200	180000				
200	200	255	42	224.1	1.35	NA 2200	257.0	830	1100	1700	0.2057	3.560
	7.8740	10.0394	1.654	8.8228	0.053		57800	187000				





## DIMENSIONAL ACCURACY

### TOLERANCES AND BEARING CLEARANCE

Metric series cylindrical roller radial bearings are available in various tolerance classes and clearance groups. Single row cylindrical roller bearings are made to normal clearance group C0 although bearings with radial clearance groups C2, C3 and C4 may be obtained on request.

For tolerances of cylindrical roller bearings see page B336. For radial internal clearances of cylindrical roller radial bearings see page B336.

### ALIGNMENT

The modified line contact between the cylindrical rollers and raceways of cylindrical roller bearings reduces stress concentration at ends of the rollers and provides some aligning capability. The angular alignment of single row cylindrical roller bearings must not exceed a maximum of 4 angular minutes at a load of  $P/C < 0.2$  ( $P$  = equivalent dynamic load, kN.) At higher applied loads, or with presence of greater misalignment, consultation with your Timken representative is strongly encouraged.

### MOUNTING DIMENSIONS

The bearing inner and outer rings should be mounted against the stepped portion on the shaft and the shoulder of the housing. Under no circumstances should they interfere with the shaft or housing fillets. For this reason the maximum fillet radius  $r_{as\ max}$  of the mating component must be no greater than the minimum chamfer dimension of the corresponding cylindrical roller bearing ring corner  $r_{s\ min}$ .

The shoulder of the mating components must be such that, even with the maximum permissible single chamfer dimension of the corresponding bearing ring, there is an adequate contact surface area. Table 1 lists the maximum fillet radius  $r_{as\ max}$  and the minimum shoulder height. At high axial loads the ribs must be supported over half their height.

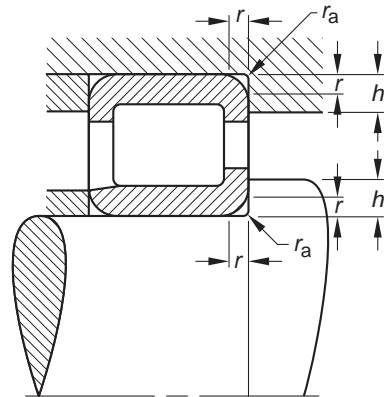
$$\left( \frac{H + E}{2} \text{ and } \frac{F + J}{2} \right)$$

where from bearing tables:

- F** raceway diameter of the inner ring
- E** raceway diameter of the outer ring
- J** rib diameter of the inner ring
- H** rib diameter of the outer ring

The shaft can be mounted and removed if the mounting dimensions shown in Table 2 on page C135 are observed.

TABLE 1 – ABUTMENT DIMENSIONS AS SPECIFIED IN DIN 5418 FOR METRIC SERIES BEARINGS



mm	Bearing series			
	10		2..E	3..E
			22..E	23..E
$r_{s\ min}$	$r_{as\ max}$	$h\ min$		
0.3	0.3	1	1.2	
0.6	0.6	1.6	2.1	
1	1	2.3	2.8	
1.1	1	3	3.5	
1.5	1.5	3.5	4.5	
2	2	4.4	5.5	
2.1	2.1	5.1	6	
3	2.5	6.2	7	
4	3	7.3	8.5	
5	4	9	10	
6	5	11.5	13	

See engineering section for shaft tolerances for cylindrical roller bearings with inner rings.

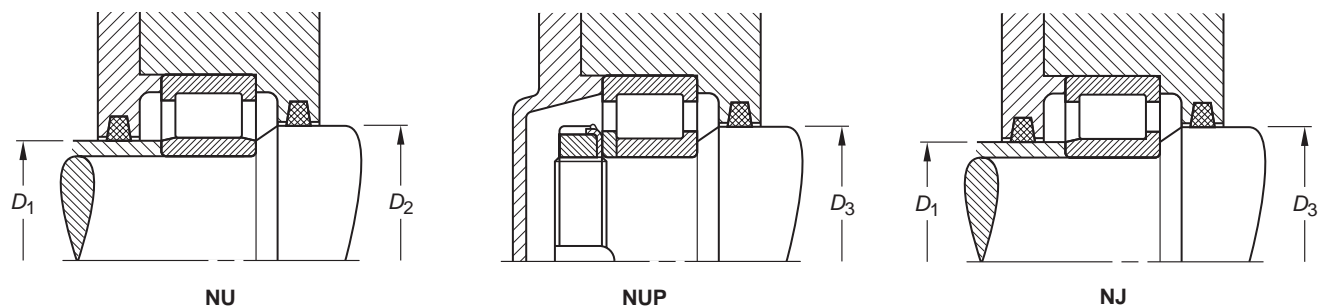


TABLE 2 – MOUNTING DIMENSIONS FOR METRIC SERIES SINGLE-ROW CYLINDRICAL ROLLER BEARINGS

Bore Reference Number	Shaft Diameter mm	Bearing Series 10							
		Max.	Min.	2..E 22..E Max.	Min.	Min.	3..E 23..E Max.	Min.	Min.
		D <sub>1</sub>	D <sub>2</sub>	D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>	D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>
02	15			20	23	26			
03	17			21	25	27	24	27	30
04	20	25	27	26	29	32	27	30	33
05	25	30	32	31	34	37	33	37	40
06	30	35	38	37	40	44	40	44	48
07	35	41	44	43	46	50	45	48	53
08	40	46	49	49	52	56	51	55	60
09	45	52	54	54	57	61	57	60	66
10	50	57	59	58	62	67	63	67	73
11	55	63	66	65	68	73	69	72	80
12	60	68	71	71	75	80	75	79	86
13	65	73	76	77	81	87	81	85	93
14	70	78	82	82	86	92	87	92	100
15	75	83	87	87	90	96	93	97	106
16	80	90	94	94	97	104	99	105	114





## LOAD RATINGS

### MAXIMUM CAPACITY BEARINGS

The maximum capacity cylindrical roller radial bearings are designated with a letter E in the suffix. The cylindrical rollers are designed for maximum load carrying capability and are available in bearings of series 2, 22, 3 and 23.

### EQUIVALENT DYNAMIC LOADS

For cylindrical roller bearings with purely radial applied load:

$$P = F_r \text{ (kN)}$$

P = Equivalent dynamic load (kN)

$F_r$  = The maximum dynamic radial load that may be applied to a cylindrical roller bearing based on the dynamic load rating C given in the tabular pages. This load should be  $\leq C/3$ .

If, in addition to the radial load, an axial load  $F_a$  acts on the bearing, this axial load is taken into consideration when calculating the life of a bearing (with  $F_a \leq F_{az}$ ;  $F_{az}$  is the allowable axial load).

Dimension Series	Load Ratio	Equivalent Dynamic Load
10, 2..E, 3..E	$F_a/F_r \leq 0.11$ $F_a/F_r > 0.11$	$P = F_r$ $P = 0.93 \cdot F_r + 0.69 \cdot F_a$
22..E, 23..E	$F_a/F_r \leq 0.17$ $F_a/F_r > 0.17$	$P = F_r$ $P = 0.93 \cdot F_r + 0.45 \cdot F_a$

### ALLOWABLE AXIAL LOAD

Metric series cylindrical roller bearings of NUP, NJ, as well as NU or NJ designs with a thrust collar can transmit axial loads if they are radially loaded at the same time. The allowable axial load ratio  $F_a/C$  of 0,1 maximum depends to a great extent on the magnitude of radial load, the operating speed, type of lubricant used, the operating temperature and heat transfer conditions at the bearing location. The heat balance achieved at the bearing location is used as a basis for determination of the allowable axial load.

The nomogram on page C137 should be used to determine the allowable axial load  $F_{az}$  based on the following operating conditions:

- The axial load is of constant direction and magnitude
- Radial load ratio  $F_r/C \leq 0.2$
- Ratio of axial load to radial load  $F_a/F_r < 0.4$
- The temperature of the bearing is 80° C at an ambient temperature of 20° C.
- Lubricating oil is ISO VG 100 using oil bath lubrication or circulating oil.
- As an alternative, the bearing may be lubricated with a grease using the above specified base oil and viscosity. Use of EP additives will be necessary, although considerably shorter relubrication intervals may be expected than with purely radially loaded cylindrical roller radial bearings.

### EXAMPLE OF USING THE NOMOGRAM

From the lower part of the nomogram, determine the intersection point of the inner ring bore diameter and the dimension series of the bearing. From the upper part, the allowable axial load ratio  $F_{az}/C$  can be found as a function of the operating speed, n.

For a cylindrical roller radial bearing **NU2207E.TVP**

$$C = 63 \text{ kN}; d = 35 \text{ mm}$$

$$n = 2000 \text{ RPM}$$

$$F_r = 10 \text{ kN}$$

From the nomogram:

$$F_{az}/C = 0.06$$

$$\text{Then } F_{az} = 0.06 \cdot 63$$

The calculated allowable axial load  $F_{az}$  is 3.78 kN

It should be noted that an axial load as high as that determined by means of the nomogram should not be applied if an oil of rated kinematic viscosity lower than ISO VG 100 is used. Suitable EP additives, which are known for fatigue life improving qualities, may allow for an increase in applied axial load subject to thorough testing.

### HIGHER APPLIED AXIAL LOADS

Axial loads greater than those determined by means of the nomogram may be considered, providing they are to be applied intermittently. Also, the bearing should be cooled using circulating oil lubrication and if the operating temperature, due to the internal friction and the higher axial load, exceeds 80° C, a more viscous oil must be used.

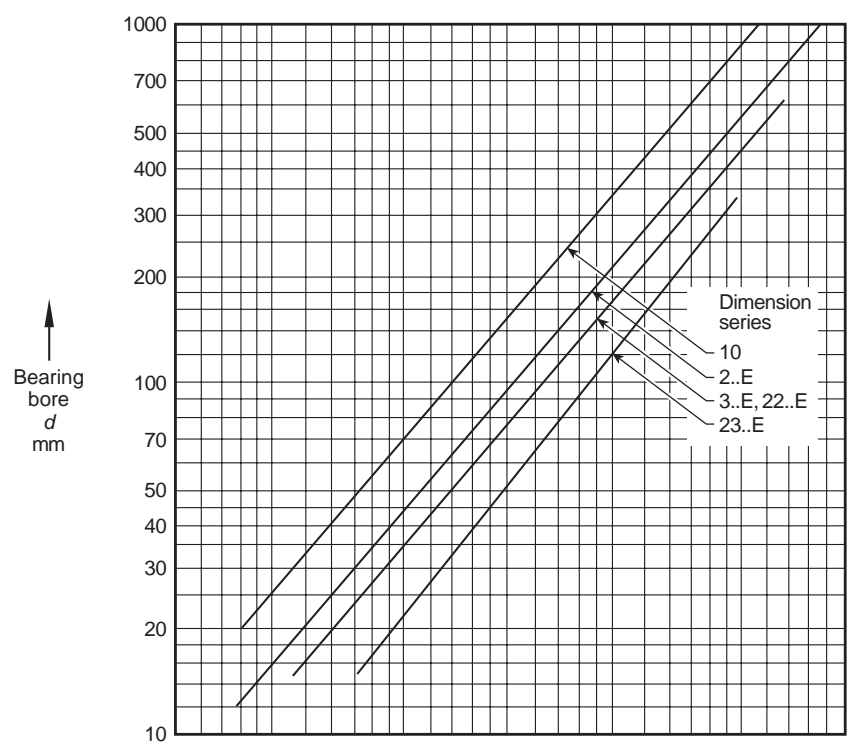
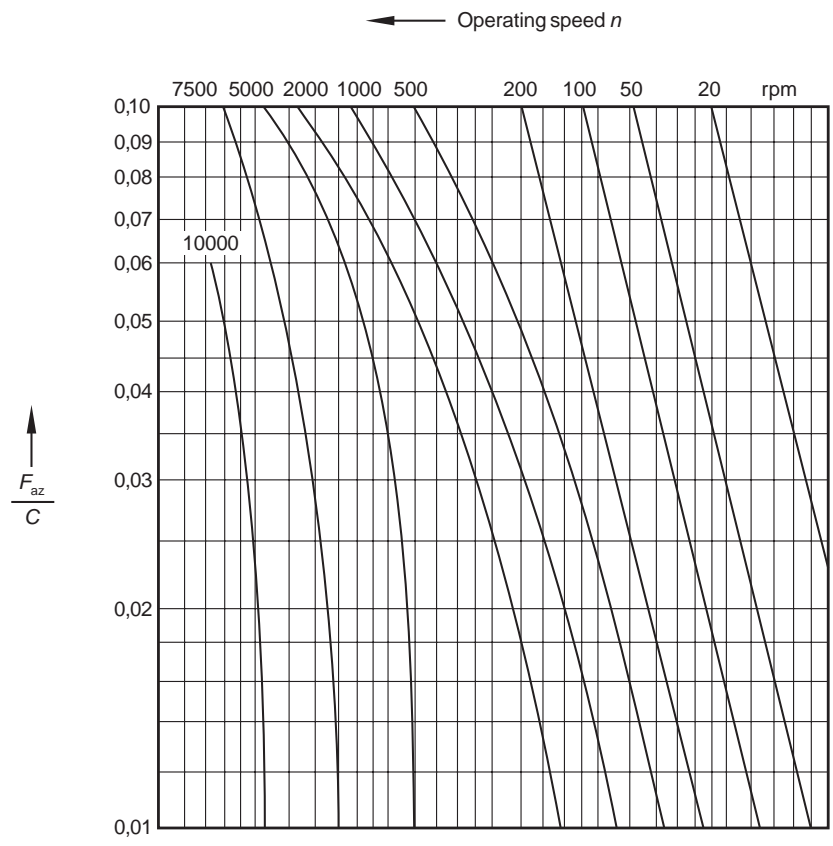
### EQUIVALENT STATIC LOAD

For cylindrical roller radial bearings with radially applied static loads

$$P_0 = F_r \text{ (kN)}$$

**FOR MORE INFORMATION ON CYLINDRICAL ROLLER TYPES NU, NUP AND NJ, SEE THE RADIAL CYLINDRICAL SECTION**

**NOMOGRAM FOR DETERMINING THE ALLOWABLE AXIAL LOAD  $F_{AZ}$**





## NEEDLE ROLLER BEARINGS –

### INCH SERIES

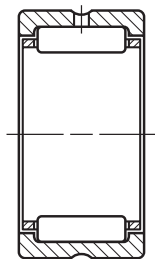
When there is a requirement for a rolling bearing to support very high dynamic, static or even shock loads with a restricted mounting space, the needle roller bearing may be found to give best results.

### REFERENCE STANDARDS ARE:

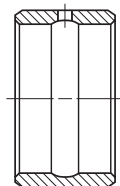
- **ANSI/ABMA Standard 18.2** – Needle Roller Bearings – Radial, Inch Design.
- **ASTM Standard F 2246** – Standard Specification for Bearing, Roller, Needle: Thick Outer Ring with Rollers and Cage.
- **Military Standard MS 51961** – Bearing, Roller, Needle: Thick Outer Ring with Rollers and Cage.

## C

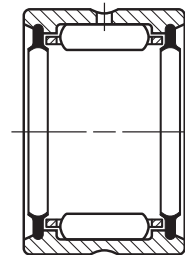
## IDENTIFICATION



HJ



IR



HJ – .2RS

The prefix letters HJ in the needle roller bearing designation denote that the bearing is manufactured to inch nominal dimensions.

Bearings are available with one or two lip contact seals as listed on pages C148-C149. One seal is designated by suffix letters RS. Two seals are designated by .2RS.

Inner rings can be used with HJ Series needle roller bearings for applications where it is impractical to use the shaft as the inner raceway. These inch series inner rings are identified by the prefix letters IR.

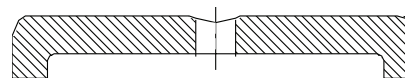
Since the entire identification code may not appear on the bearing itself, the manufacturer's parts list or another reliable source should always be consulted when ordering bearings for service or field replacement, to make certain that the correct bearing with the correct lubricant is used.

## CONSTRUCTION

The HJ Series needle roller bearing has a one-piece channel-shaped outer ring of bearing quality steel, heat treated to provide maximum load rating. The integral end flanges provide axial location for the needle rollers. The bores of the end flanges serve as piloting surfaces for the cage, locating it to prevent removal of the lubricant film on the raceway.

These bearings have a steel cage which provides inward retention for the needle rollers. The design assures roller stability and minimizes friction between the cage and the needle rollers. The cage has a maximum strength consistent with the inherent high load ratings of needle roller bearings.

The needle rollers are made from high carbon chrome steel, through-hardened, ground and lapped to close tolerance with controlled contour for optimum load distribution.



One Piece Channel-Shaped, Outer Ring









## DIMENSIONAL ACCURACY, INNER RINGS – INCH SERIES

Tolerances for the IR inner rings are given in Table 3 and 4. Pages C150-C153 list the nominal outside diameter, width and bore diameter for the IR series inner rings.

**TABLE 3 – BORE AND WIDTH TOLERANCES, IR INNER RING**

d Nominal Outside Diameter				Deviations from Nominal of Single Mean Outside Diameter, $d_{mp}^{(1)}$							
mm		inch		mm				inch			
>	≤	>	≤	high	low	high	low	high	low	high	low
7.938	19.050	0.3125	0.7500	+0	-0.010	+0	-0.0004	+0.25	+0.12	+0.010	+0.005
19.050	50.800	0.7500	2.0000	+0	-0.013	+0	-0.0005	+0.25	+0.12	+0.010	+0.005
50.800	82.550	2.0000	3.2500	+0	-0.015	+0	-0.0006	+0.25	+0.12	+0.010	+0.005
82.550	107.950	3.2500	4.2500	+0	-0.020	+0	-0.0008	+0.25	+0.12	+0.010	+0.005
107.950	120.650	4.2500	4.7500	+0	-0.020	+0	-0.0009	+0.38	+0.25	+0.015	+0.010
120.650	177.800	4.7500	7.0000	+0	-0.025	+0	-0.0010	+0.38	+0.25	+0.015	+0.010
177.800	203.200	7.0000	8.0000	+0	-0.030	+0	-0.00012	+0.38	+0.25	+0.015	+0.010

<sup>(1)</sup> "Single mean diameter" is defined as the mean diameter in a single radial plane.

**TABLE 4 – OUTSIDE DIAMETER TOLERANCE, IR INNER RINGS**

$F_w$ Nominal Bore Diameter				Deviations from Nominal of Single Mean Outside Diameter, $F_{mp}^{(1)}$					
mm		inch		mm			inch		
>	≤	>	≤	low	high	low	high	low	high
12.700	15.875	0.5000	0.6250	-0.013	-0.023	-0.0005	-0.0009	-0.0005	-0.0009
15.875	25.400	0.6250	1.0000	-0.018	-0.031	-0.0007	-0.0012	-0.0007	-0.0012
25.400	28.575	1.0000	1.1250	-0.023	-0.036	-0.0009	-0.0014	-0.0009	-0.0014
28.575	34.925	1.1250	1.3750	-0.023	-0.036	-0.0009	-0.0015	-0.0009	-0.0015
34.925	47.625	1.3750	1.8750	-0.025	-0.038	-0.0010	-0.0016	-0.0010	-0.0016
47.625	76.200	1.8750	3.0000	-0.028	-0.040	-0.0011	-0.0018	-0.0011	-0.0018
76.200	95.250	3.0000	3.7500	-0.033	-0.046	-0.0013	-0.0022	-0.0013	-0.0022
95.250	114.300	3.7500	4.5000	-0.038	-0.056	-0.0015	-0.0024	-0.0015	-0.0024
114.300	139.700	4.5000	5.5000	-0.038	-0.061	-0.0015	-0.0025	-0.0015	-0.0025
139.700	165.100	5.5000	6.5000	0.043	-0.063	-0.0017	-0.0027	-0.0017	-0.0027
165.100	209.550	6.5000	8.2500	-0.046	-0.068	-0.0019	-0.0031	-0.0019	-0.0031
209.550	234.950	8.2500	9.2500	-0.051	-0.078	-0.0020	-0.0032	-0.0020	-0.0032

<sup>(1)</sup> "Single mean diameter" is defined as the mean diameter in a single radial plane.





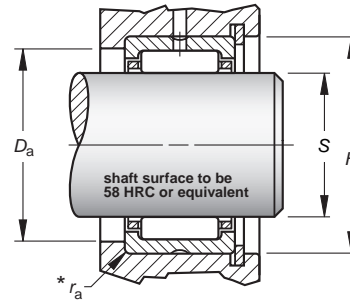
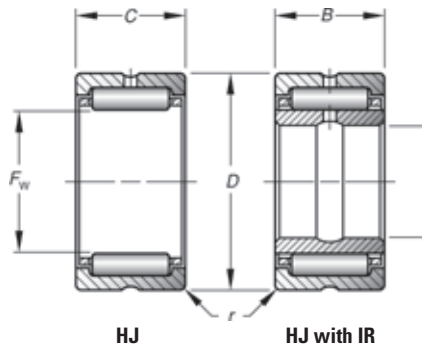
## HJ TYPE

### INCH SERIES

- Check for availability.
- Nominal bearing diameters and widths shown.
- Tolerance tables found on page C139.
- Clearance fit suggested for outer ring when housing is stationary relative to load.
- Tight transition fit suggested if housing rotates relative to load.
- See page C141 for further discussion on mounting practices.
- Consult your Timken representative for oscillating applications (e.g., low radial clearance concerns).
- Unmarked end of outer ring should be assembled against housing shoulder to clear maximum allowed housing fillet ( $r_{as\ max^*}$ ).
- Meets Military Standard MS 51961.

Shaft Diameter	Dimensions mm/in.				Bearing Designation	Used With Inner Ring Designation †	Load Ratings kN/lbf.				Approx Wt. kg/lbs.	
	in.	F <sub>w</sub>	D	C/B			r <sub>s min</sub>	Basic Dynamic C	Basic Static C <sub>0</sub>	Limiting Speed		
										Grease		Oil
5/8	15.875	28.575	19.050	0.64	HJ-101812	IR-061012	19.3	20.7	20000	30000	0.050	
	0.6250	1.1250	0.750	0.03								4350
3/4	19.050	31.750	19.050	1.02	HJ-122012	IR-081212	20.7	23.3	16000	25000	0.059	
	0.7500	1.2500	0.750	0.04								4650
7/8	19.050	31.750	25.400	1.02	HJ-122016	IR-081216	27.5	33.7	16000	25000	0.077	
	0.7500	1.2500	1.000	0.04								6190
1	22.225	34.925	19.050	1.02	HJ-142212	IR-101412	23	27.9	13000	21000	0.064	
	0.8750	1.3750	0.750	0.04								5180
1 1/8	22.225	34.925	25.400	1.02	HJ-142216	IR-101416	30.7	40.3	13000	21000	0.086	
	0.8750	1.3750	1.000	0.04								6910
1 1/4	25.400	38.100	19.050	1.02	HJ-162412	IR-121612	25.3	32.5	12000	18000	0.073	
	1.0000	1.5000	0.750	0.04								5680
1 1/2	25.400	38.100	25.400	1.02	HJ-162416	IR-121616	33.6	47.2	12000	18000	0.095	
	1.0000	1.5000	1.000	0.04								7560
1 3/8	28.575	41.275	25.400	1.02	HJ-182616	IR-141816	36.3	53.8	10000	16000	0.104	
	1.1250	1.6250	1.000	0.04								8170
1 3/4	28.575	41.275	31.750	1.02	HJ-182620	IR-141820	44.9	70.3	10000	16000	0.132	
	1.1250	1.6250	1.250	0.04								10100
1 7/8	31.750	44.450	25.400	1.02	HJ-202816	IR-162016	37.4	57.4	9100	14000	0.113	
	1.2500	1.7500	1.000	0.04								8410
2	31.750	44.450	31.750	1.02	HJ-202820	IR-162020	46.3	75.2	9100	14000	0.145	
	1.2500	1.7500	1.250	0.04								10400
2 1/8	34.925	47.625	25.400	1.02	HJ-223016	IR-182216	39.8	64.1	8200	13000	0.127	
	1.3750	1.8750	1.000	0.04								8950
2 1/4	34.925	47.625	31.750	1.02	HJ-223020	IR-182220	49.4	84.1	8200	13000	0.159	
	1.3750	1.8750	1.250	0.04								11100
2 3/8	38.100	52.388	25.400	1.52	HJ-243316	IR-202416	47.6	72.5	7600	12000	0.154	
	1.5000	2.0625	1.000	0.06								10700
2 3/4	38.100	52.388	31.750	1.52	HJ-243320	IR-192420	58.7	95.2	7600	12000	0.195	
	1.5000	2.0625	1.250	0.06								13200
3	41.275	55.563	25.400	1.52	HJ-263516	IR-212616	48.5	76.5	7000	11000	0.163	
	1.6250	2.1875	1.000	0.06								10900
3 1/8	41.275	55.563	31.750	1.52	HJ-263520	IR-212620	60.1	100.5	7000	11000	0.209	
	1.6250	2.1875	1.250	0.06								13500
3 1/4	44.450	58.738	25.400	1.52	HJ-283716	IR-232816	49.8	81.0	6400	9900	0.177	
	1.7500	2.3125	1.000	0.06								11200
3 1/2	44.450	58.738	31.750	1.52	HJ-283720	IR-222820	61.8	106	6400	9900	0.222	
	1.7500	2.3125	1.250	0.06								13900
3 3/4	47.625	61.913	31.750	1.52	HJ-303920	IR-253020	65.4	117	6000	9200	0.236	
	1.8750	2.4375	1.250	0.06								14700

† See pages C150-C153 for inch series inner rings. Order inner rings separately.



C <sub>g</sub> <sup>1</sup>	Mounting Dimensions mm/in.				Bearing Designation	Mounting Dimensions mm/in.				Shoulder Dia. ±.038 ±.015	Shaft Diameter in.
	Clearance Fit					Tight Transition Fit					
	Max.	Min.	Min.	Max.		Max.	Min.	Min.	Max.		
	S		H		S		H		D <sub>a</sub>		
0.0252	15.875 0.6250	15.865 0.6246	28.575 1.1250	28.595 1.1258	HJ-101812	15.860 0.6244	15.850 0.6240	28.547 1.1239	28.567 1.1247	23.83 0.938	5/8
0.0279	19.050 0.7500	19.037 0.7495	31.750 1.2500	31.775 1.2510	HJ-122012	19.030 0.7492	19.017 0.7487	31.717 1.2487	31.742 1.2497	26.97 1.062	3/4
0.0305	19.050 0.7500	19.037 0.7495	31.750 1.2500	31.775 1.2510	HJ-122016	19.030 0.7492	19.017 0.7487	31.717 1.2487	31.742 1.2497	26.97 1.062	
0.0310	22.225 0.8750	22.212 0.8745	34.925 1.3750	34.950 1.3760	HJ-142212	22.205 0.8742	22.192 0.8737	34.892 1.3737	34.917 1.3747	30.18 1.188	7/8
0.0340	22.225 0.8750	22.212 0.8745	34.925 1.3750	34.950 1.3760	HJ-142216	22.205 0.8742	22.192 0.8737	34.892 1.3737	34.917 1.3747	30.18 1.188	
0.0340	25.400 1.0000	25.387 0.9995	38.100 1.5000	38.125 1.5010	HJ-162412	25.380 0.9992	25.367 0.9987	38.067 1.4987	38.092 1.4997	33.32 1.312	1
0.0373	25.400 1.0000	25.387 0.9995	38.100 1.5000	38.125 1.5010	HJ-162416	25.380 0.9992	25.367 0.9987	38.067 1.4987	38.092 1.4997	33.32 1.312	
0.0404	28.575 1.1250	28.562 1.1245	41.275 1.6250	41.300 1.6260	HJ-182616	28.555 1.1242	28.542 1.1237	41.242 1.6237	41.267 1.6247	36.53 1.438	1 1/8
0.0433	28.575 1.1250	28.562 1.1245	41.275 1.6250	41.300 1.6260	HJ-182620	28.555 1.1242	28.542 1.1237	41.242 1.6237	41.267 1.6247	36.53 1.438	
0.0430	31.750 1.2500	31.735 1.2494	44.450 1.7500	44.475 1.7510	HJ-202816	31.725 1.2490	31.709 1.2484	44.417 1.7487	44.442 1.7497	39.67 1.562	1 1/4
0.0460	31.750 1.2500	31.735 1.2494	44.450 1.7500	44.475 1.7510	HJ-202820	31.725 1.2490	31.709 1.2484	44.417 1.7487	44.442 1.7497	39.67 1.562	
0.0460	34.925 1.3750	34.910 1.3744	47.625 1.8750	47.650 1.8760	HJ-223016	34.900 1.374	34.884 1.3734	47.592 1.8737	47.617 1.8747	42.88 1.688	1 3/8
0.0492	34.925 1.3750	34.910 1.3744	47.625 1.8750	47.650 1.8760	HJ-223020	34.900 1.3740	34.884 1.3734	47.592 1.8737	47.617 1.8747	42.88 1.688	
0.0480	38.100 1.5000	38.085 1.4994	52.388 2.0625	52.418 2.0637	HJ-243316	38.075 1.4990	38.059 1.4984	52.349 2.0610	52.380 2.0622	47.63 1.875	1 1/2
0.0514	38.100 1.5000	38.085 1.4994	52.388 2.0625	52.418 2.0637	HJ-243320	38.075 1.4990	38.059 1.4984	52.349 2.0610	52.380 2.0622	47.63 1.875	
0.0503	41.275 1.6250	41.260 1.6244	55.563 2.1875	55.593 2.1887	HJ-263516	41.250 1.6240	41.234 1.6234	55.524 2.1860	55.555 2.1872	50.80 2.000	1 5/8
0.0539	41.275 1.6250	41.260 1.6244	55.563 2.1875	55.593 2.1887	HJ-263520	41.250 1.6240	41.234 1.6234	55.524 2.1860	55.555 2.1872	50.80 2.000	
0.0527	44.450 1.7500	44.435 1.7494	58.738 2.3125	58.768 2.3137	HJ-283716	44.425 1.7490	44.409 1.7484	58.699 2.3110	58.730 2.3122	53.98 2.125	1 3/4
0.0564	44.450 1.7500	44.435 1.7494	58.738 2.3125	58.768 2.3137	HJ-283720	44.425 1.7490	44.409 1.7484	58.699 2.3110	58.730 2.3122	53.98 2.125	
0.0595	47.625 1.8750	47.610 1.8744	61.913 2.4375	61.943 2.4387	HJ-303920	47.600 1.8740	47.584 1.8734	61.874 2.4360	61.905 2.4372	57.15 2.250	1 7/8

\*r<sub>as max</sub> is equal to the minimum bearing chamfer (r<sub>s min</sub>) at unmarked end.

(1) C<sub>g</sub> factor for bearing without inner ring

Continued on next page.



## HJ TYPE — continued

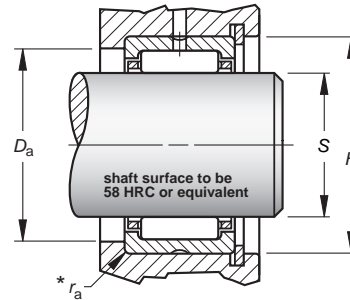
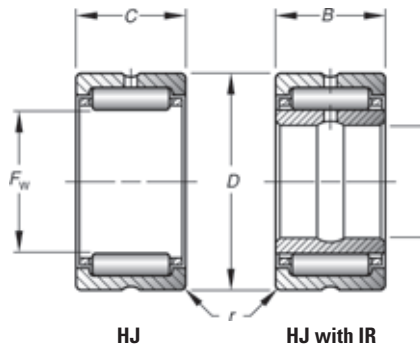
### INCH SERIES

- Check for availability.
- Nominal bearing diameters and widths shown.
- Tolerance tables found on page C139.
- Clearance fit suggested for outer ring when housing is stationary relative to load.
- Tight transition fit suggested if housing rotates relative to load.
- See page C141 for further discussion on mounting practices.
- Consult your Timken representative for oscillating applications (e.g., low radial clearance concerns).
- Unmarked end of outer ring should be assembled against housing shoulder to clear maximum allowed housing fillet ( $r_{as\ max^*}$ ).
- Meets Military Standard MS 51961.

Shaft Diameter	Dimensions mm/in.				Bearing Designation	Used With Inner Ring Designation †	Load Ratings kN/lbf.				Approx. Wt. kg/lbs.	
	in.	F <sub>w</sub>	D	C/B			r <sub>s min</sub>	C	C <sub>0</sub>	Limiting Speed		
										Grease		Oil
2	50.800	65.088	25.400	1.52	HJ-324116	IR-273216	53.8	93.0	5600	8600	0.200	
	2.0000	2.5625	1.000	0.06			12100	20900				0.44
	50.800	65.088	31.750	1.52	HJ-324120	IR-243220 IR-253220 IR-263220 IR-273220	66.7	122	5600	8600	0.249	
	2.0000	2.5625	1.250	0.06			15000	27500				0.55
2 1/4	57.150	76.200	38.100	1.52	HJ-364824	IR-283624	89.9	164	5000	7600	0.458	
	2.2500	3.0000	1.500	0.06			20200	36900				1.01
	57.150	76.200	44.450	1.52	HJ-364828	IR-283628	104	198	5000	7600	0.531	
	2.2500	3.0000	1.750	0.06			23400	44500				1.17
2 1/2	63.500	82.550	38.100	2.03	HJ-405224	IR-314024 IR-324024	97.0	187	4400	6800	0.499	
	2.5000	3.2500	1.500	0.08			21800	42100				1.10
	63.500	82.550	44.450	2.03	HJ-405228	IR-314028 IR-324028	97.0	187	4400	6800	0.499	
	2.5000	3.2500	1.750	0.08			25200	50800				1.29
2 3/4	69.850	88.900	25.400	2.03	HJ-445616	—	67.2	120	4000	6200	0.363	
	2.7500	3.5000	1.000	0.08			15100	27000				0.80
	69.850	88.900	38.100	2.03	HJ-445624	IR-364424	101	203	4000	6200	0.544	
	2.7500	3.5000	1.500	0.08			22700	45700				1.20
	69.850	88.900	44.450	2.03	HJ-445628	IR-354428 IR-364428	117	245	4000	6200	0.635	
	2.7500	3.5000	1.750	0.08			26300	55100				1.40
3	76.200	95.250	38.100	2.03	HJ-486024	IR-404824	107	226	3700	5600	0.585	
	3.0000	3.7500	1.500	0.08			24100	50900				1.29
	76.200	95.250	44.450	2.03	HJ-486028	IR-384828 IR-404828	124	273	3700	5600	0.685	
	3.0000	3.7500	1.750	0.08			27900	61400				1.51
3 1/4	82.550	107.950	44.450	2.03	HJ-526828	IR-445228	162	305	3400	5300	1.016	
	3.2500	4.2500	1.750	0.08			36400	68600				2.24
	82.550	107.950	50.800	2.03	HJ-526832	IR-445232	184	358	3400	5300	1.161	
	3.2500	4.2500	2.000	0.08			41300	80500				2.56
3 1/2	88.900	114.300	50.800	2.03	HJ-567232	IR-475632 IR-485632	187	375	3200	4900	1.238	
	3.5000	4.5000	2.000	0.08			42000	84300				2.73
3 3/4	95.250	120.650	50.800	2.54	HJ-607632	IR-506032 IR-526032	197	405	4540	4375	1.455	
	3.7500	4.7500	2.000	0.10			44200	91000				3.208
4	101.600	127.000	50.800	2.54	HJ-648032	IR-526432 IR-546432 IR-566432	205	436	4230	4625	1.541	
	4.0000	5.0000	2.000	0.10			46000	98000				3.397
4 1/4	107.950	133.350	50.800	2.54	HJ-688432	IR-566832 IR-606832	207	454	3970	4875	1.626	
	4.2500	5.2500	2.000	0.10			46500	102000				3.586
4 1/2	114.300	152.400	57.150	2.54	HJ-729636	IR-607236	286	516	3850	5438	3.035	
	4.5000	6.0000	2.250	0.10			64400	116000				6.691
	114.3000	152.4000	63.500	2.54	HJ-729640	IR-607240	319	596	3850	5438	3.372	
	4.5000	6.0000	2.500	0.10			71700	134000				7.434

† See pages C150-C153 for inch series inner rings. Order inner rings separately.

(1) C<sub>0</sub> factor for bearing without inner ring.



C <sub>g</sub> <sup>(1)</sup>	Mounting Dimensions mm/in.				Bearing Designation	Mounting Dimensions mm/in.				Shoulder Dia. ±.38 ±.015	Shaft Diameter in.
	Clearance Fit					Tight Transition Fit					
	Max.	Min.	Min.	Max.		Max.	Min.	Min.	Max.		
	S	H			S	H			D <sub>a</sub>		
0.0578	50.800 2.0000	50.782 1.9993	65.088 2.5625	65.118 2.5637	HJ-324116	50.770 1.9988	50.752 1.9981	65.049 2.5610	65.080 2.5622	60.33 2.375	
0.0618	50.800 2.0000	50.782 1.9993	65.088 2.5625	65.118 2.5637	HJ-324120	50.770 1.9988	50.752 1.9981	65.049 2.5610	65.080 2.5622	60.33 2.375	2
0.0683	57.150 2.2500	57.132 2.2493	76.200 3.0000	76.230 3.0012	HJ-364824	57.120 2.2488	57.102 2.2481	76.162 2.9985	76.192 2.9997	68.28 2.688	2 1/4
0.0715	57.150 2.2500	57.132 2.2493	76.200 3.0000	76.230 3.0012	HJ-364828	57.120 2.2488	57.102 2.2481	76.162 2.9985	76.192 2.9997	68.28 2.688	
0.0739	63.500 2.5000	63.482 2.4993	82.550 3.2500	82.586 3.2514	HJ-405224	63.470 2.4988	63.452 2.4981	82.502 3.2481	82.537 3.2495	74.63 2.938	2 1/2
0.0774	63.500 2.5000	63.482 2.4993	82.550 3.2500	82.586 3.2514	HJ-405228	63.470 2.4988	63.452 2.4981	82.502 3.2481	82.537 3.2495	74.63 2.938	
0.0690	69.850 2.7500	69.832 2.7493	88.900 3.5000	88.936 3.5014	HJ-445616	69.820 2.7488	69.802 2.7481	88.852 3.4981	88.887 3.4995	80.98 3.188	
0.0786	69.850 2.7500	69.832 2.7493	88.900 3.5000	88.936 3.5014	HJ-445624	69.820 2.7488	69.802 2.7481	88.852 3.4981	88.887 3.4995	80.98 3.188	2 3/4
0.0823	69.850 2.7500	69.832 2.7493	88.900 3.5000	88.936 3.5014	HJ-445628	69.820 2.7488	69.802 2.7481	88.852 3.4981	88.887 3.4995	80.98 3.188	
0.0839	76.200 3.0000	76.182 2.9993	95.250 3.7500	95.286 3.7514	HJ-486024	76.170 2.9988	76.152 2.9981	95.202 3.7481	95.237 3.7495	87.33 3.438	3
0.0879	76.200 3.0000	76.182 2.9993	95.250 3.7500	95.286 3.7514	HJ-486028	76.170 2.9988	76.152 2.9981	95.202 3.7481	95.237 3.7495	87.33 3.438	
0.0888	82.550 3.2500	82.527 3.2491	107.950 4.2500	107.986 4.2514	HJ-526828	82.514 3.2486	82.492 3.2477	107.902 4.2481	107.937 4.2495	98.43 3.875	3 1/4
0.0924	82.550 3.2500	82.527 3.2491	107.950 4.2500	107.986 4.2514	HJ-526832	82.514 3.2486	82.492 3.2477	107.902 4.2481	107.937 4.2495	98.43 3.875	
0.0965	88.900 3.5000	88.877 3.4991	114.300 4.5000	114.336 4.5014	HJ-567232	88.864 3.4986	88.842 3.4977	114.252 4.4981	114.287 4.4995	104.78 4.125	3 1/2
0.1011	95.250 3.7500	95.227 3.7491	120.650 4.7500	120.691 4.7516	HJ-607632	95.217 3.7487	95.192 3.7477	120.594 4.7478	120.635 4.7494	111.13 4.375	3 3/4
0.1060	101.600 4.0000	101.577 3.9991	127.000 5.0000	127.041 5.0016	HJ-648032	101.564 3.9986	101.542 3.9977	126.944 4.9978	126.985 4.9994	117.48 4.625	4
0.1099	107.950 4.2500	107.927 4.2491	133.350 5.2500	133.391 5.2516	HJ-688432	107.914 4.2486	107.892 4.2477	133.294 5.2478	133.335 5.2494	123.83 4.875	4 1/4
	114.300 4.5000	114.277 4.4991	152.400 6.0000	152.441 6.0016	HJ-729636	114.264 4.4986	114.242 4.4977	152.344 5.9978	152.385 5.9994	138.11 5.438	4 1/2
0.1137	114.300 4.5000	114.277 4.4991	152.400 6.0000	152.441 6.0016	HJ-729640	114.264 4.4986	114.242 4.4977	152.344 5.9978	152.385 5.9994	138.11 5.438	

\*r<sub>as max</sub> is equal to the minimum bearing chamfer (r<sub>s min</sub>) at unmarked end.  
<sup>(1)</sup> C<sub>g</sub> factor for bearing without inner ring.

Continued on next page.



## HJ TYPE — continued

### INCH SERIES

- Check for availability.
- Nominal bearing diameters and widths shown.
- Tolerance tables found on page C139.
- Clearance fit suggested for outer ring when housing is stationary relative to load.
- Tight transition fit suggested if housing rotates relative to load.
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- Consult your Timken representative for oscillating applications (e.g., low radial clearance concerns).
- Unmarked end of outer ring should be assembled against housing shoulder to clear maximum allowed housing fillet ( $r_{as\ max^*}$ ).
- Meets Military Standard MS 51961.

Shaft Diameter	Dimensions mm/in.				Bearing Designation	Used With Inner Ring Designation †	Load Ratings kN/lbf.				Approx. Wt. kg/lbs.	
	in.	F <sub>w</sub>	D	C/B			r <sub>s min</sub>	Basic Dynamic	Basic Static	Limiting Speed		
										Grease		Oil
							C	C <sub>0</sub>	RPM			
5	127.000	165.100	50.800	2.54	HJ-8010432	—	272	503	3430	5938	—	
	5.0000	6.5000	2.000	0.10			61200	113000				
	127.000	165.100	57.150	2.54	HJ-8010436	IR-648036 IR-688036	309	592	3430	5938	3.324	
	5.0000	6.5000	2.250	0.10			69400	133000			7.327	
	127.000	165.100	63.500	2.54	HJ-8010440	IR-648040	344	676	3430	5938	3.693	
	5.0000	6.5000	2.500	0.10			77300	152000			8.141	
5 1/2	139.700	177.800	63.500	2.54	HJ-8811240	IR-728840	350	712	3120	6438	4.014	
	5.5000	7.0000	2.500	0.10			78600	160000			8.849	
	139.700	177.800	76.200	2.54	HJ-8811248	IR-728848	415	885	3120	6438	4.817	
	5.5000	7.0000	3.000	0.10			93300	199000			10.62	
5 3/4	146.050	184.150	76.200	3.05	HJ-9211648	IR-769248	422	921	2960	6688	5.009	
	5.7500	7.2500	3.000	0.12			94800	207000			11.04	
6	152.400	190.500	63.500	3.05	HJ-9612040	IR-809640	369	792	2830	6938	4.335	
	6.0000	7.5000	2.500	0.12			83000	178000			9.557	
	152.400	190.500	76.200	3.05	HJ-9612048	IR-809648	442	996	2830	6938	5.202	
	6.0000	7.5000	3.000	0.12			99300	224000			11.47	
6 1/2	165.100	203.200	63.500	3.05	HJ-10412840	IR-8810440	383	850	2600	7438	4.656	
	6.5000	8.0000	2.500	0.12			86000	191000			10.26	
	165.100	203.200	76.200	3.05	HJ-10412848	IR-8810448	454	1054	2600	7438	5.582	
	6.5000	8.0000	3.000	0.12			102000	237000			12.31	
7 1/4	184.150	231.775	76.200	3.05	HJ-11614648	IR-9611648	526	1125	2340	8500	7.888	
	7.2500	9.1250	3.000	0.12			118300	253000			17.39	
7 3/4	196.850	244.475	76.200	3.05	HJ-12415448	IR-10412448	547	1205	2180	9000	8.370	
	7.7500	9.6250	3.000	0.12			123000	271000			18.45	
8 1/4	209.550	257.175	76.200	3.05	HJ-13216248	IR-11213248	565	1290	2040	9500	8.852	
	8.2500	10.1250	3.000	0.12			127000	290000			19.51	
8 3/4	222.250	269.875	76.200	4.06	HJ-14017048	IR-12014048	578	1370	1920	10000	9.333	
	8.7500	10.6250	3.000	0.16			130000	308000			20.58	
9 1/4	234.950	282.575	76.200	4.06	HJ-14817848	IR-12814848	605	1450	1810	10500	9.815	
	9.2500	11.1250	3.000	0.16			136000	326000			21.64	

† See pages C150-C153 for inch series inner rings. Order inner rings separately.

(1) C<sub>0</sub> factor for bearing without inner ring.







## SEALED HEAVY-DUTY NEEDLE ROLLER BEARINGS

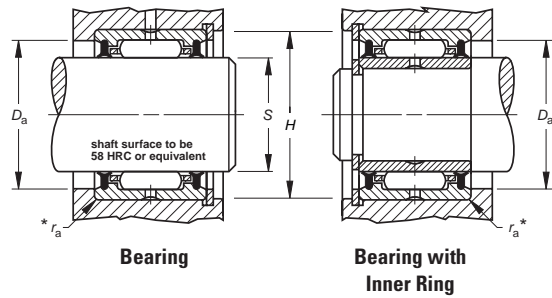
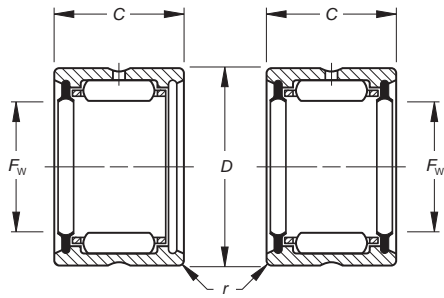
### INCH SERIES

- Bearing diameters and widths listed are nominal.
- For inspection purposes, see tolerance tables on page C139.
- Available with one or two contact lip seals designed to retain lubricant and exclude foreign material.
- Single seals are normally installed in the stamped end of bearing.
- Seals limit the bearing operating temperature between -25° F and +225° F (-30° C and +110° C).
- For operating temperature outside of the above range, or if seals are exposed to unusual fluids, please consult your Timken representative.

Shaft Diameter	Dimensions mm/in.				Bearing Designation			Used With Inner Ring †	Load Ratings kN/lbf.			C <sub>0</sub>
	in.	F <sub>w</sub>	D	C/B	r <sub>s min</sub>	One Seal	Two Seals		Dynamic C	Static C <sub>0</sub>	Limiting Speed	
								RPM				
5/8	15.875 0.6250	28.575 1.1250	25.40 1.000	0.64 0.03	HJ-101816RS	HJ-101816.2RS	—	19.3 4350	20.7 4650	12000	0.025	
3/4	19.050 0.7500	31.750 1.2500	25.40 1.000	1.02 0.04	HJ-122016RS	HJ-122016.2RS	IR-081216	20.7 4650	23.3 5240	10000	0.028	
7/8	22.225 0.8750	34.925 1.3750	25.40 1.000	1.02 0.04	HJ-142216RS	HJ-142216.2RS	IR-101416	23.0 5180	27.9 6270	8700	0.031	
1	25.400 1.0000	38.100 1.5000	25.40 1.000	1.02 0.04	HJ-162416RS	HJ-162416.2RS	IR-121616 IR-131616	25.3 5680	32.5 7300	7600	0.034	
1 1/8	28.575 1.1250	41.275 1.6250	31.75 1.250	1.02 0.04	HJ-182620RS	HJ-182620.2RS	IR-141820	36.3 8170	53.8 12100	6800	0.040	
1 1/4	31.750 1.2500	44.450 1.7500	31.75 1.250	1.02 0.04	HJ-202820RS	HJ-202820.2RS	IR-162020	37.4 8410	57.4 12900	6100	0.043	
1 3/8	34.925 1.3750	47.625 1.8750	31.75 1.250	1.02 0.04	HJ-223020RS	HJ-223020.2RS	IR-182220	39.8 8950	64.1 14400	5600	0.046	
1 1/2	38.100 1.5000	52.388 2.0625	31.75 1.250	1.52 0.06	HJ-243320RS	HJ-243320.2RS	IR-192420	47.6 10700	72.5 16300	5100	0.0480	
1 5/8	41.275 1.6250	55.563 2.1875	31.75 1.250	1.52 0.06	HJ-263520RS	HJ-263520.2RS	IR-212620	48.5 10900	76.5 17200	2400	0.050	
1 3/4	44.450 1.7500	58.738 2.3125	31.75 1.250	1.52 0.06	HJ-283720RS	HJ-283720.2RS	IR-222820 IR-232820 IR-242820	49.8 11200 —	81.0 18200 —	4400	0.053	
2	50.800 2.0000	65.088 2.5625	31.75 1.250	1.52 0.06	HJ-324120RS	HJ-324120.2RS	IR-243220 IR-253220 IR-263220 IR-273220	53.8 12100 — —	93.0 20900 — —	3800	0.058	
2 1/4	57.150 2.2500	76.200 3.0000	44.45 1.750	1.52 0.06	HJ-364828RS	HJ-364828.2RS	IR-283628	89.9 20200	164.1 36900	1700	0.068	
2 1/2	63.500 2.5000	82.550 3.2500	44.45 1.750	2.03 0.08	HJ-405228RS	HJ-405228.2RS	IR-222620 IR-314028 IR-324028	97.0 21800 —	187.3 42100 —	3100	0.074	
2 3/4	69.850 2.7500	88.900 3.5000	44.45 1.750	2.03 0.08	HJ-445628RS	HJ-445628.2RS	IR-354428 IR-364428	101.0 22700	203.3 45700	1400	0.079	
3	76.200 3.0000	95.250 3.7500	44.45 1.750	2.03 0.08	HJ-486028RS	HJ-486028.2RS	IR-384828 IR-404828	107.2 24100	226.4 50900	2500	0.084	

† See pages C150-C153 for inch series inner rings. Order inner rings separately.

§ Based on standard seal shaft contact speed of 305 m/min., 1000 ft./min.



Approx. Wt. kg/lbs.	Mounting Dimensions mm/in.				Bearing Designation	Mounting Dimensions mm/in.				Shoulder Dia. ±.38 ±.015	Shaft Diameter in.
	Clearance Fit					Tight Transition Fit					
	Max.	Min.	Min.	Max.		Max.	Min.	Min.	Max.		
	S		H			S		H		D <sub>a</sub>	in.
<b>0.07</b> 0.15	<b>15.875</b> 0.6250	<b>15.865</b> 0.6246	<b>28.575</b> 1.1250	<b>28.595</b> 1.1258	-101816	<b>15.860</b> 0.6244	<b>15.850</b> 0.6240	<b>28.547</b> 1.1239	<b>28.567</b> 1.1247	<b>23.83</b> 0.938	<b>5/8</b>
<b>0.08</b> 0.17	<b>19.050</b> 0.7500	<b>19.037</b> 0.7495	<b>31.750</b> 1.2500	<b>31.775</b> 1.2510	-122016	<b>19.030</b> 0.7492	<b>19.017</b> 0.7487	<b>31.717</b> 1.2487	<b>31.742</b> 1.2497	<b>26.97</b> 1.062	<b>3/4</b>
<b>0.09</b> 0.19	<b>22.225</b> 0.8750	<b>22.212</b> 0.8745	<b>34.925</b> 1.3750	<b>34.950</b> 1.3760	-142216	<b>22.205</b> 0.8742	<b>22.192</b> 0.8737	<b>34.892</b> 1.3737	<b>34.917</b> 1.3747	<b>30.18</b> 1.188	<b>7/8</b>
<b>0.10</b> 0.21	<b>25.400</b> 1.0000	<b>25.387</b> 0.9995	<b>38.100</b> 1.5000	<b>38.125</b> 1.5010	-162416	<b>25.380</b> 0.9992	<b>25.367</b> 0.9987	<b>38.067</b> 1.4987	<b>38.092</b> 1.4997	<b>33.32</b> 1.312	<b>1</b>
<b>0.13</b> 0.29	<b>28.575</b> 1.1250	<b>28.562</b> 1.1245	<b>41.275</b> 1.6250	<b>41.300</b> 1.6260	-182620	<b>28.555</b> 1.1242	<b>28.542</b> 1.1237	<b>41.242</b> 1.6237	<b>41.267</b> 1.6247	<b>36.53</b> 1.438	<b>1 1/8</b>
<b>0.15</b> 0.32	<b>31.750</b> 1.2500	<b>31.735</b> 1.2494	<b>44.450</b> 1.7500	<b>44.475</b> 1.7510	-202820	<b>31.725</b> 1.2490	<b>31.709</b> 1.2484	<b>44.417</b> 1.7487	<b>44.442</b> 1.7497	<b>39.67</b> 1.562	<b>1 1/4</b>
<b>0.16</b> 0.35	<b>34.925</b> 1.3750	<b>34.910</b> 1.3744	<b>47.625</b> 1.8750	<b>47.650</b> 1.8760	-223020	<b>34.900</b> 1.3740	<b>34.884</b> 1.3734	<b>47.592</b> 1.8737	<b>47.617</b> 1.8747	<b>42.88</b> 1.688	<b>1 3/8</b>
<b>0.20</b> 0.43	<b>38.100</b> 1.5000	<b>38.085</b> 1.4994	<b>52.388</b> 2.0625	<b>52.418</b> 2.0637	-243320	<b>38.075</b> 1.4990	<b>38.059</b> 1.4984	<b>52.349</b> 2.0610	<b>52.380</b> 2.0622	<b>47.63</b> 1.875	<b>1 1/2</b>
<b>0.21</b> 0.46	<b>41.275</b> 1.6250	<b>41.260</b> 1.6244	<b>55.563</b> 2.1875	<b>55.593</b> 2.1887	-263520	<b>41.250</b> 1.6240	<b>41.234</b> 1.6234	<b>55.524</b> 2.1860	<b>55.555</b> 2.1872	<b>50.80</b> 2.000	<b>1 5/8</b>
<b>0.22</b> 0.49	<b>44.450</b> 1.7500	<b>44.435</b> 1.7494	<b>58.738</b> 2.3125	<b>58.768</b> 2.3137	-283720	<b>44.425</b> 1.7490	<b>44.409</b> 1.7484	<b>58.699</b> 2.3110	<b>58.730</b> 2.3122	<b>53.98</b> 2.125	<b>1 3/4</b>
<b>0.25</b> 0.55	<b>50.800</b> 2.0000	<b>50.782</b> 1.9993	<b>65.088</b> 2.5625	<b>65.118</b> 2.5637	-324120	<b>50.770</b> 1.9988	<b>50.752</b> 1.9981	<b>65.049</b> 2.5610	<b>65.080</b> 2.5622	<b>60.33</b> 2.375	<b>2</b>
<b>0.53</b> 1.17	<b>57.150</b> 2.2500	<b>57.132</b> 2.2493	<b>76.200</b> 3.0000	<b>76.230</b> 3.0012	-364828	<b>57.120</b> 2.2488	<b>57.102</b> 2.2481	<b>76.162</b> 2.9985	<b>76.192</b> 2.9997	<b>68.28</b> 2.688	<b>2 1/4</b>
<b>0.59</b> 1.29	<b>63.500</b> 2.5000	<b>63.482</b> 2.4993	<b>82.550</b> 3.2500	<b>82.586</b> 3.2514	-405228	<b>63.470</b> 2.4988	<b>63.452</b> 2.4981	<b>82.502</b> 3.2481	<b>82.537</b> 3.2495	<b>74.63</b> 2.938	<b>2 1/2</b>
<b>0.64</b> 1.40	<b>69.850</b> 2.7500	<b>69.832</b> 2.7493	<b>88.900</b> 3.5000	<b>88.936</b> 3.5014	-445628	<b>69.820</b> 2.7488	<b>69.802</b> 2.7481	<b>88.852</b> 3.4981	<b>88.887</b> 3.4995	<b>80.98</b> 3.188	<b>2 3/4</b>
<b>0.68</b> 1.51	<b>76.200</b> 3.0000	<b>76.182</b> 2.9993	<b>95.250</b> 3.7500	<b>95.286</b> 3.7514	-486028	<b>76.170</b> 2.9988	<b>76.152</b> 2.9981	<b>95.202</b> 3.7481	<b>95.237</b> 3.7495	<b>87.33</b> 3.438	<b>3</b>

\*r<sub>as max</sub> is equal to the minimum bearing chamfer (r<sub>s min</sub>) at unmarked end.



## INNER RINGS

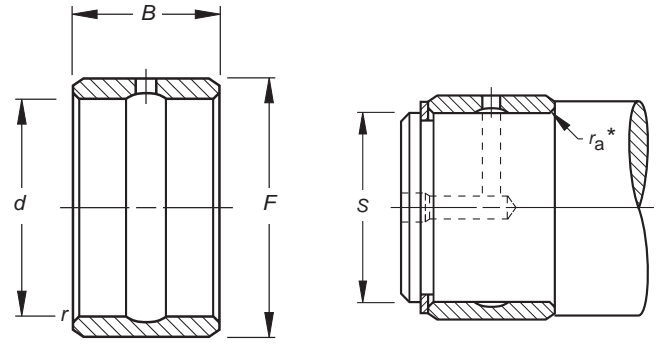
### INCH SERIES

- Check for availability.
- Ideal choice where shaft not practical to use as inner raceway.
- Provided in inch nominal dimensions for use with inch series heavy-duty needle roller bearings.
- Designed to meet established inch tolerances.
- Selected size should be wider than matching drawn cup bearing.
- Maximum shaft fillet radius ( $r_{as\ max}$ ) cannot exceed inner ring bore chamfer ( $r_{s\ min}$ ) as shown.
- Optional centralized lubrication groove (bore) or through-hole available – specify when ordering.
- Designed to be axially clamped against shoulder for loose transition fit on shaft.
- After mounting, for tight transition fit (keeping inner ring from rotating relative to shaft), inner ring O.D. must not exceed raceway diameter on matching bearing.

Shaft Diameter	Dimensions mm/in.				Inner Ring Designation	Approx. Wt. kg/lbs.	Loose Transition Fit mm/in.		Inner Ring Designation	Interference Fit mm/in.		Used With Bearing Designation
	d	F	B	$r_{s\ min}$			Max.	Min.		Max.	Min.	
in.							S			S		
3/8	9.525	15.875	19.05	0.64	IR-061012	0.018	9.520	9.510	IR-061012	9.538	9.530	HJ-101812
	0.3750	0.6250	0.750	0.025			0.3748	0.3744		0.3755	0.3752	
1/2	12.700	19.050	19.05	1.02	IR-081212	0.023	12.692	12.682	IR-081212	12.715	12.708	HJ-122012
	0.5000	0.7500	0.750	0.04			0.4997	0.4993		0.5006	0.5003	
	12.700	19.050	25.40	1.02	IR-081216	0.032	12.692	12.682	IR-081216	12.715	12.708	HJ-122016
	0.5000	0.7500	1.000	0.04			0.4997	0.4993		0.5006	0.5003	
5/8	15.875	22.225	19.05	1.02	IR-101412	0.027	15.867	15.857	IR-101412	15.890	15.883	HJ-142212
	0.6250	0.8750	0.750	0.04			0.6247	0.6243		0.6256	0.6253	
	15.875	22.225	25.40	1.02	IR-101416	0.036	15.867	15.857	IR-101416	15.890	15.883	HJ-142216
	0.6250	0.8750	1.000	0.04			0.6247	0.6243		0.6256	0.6253	
11/16	17.463	22.225	19.05	1.02	IR-111412	0.023	17.455	17.445	IR-111412	17.478	17.470	HJ-142212
	0.6875	0.8750	0.750	0.04			0.6872	0.6868		0.6881	0.6878	
3/4	19.050	25.400	19.05	1.02	IR-121612	0.032	19.042	19.030	IR-121612	19.068	19.058	HJ-162412
	0.7500	1.0000	0.750	0.04			0.7497	0.7492		0.7507	0.7503	
	19.050	25.400	25.40	1.02	IR-121616	0.041	19.042	19.030	IR-121616	19.068	19.058	HJ-162416
	0.7500	1.0000	1.000	0.04			0.7497	0.7492		0.7507	0.7503	
13/16	20.638	25.400	25.40	1.02	IR-131616	0.032	20.630	20.617	IR-131616	20.655	20.645	HJ-162416
	0.8125	1.0000	1.000	0.04			0.8122	0.8117		0.8132	0.8128	
7/8	22.225	28.575	25.40	1.02	IR-141816	0.050	22.217	22.205	IR-141816	22.243	22.233	HJ-182616
	0.8750	1.1250	1.000	0.04			0.8747	0.8742		0.8757	0.8753	
	22.225	28.575	31.75	1.02	IR-141820	0.059	22.217	22.205	IR-141820	22.243	22.233	HJ-182620
	0.8750	1.1250	1.250	0.04			0.8747	0.8742		0.8757	0.8753	
15/16	23.813	28.575	25.40	1.02	IR-151816	0.036	23.805	23.792	IR-151816	23.830	23.820	HJ-182616
	0.9375	1.1250	1.000	0.04			0.9372	0.9367		0.9382	0.9378	
	23.813	28.575	31.75	1.02	IR-151820	0.045	23.805	23.792	IR-151820	23.830	23.820	HJ-182620
	0.9375	1.1250	1.250	0.04			0.9372	0.9367		0.9382	0.9378	
1	25.400	31.750	25.40	1.02	IR-162016	0.054	25.392	25.380	IR-162016	25.418	25.408	HJ-202816
	1.0000	1.2500	1.000	0.04			0.9997	0.9992		1.0007	1.0003	
	25.400	31.750	31.75	1.02	IR-162020	0.068	25.392	25.380	IR-162020	25.418	25.408	HJ-202820
	1.0000	1.2500	1.250	0.04			0.9997	0.9992		1.0007	1.0003	
1 1/8	28.575	34.925	25.40	1.02	IR-182216	0.059	28.567	28.555	IR-182216	28.593	28.583	HJ-223016
	1.1250	1.3750	1.000	0.04			1.1247	1.1242		1.1257	1.1253	
	28.575	34.925	31.75	1.02	IR-182220	0.077	28.567	28.555	IR-182220	28.593	28.583	HJ-223020
	1.1250	1.3750	1.250	0.04			1.1247	1.1242		1.1257	1.1253	
1 1/16	30.163	38.100	31.75	1.52	IR-192420	0.100	30.155	30.142	IR-192420	30.180	30.170	HJ-243320
	1.1875	1.5000	1.250	0.06			1.1872	1.1867		1.1882	1.1878	
1 1/4	31.750	38.100	25.40	1.52	IR-202416	0.068	31.740	31.725	IR-202416	31.770	31.760	HJ-243316
	1.2500	1.5000	1.000	0.06			1.2496	1.2490		1.2508	1.2504	
	31.750	38.100	31.75	1.52	IR-202420	0.082	31.740	31.725	IR-202420	31.770	31.760	HJ-243320
	1.2500	1.5000	1.250	0.06			1.2496	1.2490		1.2508	1.2504	
1 5/16	33.338	41.275	25.40	1.52	IR-212616	0.086	33.327	33.312	IR-212616	33.358	33.348	HJ-263516
	1.3125	1.6250	1.000	0.06			1.3121	1.3115		1.3133	1.3129	

Continued on next page.

- See tables for required bearing dimensions raceway diameter.
- After mounting, if O.D. of inner ring exceeds the required raceway diameter for matching bearing, ring should be ground to proper diameter while mounted on shaft.
- Unmarked end of inner ring to be assembled against the shaft shoulder to assure clearing the maximum allowable shaft fillet ( $r_{as\ max}$ ) as indicated in tables shown.



Shaft Diameter	Dimensions mm/in.				Inner Ring Designation	Approx. Wt. kg/lbs.	Loose Transition Fit mm/in.		Inner Ring Designation	Interference Fit mm/in.		Used With Bearing Designation
	d	F	B	r <sub>s min</sub>			Max.	Min.		Max.	Min.	
in.	d	F	B	r <sub>s min</sub>			S			S		
1 3/8	33.338	41.275	31.75	1.52	IR-212620	0.109	33.327	33.312	IR-212620	33.358	33.348	HJ-263520
	1.3125	1.6250	1.250	0.06		0.240	1.3121	1.3115		1.3133	1.3129	
1 3/8	34.925	41.275	31.75	1.52	IR-222620	0.091	34.915	34.900	IR-222620	34.945	34.935	HJ-263520
	1.3750	1.6250	1.250	0.06		0.200	1.3746	1.3740		1.3758	1.3754	
1 7/16	34.925	44.450	31.75	1.52	IR-222820	0.141	34.915	34.900	IR-222820	34.945	34.935	HJ-283720
	1.3750	1.7500	1.250	0.06		0.310	1.3746	1.3740		1.3758	1.3754	
1 7/16	36.513	44.450	25.40	1.52	IR-232816	0.095	36.502	36.487	IR-232816	36.533	36.523	HJ-283716
	1.4375	1.7500	1.000	0.06		0.210	1.4371	1.4365		1.4383	1.4379	
1 1/2	36.513	44.450	31.75	1.52	IR-232820	0.118	36.502	36.487	IR-232820	36.533	36.523	HJ-283720
	1.4375	1.7500	1.250	0.06		0.260	1.4371	1.4365		1.4383	1.4379	
1 1/2	38.100	44.450	25.40	1.52	IR-242816	0.077	38.090	38.075	IR-242816	38.120	38.110	HJ-283716
	1.5000	1.7500	1.000	0.06		0.170	1.4996	1.4990		1.5008	1.5004	
1 1/2	38.100	44.450	31.75	1.52	IR-242820	0.095	38.090	38.075	IR-242820	38.120	38.110	HJ-283720
	1.5000	1.7500	1.250	0.06		0.210	1.4996	1.4990		1.5008	1.5004	
1 9/16	38.100	50.800	31.75	1.52	IR-243220	0.209	38.090	38.075	IR-243220	38.120	38.110	HJ-324120
	1.5000	2.0000	1.250	0.06		0.460	1.4996	1.4990		1.5008	1.5004	
1 9/16	39.688	47.625	31.75	1.52	IR-253020	0.127	39.677	39.662	IR-253020	39.708	39.698	HJ-303920
	1.5625	1.8750	1.250	0.06		0.280	1.5621	1.5615		1.5633	1.5629	
1 9/16	39.688	50.800	31.75	1.52	IR-253220	0.186	39.677	39.662	IR-253220	39.708	39.698	HJ-324120
	1.5625	2.0000	1.250	0.06		0.410	1.5621	1.5615		1.5633	1.5629	
1 5/8	41.275	50.800	31.75	1.52	IR-263220	0.163	41.265	41.250	IR-263220	41.295	41.285	HJ-324120
	1.6250	2.0000	1.250	0.06		0.360	1.6246	1.6240		1.6258	1.6254	
1 11/16	42.863	50.800	25.40	1.52	IR-273216	0.109	42.852	42.837	IR-273216	42.883	42.873	HJ-324116
	1.6875	2.0000	1.000	0.06		0.240	1.6871	1.6865		1.6883	1.6879	
1 11/16	42.863	50.800	31.75	1.52	IR-273220	0.136	42.852	42.837	IR-273220	42.883	42.873	HJ-324120
	1.6875	2.0000	1.250	0.06		0.300	1.6871	1.6865		1.6883	1.6879	
1 3/4	44.450	57.150	38.10	1.52	IR-283624	0.286	44.440	44.425	IR-283624	44.470	44.460	HJ-364824
	1.7500	2.2500	1.500	0.06		0.630	1.7496	1.7490		1.7508	1.7504	
1 3/4	44.450	57.150	44.45	1.52	IR-283628	0.336	44.440	44.425	IR-283628	44.470	44.460	HJ-364828
	1.7500	2.2500	1.750	0.06		0.740	1.7496	1.7490		1.7508	1.7504	
1 15/16	49.213	63.500	38.10	2.03	IR-314024	0.358	49.202	49.187	IR-314024	49.233	49.223	HJ-405224
	1.9375	2.5000	1.500	0.08		0.790	1.9371	1.9365		1.9383	1.9379	
1 15/16	49.213	63.500	44.45	2.03	IR-314028	0.417	49.202	49.187	IR-314028	49.233	49.223	HJ-405228
	1.9375	2.5000	1.750	0.08		0.920	1.9371	1.9365		1.9383	1.9379	
2	50.800	63.500	38.10	2.03	IR-324024	0.322	50.790	50.772	IR-324024	50.823	50.810	HJ-405224
	2.0000	2.5000	1.500	0.08		0.710	1.9996	1.9989		2.0009	2.0004	
2	50.800	63.500	44.45	2.03	IR-324028	0.376	50.790	50.772	IR-324028	50.823	50.810	HJ-405228
	2.0000	2.5000	1.750	0.08		0.830	1.9996	1.9989		2.0009	2.0004	
2 3/16	55.563	69.850	44.45	2.03	IR-354428	0.467	55.552	55.535	IR-354428	55.585	55.573	HJ-445628
	2.1875	2.7500	1.750	0.08		1.030	2.1871	2.1864		2.1884	2.1879	
2 1/4	57.150	69.850	38.10	2.03	IR-364424	0.358	57.140	57.122	IR-364424	57.173	57.160	HJ-445624
	2.2500	2.7500	1.500	0.08		0.790	2.2496	2.2489		2.2509	2.2504	

Continued on next page.



## INNER RINGS — *continued*

### INCH SERIES

- Check for availability.
- Ideal choice where shaft not practical to use as inner raceway.
- Provided in inch nominal dimensions for use with inch series heavy-duty needle roller bearings.
- Designed to meet established inch tolerances.
- Selected size should be wider than matching drawn cup bearing.
- Maximum shaft fillet radius ( $r_{s \max}$ ) cannot exceed inner ring bore chamfer ( $r_{s \min}$ ) as shown.
- Optional centralized lubrication groove (bore) or through-hole available – specify when ordering.
- Designed to be axially clamped against shoulder for loose transition fit on shaft.
- After mounting, for tight transition fit (keeping inner ring from rotating relative to shaft), inner ring O.D. must not exceed raceway diameter on matching bearing.

Shaft Diameter	Dimensions mm/in.				Inner Ring Designation	Approx. Wt. kg/lbs.	Loose Transition Fit mm/in.		Inner Ring Designation	Interference Fit mm/in.		Used With Bearing Designation
	d	F	B	$r_{s \min}$			Max.	Min.		Max.	Min.	
<b>in.</b>	<b>d</b>	<b>F</b>	<b>B</b>	<b><math>r_{s \min}</math></b>			<b>S</b>			<b>S</b>		
	57.150 2.2500	69.850 2.7500	44.45 1.750	2.03 0.08	IR-364428	0.417 0.920	57.140 2.2496	57.122 2.2489	IR-364428	57.173 2.2509	57.160 2.2504	HJ-445628
2 3/8	60.325 2.3750	76.200 3.0000	44.45 1.750	2.03 0.08	IR-384828	0.562 1.240	60.315 2.3746	60.297 2.3739	IR-384828	60.348 2.3759	60.335 2.3754	HJ-486028
2 1/2	63.500 2.5000	76.200 3.0000	38.10 1.500	2.03 0.08	IR-404824	0.395 0.870	63.490 2.4996	63.472 2.4989	IR-404824	63.523 2.5009	63.510 2.5004	HJ-486024
	63.500 2.5000	76.200 3.0000	44.45 1.750	2.03 0.08	IR-404828	0.463 1.020	63.490 2.4996	63.472 2.4989	IR-404828	63.523 2.5009	63.510 2.5004	HJ-486028
2 3/4	69.850 2.7500	82.550 3.2500	44.45 1.750	2.03 0.08	IR-445228	0.503 1.110	69.840 2.7496	69.822 2.7489	IR-445228	69.873 2.7509	69.860 2.7504	HJ-526828
	69.850 2.7500	82.550 3.2500	50.80 2.000	2.03 0.08	IR-445232	0.576 1.270	69.840 2.7496	69.822 2.7489	IR-445232	69.873 2.7509	69.860 2.7504	HJ-526832
2 15/16	74.613 2.9375	88.900 3.5000	50.80 2.000	2.03 0.08	IR-475632	0.694 1.530	74.602 2.9371	74.585 2.9364	IR-475632	74.635 2.9384	74.623 2.9379	HJ-567232
3	76.200 3.0000	88.900 3.5000	50.80 2.000	2.03 0.08	IR-485632	0.621 1.370	76.190 2.9996	76.172 2.9989	IR-485632	76.223 3.0009	76.210 3.0004	HJ-567232
3 1/8	79.375 3.1250	95.250 3.7500	50.80 2.000	2.54 0.1	IR-506032	0.880 1.940	79.365 3.1246	79.347 3.1239	IR-506032	79.398 3.1259	79.385 3.1254	HJ-607632
3 1/4	82.550 3.2500	95.250 3.7500	50.80 2.000	2.54 0.1	IR-526032	0.708 1.560	82.537 3.2495	82.517 3.2487	IR-526032	82.578 3.2511	82.563 3.2505	HJ-607632
	82.550 3.2500	101.600 4.0000	50.80 2.000	2.54 0.1	IR-526432	1.089 2.400	82.537 3.2495	82.517 3.2487	IR-526432	82.578 3.2511	82.563 3.2505	HJ-648032
3 3/8	85.725 3.3750	101.600 4.0000	50.80 2.000	2.54 0.1	IR-546432	0.930 2.050	85.712 3.3745	85.692 3.3737	IR-546432	85.753 3.3761	85.738 3.3755	HJ-648032
3 1/2	88.900 3.5000	101.600 4.0000	50.80 2.000	2.54 0.1	IR-566432	0.757 1.670	88.887 3.4995	88.867 3.4987	IR-566432	88.928 3.5011	88.913 3.5005	HJ-648032
	88.900 3.5000	107.950 4.2500	50.80 2.000	2.54 0.1	IR-566832	1.179 2.600	88.887 3.4995	88.867 3.4987	IR-566832	88.928 3.5011	88.913 3.5005	HJ-688432
3 3/4	95.250 3.7500	107.950 4.2500	50.80 2.000	2.54 0.1	IR-606832	1.012 2.230	95.237 3.7495	95.217 3.7487	IR-606832	95.278 3.7511	95.263 3.7505	HJ-688432
	95.250 3.7500	114.300 4.5000	57.15 2.250	2.54 0.1	IR-607236	1.406 3.100	95.237 3.7495	95.217 3.7487	IR-607236	95.278 3.7511	95.263 3.7505	HJ-729636
	95.250 3.7500	114.300 4.5000	63.50 2.500	2.54 0.1	IR-607240	1.565 3.450	95.237 3.7495	95.217 3.7487	IR-607240	95.278 3.7511	95.263 3.7505	HJ-729640
4	101.600 4.0000	127.000 5.0000	57.15 2.250	2.54 0.1	IR-648036	2.046 4.510	101.587 3.9995	101.567 3.9987	IR-648036	101.628 4.0011	101.613 4.0005	HJ-8010436
	101.600 4.0000	127.000 5.0000	63.50 2.500	2.54 0.1	IR-648040	2.272 5.010	101.587 3.9995	101.567 3.9987	IR-648040	101.628 4.0011	101.613 4.0005	HJ-8010440
4 1/4	107.950 4.2500	127.000 5.0000	57.15 2.250	2.54 0.1	IR-688036	1.565 3.450	107.937 4.2495	107.917 4.2487	IR-688036	107.978 4.2511	107.963 4.2505	HJ-8010436
4 1/2	114.300 4.5000	139.700 5.5000	63.50 2.500	2.54 0.1	IR-728840	2.495 5.500	114.287 4.4995	114.267 4.4987	IR-728840	114.328 4.5011	114.313 4.5005	HJ-8811240

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## **NEEDLE ROLLER BEARINGS**



### **NOTES**

C





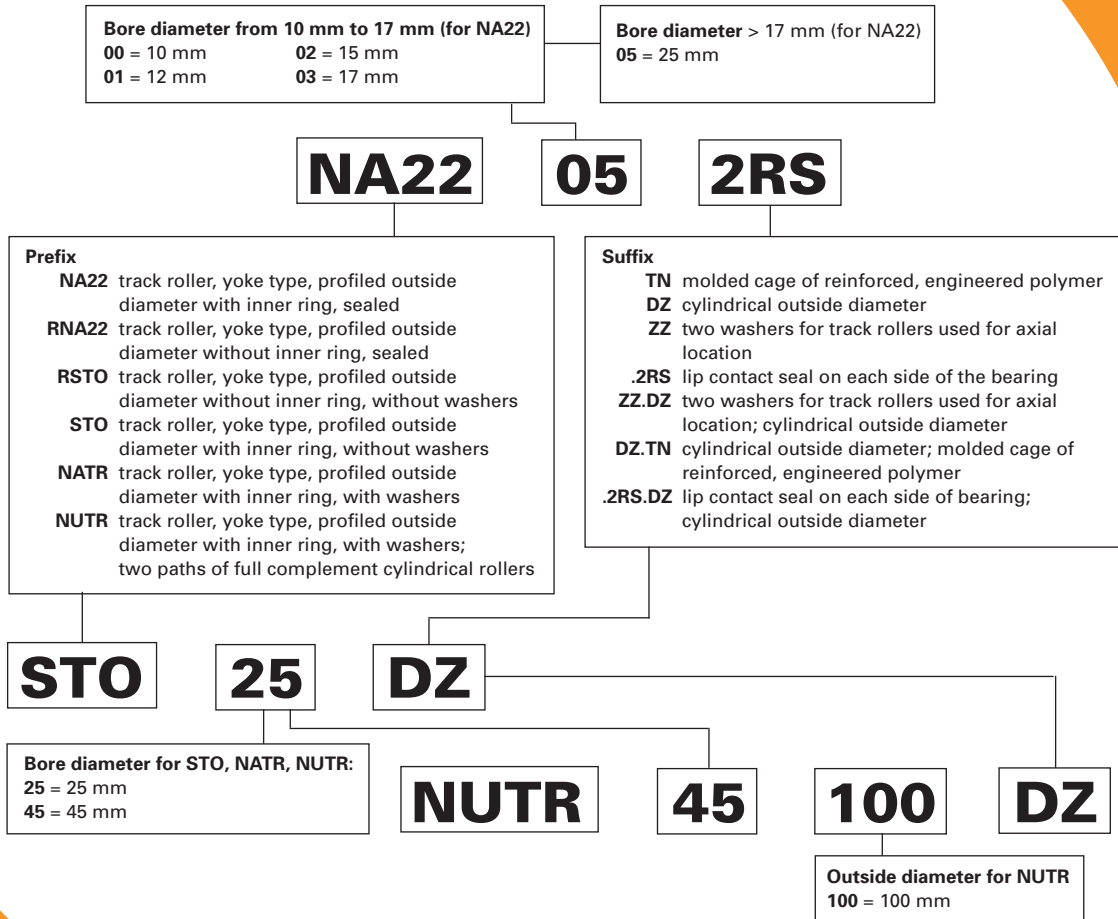
## TRACK ROLLERS

**Overview:** Track rollers (also known as cam followers) are characterized by their thick-walled outer rings that run directly on a track. The thick outer rings permit high load-carrying capability while minimizing both distortion and bending stresses. Sealed designs with internal thrust washers help extend service life under conditions of infrequent lubrication.

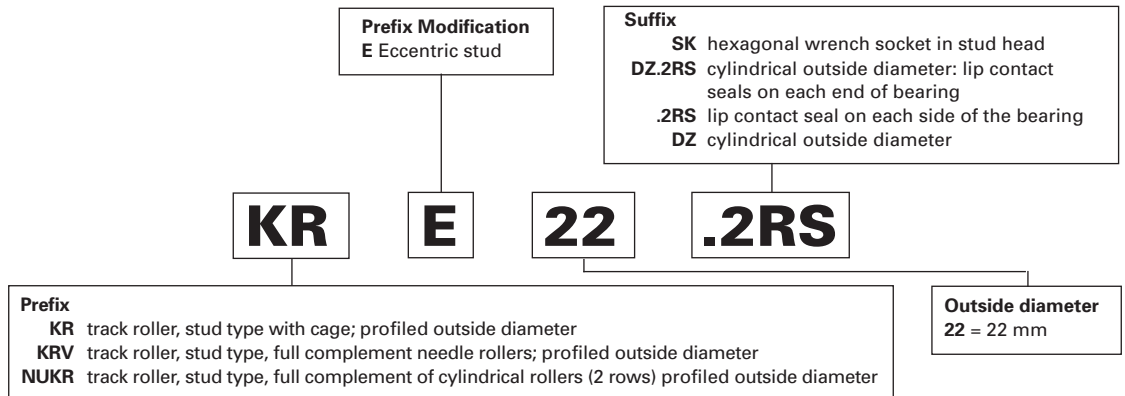
- **Sizes:** 16 mm - 110 mm (1/2 in. - 4 in.) bore.
- **Markets:** Ram support rollers, material handling and indexing equipment.
- **Features:** Available in two basic designs: with an inner ring for straddle mounting in a yoke or with an integral stud for cantilever mounting.
- **Benefits:** High load-carrying capability with minimized distortion and bending stresses. Extended service life under conditions of infrequent relubrication.



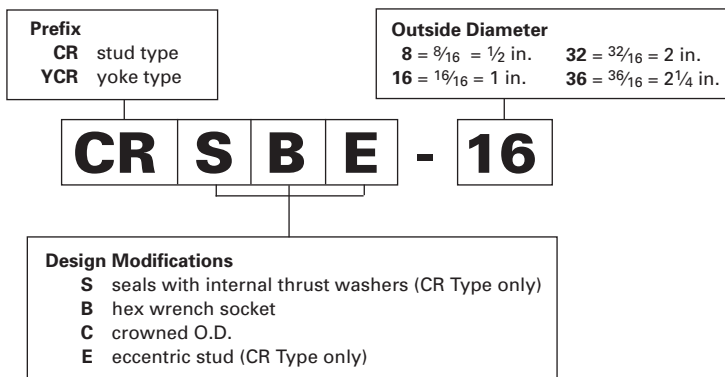
## Yoke Type Track Rollers – Metric Nominal Dimensions



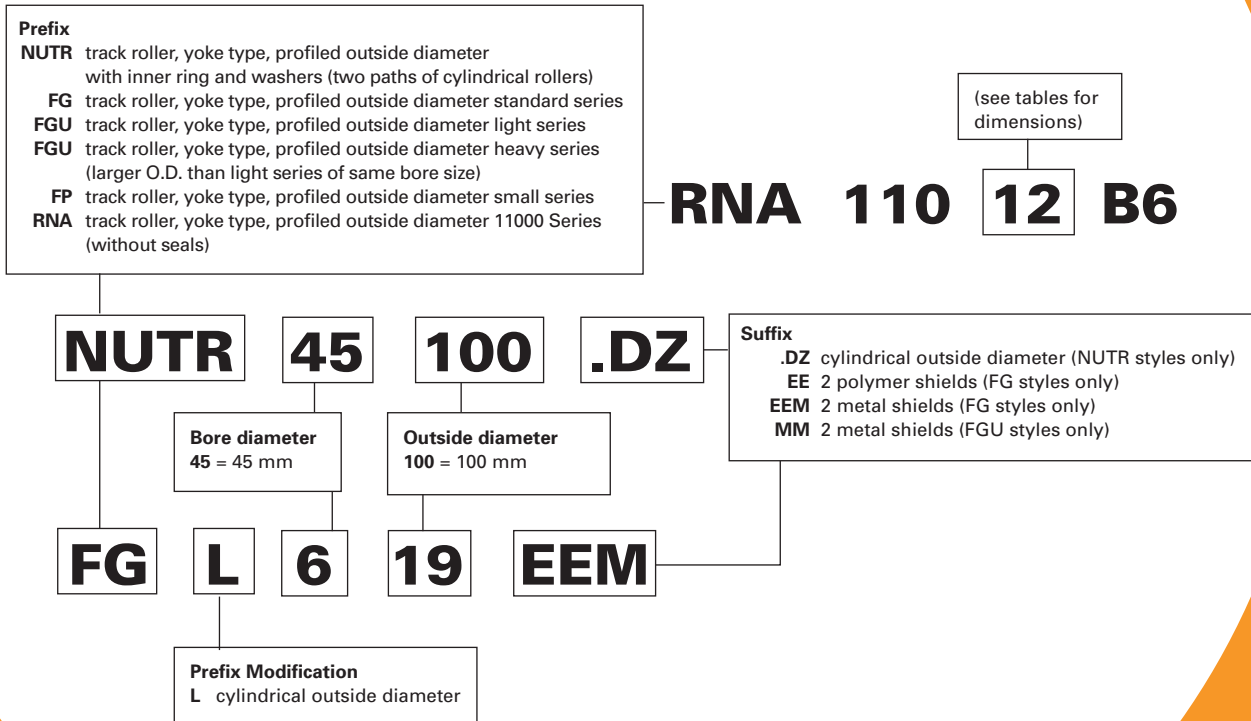
## Stud Type Track Rollers – Metric Nominal Dimensions



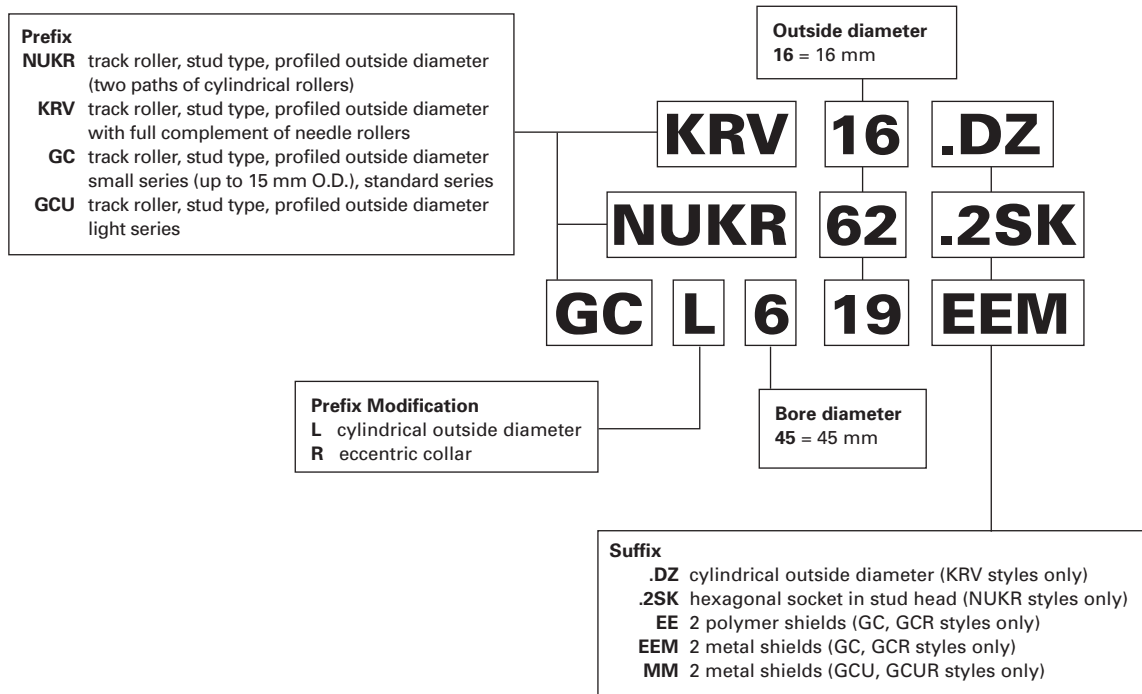
## Track Rollers / Cam Followers – Inch Nominal Dimensions



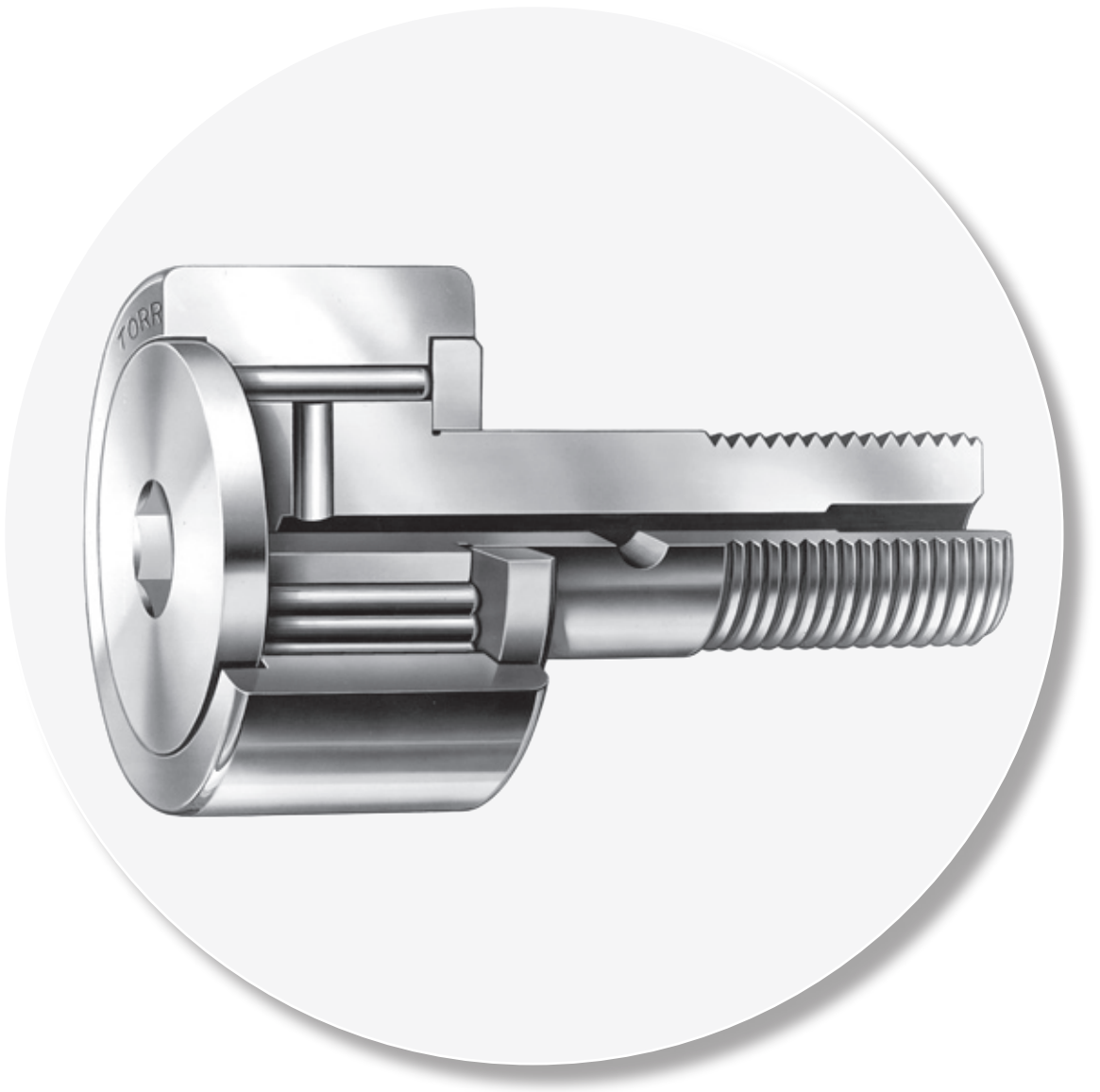
## Full Complement Yoke Type Track Rollers - Metric Nominal Dimensions



## Full Complement Stud Type Track Rollers - Metric Nominal Dimensions



C



# Stud Type and Yoke Type Track Rollers

## STUD TYPE AND YOKE TYPE TRACK ROLLERS METRIC SERIES

Introduction ..... C160

### STUD TYPE METRIC SERIES

Needle Roller and Cage Assemblies (KR Series) ..... C168

Needle Roller and Cage Assemblies, Sealed  
(KR....2S Series) ..... C170

Full Complement with Needle Rollers (KRV Series) or  
Cylindrical Rollers (NUKR Series) ..... C172

Full Complement, Small Series, Unsealed (GC Series) ..... C174

Full Complement, Standard Series, with or  
without Seals (GC Series) ..... C176

Full Complement, with Metal Seals (GCU....MM Series) ... C178

Full Complement, Eccentric (GCR Series) ..... C180

Full Complement Eccentric, with Metal Seals  
(GCU....MM Series) ..... C184

### YOKE TYPE METRIC SERIES

Caged, without Inner Ring, No End Washers  
(RSTO Series) ..... C186

Caged, with Inner Ring, No End Washers (STO Series) ..... C188

Caged, without Inner Ring, No End Washers,  
Sealed (RNA22 Series) ..... C190

Caged, with Inner Ring, No End Washers,  
Sealed (NA22 Series) ..... C192

Caged, with Inner Ring, With End Washers  
(NATR, STO.ZZ Series) ..... C194

Full Complement, with Inner Ring, with End Washers,  
Cylindrical Rollers (NUTR Series) ..... C196

## STUD TYPE AND YOKE TYPE TRACK ROLLERS

Full Complement, Non-Separable, Small Series,  
Unsealed (FP Series) ..... C198

Full Complement, Non-Separable, Sealed or Unsealed  
(FG Series) ..... C199

Full Complement, Non-Separable, Light Series,  
with Metal Seals (FGU....MM Series) ..... C202

Full Complement, Non-Separable, Heavy Series,  
with Metal Seals (FGU....MM Series) ..... C203

Full Complement, without Inner Ring, Unsealed  
(RNA....B6, RNAB, RNAL Series) ..... C205

Separate Inner Rings for RNA....B6, RNAB,  
RNAL Series (BIC Series) ..... C205

## STUD TYPE AND YOKE TYPE TRACK ROLLERS INCH SERIES

Introduction ..... C206

Stud Type Track Rollers CR, CRS Series ..... C212

Stud Type Track Rollers CRSB Series ..... C216

Yoke Type Track Rollers YCR, YCRS Series ..... C220





## STUD TYPE AND YOKE TYPE TRACK ROLLERS – METRIC SERIES

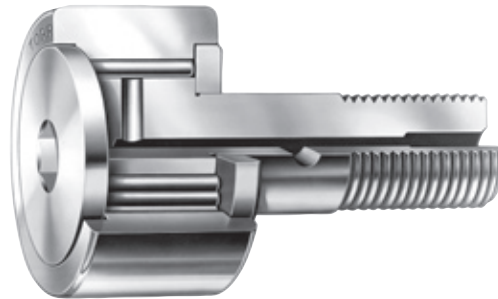
Timken track rollers listed in this catalog have been designed with outer rings of a large radial cross section to withstand heavy rolling and shock loads on track type or cam-controlled equipment. The outside diameters of the outer rings are either profiled or cylindrical. Profiled track rollers are designed to alleviate uneven bearing loading resulting from deflection, bending or misalignment in mounting.

Stud type track rollers are available in various open designs, as well as with lip contact seals or metal shields.

Yoke type track rollers are designed for straddle mounting. The various metric series designs are grouped and organized as illustrated below.

### REFERENCE STANDARDS ARE:

- **ISO 6278** – Needle roller bearings – Track rollers – Boundary dimensions
- **ISO 492** – Radial bearings – Tolerances
- **DIN 620** – Tolerances of Ball and Roller Bearings
- **ISO 281** – Rolling bearings – Dynamic load ratings and rating life



### Suffixes – Stud Type, Metric Series (except GC types)

<b>.2RS</b>	two seals
<b>DZ</b>	cylindrical outside diameter
<b>DZ.2RS</b>	cylindrical outside diameter • two seals
<b>SK</b>	hexagonal socket in flange end
<b>2SK</b>	hexagonal socket in both flange and stud ends

### Suffixes – Yoke Type, Metric Series (except FP or FG types)

<b>DZ.TN</b>	cylindrical outside diameter • molded cage of reinforced engineered polymer
<b>TN</b>	molded cage of reinforced engineered polymer
<b>DZ</b>	cylindrical outside diameter
<b>ZZ</b>	two end washers for the outer ring
<b>ZZ.DZ</b>	two end washers for the outer ring • cylindrical outside diameter
<b>.2RS</b>	two seals
<b>.2RS.DZ</b>	two seals • cylindrical outside diameter

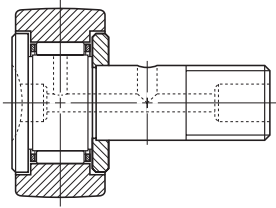
### Suffixes – Yoke Type (FP, FG) and Stud Type (GC)

<b>EE</b>	polymer seals
<b>EEM</b>	metal shields
<b>MM</b>	metal shields

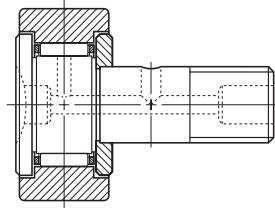
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STUD TYPE METRIC SERIES TRACK ROLLER TYPES

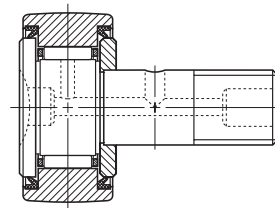
STUD TYPE TRACK ROLLERS, CAGED NEEDLE ROLLERS



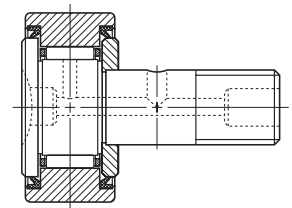
KR



KR.DZ

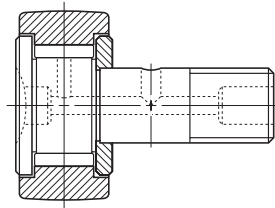


KR.2RS

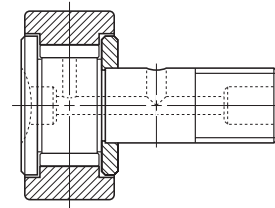


KR.DZ.2RS

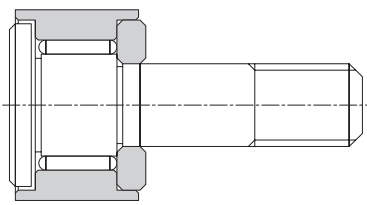
STUD TYPE TRACK ROLLERS, FULL COMPLEMENT NEEDLE ROLLERS



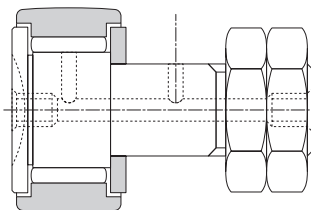
KRV



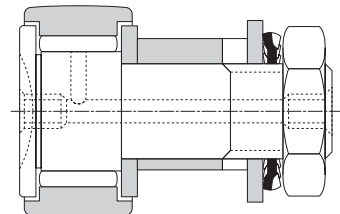
KRV.DZ



GC/GCL

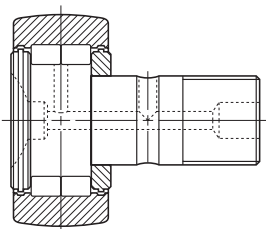


GC/GCL

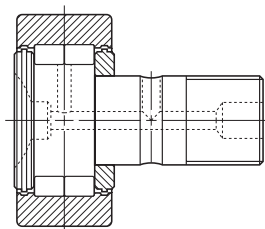


GCR/GCRL

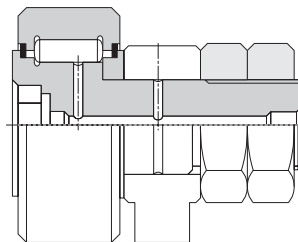
STUD TYPE TRACK ROLLERS, FULL COMPLEMENT CYLINDRICAL ROLLERS



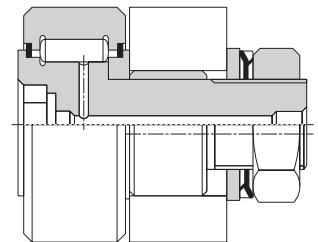
NUKR



NUKR.DZ



GCU/GCUL



GCUR/GCURL

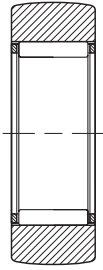
C



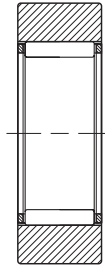


**TYPES OF METRIC SERIES YOKE TYPE TRACK ROLLERS**

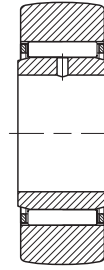
**YOKE TYPE TRACK ROLLERS WITHOUT END WASHERS**



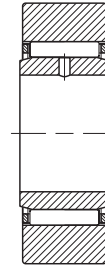
RSTO



RSTO.DZ

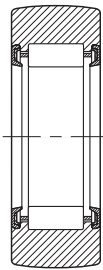


STO

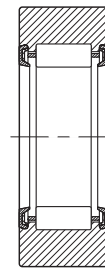


STO.DZ

**SEALED YOKE TYPE TRACK ROLLERS WITHOUT END WASHERS.**



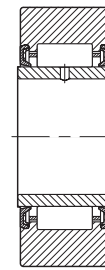
RNA22.2RS



RNA22.2RS.DZ

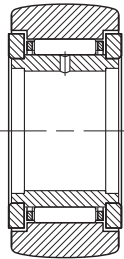


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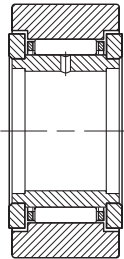


NA22.2RS.DZ

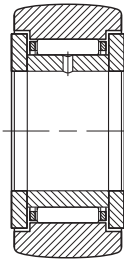
**YOKE TYPE TRACK ROLLERS WITH END WASHERS**



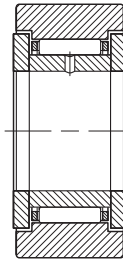
NATR



NATR.DZ

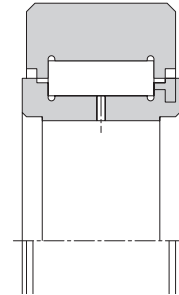


STO.ZZ

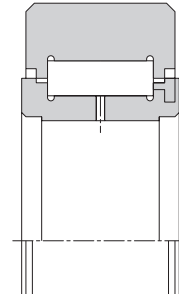


STO.ZZ.DZ

**YOKE TYPE TRACK ROLLERS WITH FULL COMPLEMENT OF CYLINDRICAL ROLLERS**

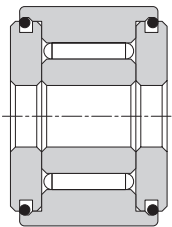


FGU/FGUL Light

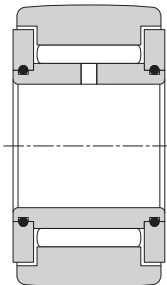


FGU/FGUL Heavy

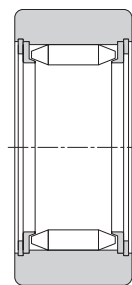
**YOKE TYPE TRACK ROLLERS WITH END WASHERS, FULL COMPLEMENT OF NEEDLE ROLLERS**



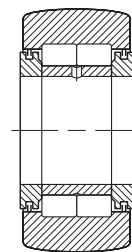
FP/FPL



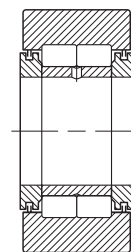
FG/FGL



RNA1100



NUTR



NUTR.DZ

C



## CONSTRUCTION

### STUD TYPE TRACK ROLLERS

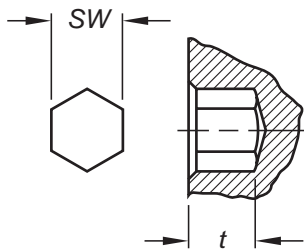
The metric series stud type track roller is a non-separable unit, consisting of a large radial cross-section outer ring, needle roller and cage radial assembly or a full complement of needle or cylindrical rollers, a stud and a retaining washer securely fastened to the stud.

The seals on the sealed stud type track rollers are located in the counterbores of the outer ring and seal against the stud flange and the retaining washer, providing good retention of lubricant and exclusion of foreign material. The seals are thermally stable in a temperature range between -30° C and 110° C.

A screwdriver slot (standard) or a hexagonal wrench socket (customer requested) in the head of the stud facilitates mounting. Wrench sizes are listed on the dimensional tables where found among certain GC Series sizes on pages later in this section. Other metric series hexagonal socket sizes are listed in Table 1.

TABLE 1 –  
HEXAGONAL SOCKET – METRIC SERIES

Stud Type Track Roller Outside Diameter		Dimensions	
> mm	≤	SW	t
19	16	3	2.5
30	26	4	2.5
40	35	6	4
62	52	8	5
80	72	12	7
	90	17	10



### ECCENTRIC STUDS FOR STUD TYPE TRACK ROLLERS

To provide radial adjustment of the outer ring toward the track or cam surface at the time of installation, some metric series stud type track rollers are available with eccentric studs which are specified by adding the letter “E” to the designation letters: KRE and NUKRE. The GCR and GCUR Series include an eccentric bushing added to the track roller stud. Appropriate dimensions of the eccentric stud bushing are listed in Table 2 and 2A.

Since a track roller with an eccentric stud is usually adjusted upon installation by turning the stud in the mounting hole, a close clearance fit between the outside diameter of the bushing and the mounting hole is necessary. For turning the stud, a hexagonal wrench is generally more convenient than a screwdriver, thus, the option of a hexagonal wrench socket in the head of the stud should be considered.

Some applications may require more secure positioning than provided by the tightened stud nut. If so, it is recommended that the mounting hole and the eccentric bushing be drilled at the time of installation to accept a locating dowel pin.

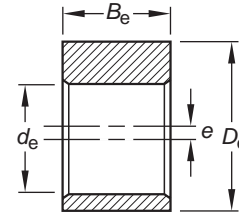


TABLE 2 –  
ECCENTRIC BUSHING DIMENSIONS –  
METRIC SERIES (EXCEPT GCR, GCUR SERIES)

Stud Type Outside >	Track Roller Diameter mm ≤	Dimensions			
		d <sub>e</sub>	D <sub>e</sub>	B <sub>e</sub>	e
	16	6	9	7	0.5
19	19	8	11	9	0.5
22	26	10	13	10	0.5
30	32	12	15	11	0.5
35	35	16	20	14	1.0
40	40	18	22	16	1.0
47	52	20	24	18	1.0
62	72	24	28	22	1.0
80	90	30	35	29	1.5

TABLE 2A -  
ECCENTRIC BUSHING DIMENSIONS  
METRIC SERIES GCR, GCUR

over mm	incl. mm	d <sub>e</sub>	D <sub>e</sub>	B <sub>w</sub>	e
-	19	6	9	7.5	0.5
19	28	10	14	10.5	1.0
28	32	12	16	11.5	1.0
32	35	16	21	15.1	1.5
35	40	18	24	17.1	1.5
40	52	20	27	19.1	2.0
52	72	24	36	24.1	3.0
72	90	30	42	30.7	3.0
90	110	36	48	36.5	3.0
110	-	42	54	43.5	3.0



## YOKE TYPE TRACK ROLLERS

### METRIC SERIES YOKE TYPE TRACK ROLLERS WITHOUT END WASHERS

These yoke type track rollers are available with a profiled or a cylindrical outside diameter of the outer ring, and with or without a separable inner ring. Since they are supplied without end washers, their outer rings must be guided by the adjacent end locating surfaces. Tolerance class F6 is the normal specification for the bore of the metric series needle roller and cage radial assemblies used with these yoke type track rollers.

### YOKE TYPE TRACK ROLLERS – SERIES RSTO & STO

Series STO have a separable inner ring and when the inner ring is removed they become series RSTO. They run directly on a hardened and ground inner raceway. Quality requirements for inner raceways are given in the engineering section of this catalog.

### SEALED YOKE TYPE TRACK ROLLERS WITHOUT END WASHERS – SERIES RNA 22.2RS & NA22.2RS

These yoke type track rollers have the same bore diameter and outside diameter as most of the other metric series yoke type track rollers listed in this catalog. The thick section outer ring is made of one-piece channel-shaped bearing quality steel, heat treated to yield maximum load carrying capability. The integral end flanges provide axial guidance for the large diameter needle rollers, and a cage supplies their inward retention. These track rollers have two integral lip contact seals designated by .2RS. The seals are thermally stable in a temperature range between -30° C and 110° C. Care should be exercised when mounting track rollers without inner rings onto inner raceways to avoid damage to the seals. Inner raceway quality requirements are given in the engineering section of this catalog.

### METRIC SERIES YOKE TYPE TRACK ROLLERS WITH END WASHERS

These yoke type track rollers are available with a crowned or a cylindrical outside diameter of the outer ring. Metric series yoke type track rollers with end washers, depending on the internal construction, may be end guided, either through the end washers or between the end faces of the rollers and the inside faces of the outer ring flanges.

### YOKE TYPE TRACK ROLLERS – SERIES NATR & STO.ZZ

The series NATR yoke type track rollers are of non-separable design consisting of a crowned or a cylindrical outer ring, caged needle rollers, an inner ring and two retaining end washers securely fastened to the inner ring. The series STO.ZZ yoke type track rollers are of separable design with two loose end washers. These end washers placed in the counter bores of the outer ring form very effective labyrinth type shields, providing good retention of lubricant and exclusion of foreign material. A lubrication hole in the inner ring enables relubrication when a cross-drilled bolt or shaft, which can be serviced from the end, is used.

### YOKE TYPE TRACK ROLLERS – SERIES NUTR

The series NUTR yoke type track rollers are of non-separable design consisting of a profiled or cylindrical outer ring, two rows of full complements of cylindrical rollers, an inner ring, two retaining end washers and two shields. The outer ring is located axially through the cylindrical rollers.

A lubricating hole in the inner ring enables relubrication when a cross-drilled bolt or shaft, which can be serviced from the end, is used.

The smallest track roller of this series has an outside diameter of 35 mm. NUTR yoke type track rollers are well suited to carry high loads and designs with a thicker outer ring are particularly suitable for high shock loads. Designs with thicker outer ring have a larger outside diameter which can be identified by the bearing designation (e.g., NUTR 1542).

### YOKE TYPE TRACK ROLLERS – SERIES FP AND FG

The FP and FG non-separable inner ring designs are available in profiled or cylindrical outer rings. Both employ a full complement of needle rollers and require relubrication via a pathway through the shaft. The FP Series is the smallest series available and is not offered with seals.

### YOKE TYPE TRACK ROLLERS – SERIES FGU (LIGHT AND HEAVY TYPES)

The FGU non-separable inner ring designs are available in profiled or cylindrical outer rings. All FGU Series use a full complement of cylindrical rollers between the inner and outer rings and require relubrication via a pathway through the shaft. The FGU Heavy series uses a thicker outer ring section and are capable of higher loads.

Both FGU Series are only available with a metal shield for a roller sealing option.

### YOKE TYPE TRACK ROLLERS – SERIES RNA, RNAB, RNAL

The RNA and RNAB Series design use a full complement of needle rollers retained with a pair of end washers. A separate, matching inner ring is listed in the tables of part numbers. The RNAL Series use a cylindrical outer ring and is only offered in limited sizes.

C

### DIMENSIONAL ACCURACY

The tolerances of the basic metric series caged roller and NUKR stud type and yoke type track rollers whose outer rings have a cylindrical outside diameter, correspond to tolerances specified in ISO-492 Radial bearings - Tolerances. The outer ring tolerances given in Table 4 apply to the outer rings used in the caged roller and NUKR stud type and caged roller and NUTR yoke type, metric series, track rollers. Metric series track rollers with a crowned outside diameter are the exception: their outside diameter tolerances is 0-0.05 for all caged roller sizes and NUTR, NUKR types. The remaining types have h9 tolerance on profiled outer diameters and h7 for straight diameters. Stud diameter and stud length tolerances are

TABLE 3 – TOLERANCES FOR STUD DIAMETER AND STUD LENGTH – METRIC SERIES

Stud Diameter mm				Stud Length mm	
>	≤	μm		high	low
		high	low	high	low
d <sub>1</sub>		Δd <sub>1s</sub>		B <sub>2</sub>	ΔB <sub>2</sub>
3	6	0	-12	all lengths	0 -1
6	10	0	-15		
10	18	0	-18		
18	30	0	-21		
30	50	0	-25		
50	80	0	-30		
80	100	0	-35		

given in Table 3. The inner ring tolerances given in Table 5 apply to inner rings used in metric series caged roller, NUKR Series yoke type track rollers.

### MOUNTING STUD TYPE TRACK ROLLERS

When the stud shank of a metric series stud type track roller is mounted in a hole of tolerance H7, the installation force should be applied only to the center portion of the flanged end of the stud, preferably with an arbor press. The surface of the hole in the machine element which supports the stud must not deform under the expected load, and the support should be sufficiently rigid to resist bending loads. Deformation and bending will cause uneven loading of the outer ring.

In mounting the stud type track roller, the retaining washer must be firmly backed up by a flat shoulder which is square with the stud center line. The shoulder diameter must be no smaller than the minimum clamping diameter, d<sub>a</sub> listed in the tabular data.

The maximum inherent strength of the stud is obtained when the track roller is supported as close as possible to the retaining washer, which minimizes the bending moment. For this reason the edge of the housing which supports the stud shank should be kept as sharp as practical, but free from burrs.

The clamping nut should not be tightened with a torque value higher than the maximum listed. A screwdriver slot or hexagonal wrench socket in the flanged end of the stud is provided for a tool to prevent the stud from turning when the nut is being tightened. Hexagonal nuts are supplied with all metric series stud type track rollers.

TABLE 4 – OUTER RING – METRIC SERIES (CAGED ROLLER AND NUKR, NUTR TYPES)

Tolerances in mm (0.001 mm)

mm		cylindrical		crowned		high	low	max.
>	≤	high	low	high	low	high	low	K <sub>ea</sub>
D		ΔD <sub>mp</sub>		ΔC <sub>s</sub>				
10	18	0	-8	0	-50	0	-120	15
18	30	0	-9	0	-50	0	-120	15
30	50	0	-11	0	-50	0	-120	20
50	80	0	-13	0	-50	0	-120	25
80	120	0	-15	0	-50	0	-120	35
120	150	0	-18	0	-50	0	-120	40
150	180	0	-25	0	-50	0	-150	45
180	240	0	-30	0	-50	0	-200	50

TABLE 5 – INNER RING – METRIC SERIES (CAGED ROLLER AND NUTR TYPES)

Tolerances in mm (0.001 mm)

mm		high	low	high	low
>	≤	Δd <sub>mp</sub>		ΔB <sub>s</sub>	
d					
2.5	18	0	-8	0	-180
18	30	0	-10	0	-210
30	50	0	-12	0	-250
50	80	0	-15	0	-300
80	120	0	-20	0	-350



## YOKE TYPE TRACK ROLLERS

The machine element with the holes in which the mounting bolt or shaft is supported must be sufficiently rigid to resist local crushing under the applied load, and to resist bending which can cause uneven loading of the needle rollers.

When applied loads are high, the h6 or j6 tolerance should be used in conjunction with a high strength shaft or bolt for mounting metric series yoke type track rollers. When loads are moderate, a g6 tolerance may be used with a high strength shaft or bolt. For light loads, the loose transition fit with the f6 tolerance may be used with an unhardened shaft or bolt.

The yoke type track rollers with inner rings, also those with end washers as well as inner rings, should be clamped endwise between parallel faces perpendicular to the axis to prevent the

retaining washers from coming off under load. The dimensions of machine parts adjoining the metric series yoke type track rollers should be based on the minimum clamping diameter  $d_a$  to ensure that the washers are adequately supported. If the track roller cannot be end clamped, a close axial fit in the yoke is required. Care should be taken that the lubricating hole is located in the unloaded zone of the raceway.

The metric series yoke type track rollers without inner rings require a hardened and ground shaft or bolt with a k5 tolerance. Inner raceway quality requirements are given in the engineering section of this catalog.

C

## LOAD RATINGS

### DYNAMIC LOADING AS A TRACK ROLLER

When the outer ring of a stud type or yoke type track roller runs on a track, the contact, under a radial load, causes elastic (oval) deformation of the outer ring. As a result, a smaller zone of the raceway is loaded and the load is distributed on fewer needle rollers. This in turn affects the dynamic and static load ratings of the track rollers. Also, this deformation generates bending stress in the outer ring which must not exceed the maximum permitted for the material of the outer ring. The maximum permissible dynamic ( $F_{r\text{ perm}}$ ) radial load condition is determined by this requirement.

The rating life of stud type or yoke type track rollers should be calculated using the dynamic load ratings  $C_w$  shown in the tables. The tables also show the maximum permissible radial load,  $F_{r\text{ perm}}$  that can be dynamically applied on stud type or yoke type track rollers. However, to calculate the  $L_{10}$  life of a track roller, the applied radial load must not be greater than  $C_w/2$  based on ideal operating conditions of alignment, lubrication, temperature, speed, and accelerations.

### STATIC RATING AS A TRACK ROLLER

In addition to the basic static load rating  $C_0$ , the tables also list the maximum permissible static radial load  $F_{0r\text{ perm}}$  that may be applied to a stud type or yoke type metric series track roller. The values of  $F_{0r\text{ perm}}$  result in a calculated minimum static factor  $f_s$  of 0.7 for the worst condition of internal load distribution in metric series track roller operation. **The  $F_{0r\text{ perm}}$  values must not be exceeded.** The static factor  $f_s$  can be calculated using the following formula:

$$f_s \geq 0.7 \cdot \frac{F_{0r\text{ perm}}}{P_{0r}}$$

where

$F_{0r\text{ perm}}$  = Maximum permissible static radial load (kN)

$P_{0r}$  = Equivalent static load (kN)

$P_{0r} = F_{0r}$  for metric series track rollers

$F_{0r}$  = Static radial load (kN)

$f_s$  = Static factor whose values should not be smaller than those suggested in Table 6.

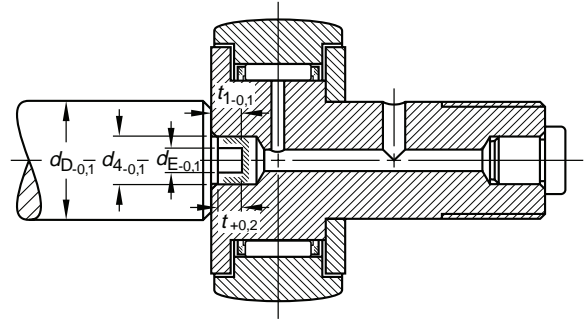
TABLE 6 – SUGGESTED VALUES FOR STATIC FACTORS  $f_s$  FOR METRIC SERIES TRACK ROLLERS

Requirements For Yoke Type Track Rollers And Stud Type Track Rollers	Suggested $f_s$ Values
High shock-type loads	
Quiet running	1.5...2.5
Normal loading	
Normal quietness of running	1...1.5
Minor impact loads and rotary motion particularly quiet running not required	0.7...1

## LUBRICATION OF STUD TYPE TRACK ROLLERS

Timken metric series stud type track rollers are supplied with a lithium soap based, general purpose grease. When the caged KR Series track rollers are operated at low speeds, with light loads and in clean environments, there often is no need to relubricate the track roller. In other applications, periodic relubrication may be necessary to obtain optimum performance. The full complement series of track rollers have less internal volume available for grease storage, therefore, they may require more frequent lubrication than caged type track rollers. Stud type track rollers, with a screwdriver slot in the flanged end of the stud, have provisions for relubrication through the flanged end of the stud. Metric series stud type track rollers with hexagonal sockets can not be relubricated from the flanged end of the stud. Both types of metric series stud type track rollers, with outside diameters larger than 22 mm (28 mm for all GC variations), allow for relubrication through the threaded end of the stud. In addition, caged roller and NUKR Series stud type track rollers with 30 mm and larger outside diameters allow for relubrication through a cross-drilled hole in the stud shank. The ends of the axial holes are counterbored to accept press-fit grease fittings of series VENN. The grease fittings are supplied with metric series stud type track rollers. Hole diameters ( $d_4$ ) for these grease fittings are listed in the tables of dimensions on pages later in this chapter as it applies. Note that the GC small series has no axial hole.

One or more plugs are supplied with every metric series stud type track roller to close off unused holes. At the flanged end, the plug must not be pushed in too deeply as it may cover the cross-drilled lubricating hole. The plug should be pressed in using an installation tool whose dimensions are given in Table 8. If the cross-drilled hole in the stud shank is not used, it will be covered when the track roller is properly installed.



During installation of the track roller it will be desirable to ensure that the cross drilled hole is positioned in the unloaded zone of the track roller raceway. The location of the cross-drilled hole can be best recognized by its alignment with the manufacturer's stamp or parallel to the screwdriver slot, in certain cases.

## LUBRICATION OF YOKE TYPE TRACK ROLLERS

Yoke type track rollers are produced with a lubricating hole in the inner ring so they can be relubricated through a cross-drilled hole in the supporting shaft or bolt. When mounting yoke type track rollers, care should be taken that the lubrication hole is located in the unloaded raceway zone.

Oil is the preferred lubricant for yoke type track rollers. Continuous oil lubrication or frequent grease lubrication should be used for steady rotating conditions. Applications involving slow, intermittent oscillations are not as critical, and longer intervals between relubrication are permitted. Sealed yoke type track rollers are normally supplied with an initial charge of a medium temperature grease. Caged yoke type track rollers have maximum grease storage capacity and, consequently, longer pregreased life than full complement types.

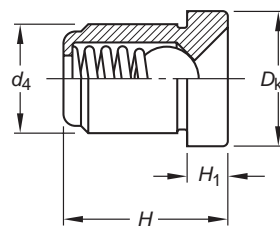


TABLE 7 – METRIC SERIES GREASE FITTINGS, SERIES VENN

Designation	Dimensions mm				Wt. g approx.
	$d_4$	$D_K$	H	$H_1$	
VENN 4	4	6	6	1.5	0.4
VENN 6	6	8	7	2	1.6
VENN 8	8	10	12	3	4.7

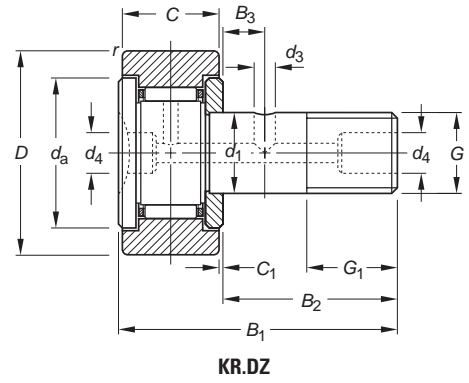
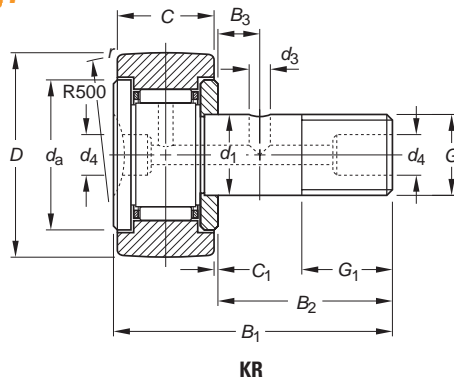
TABLE 8 – INSTALLATION TOOL FOR METRIC SERIES PLUG

Stud Type Track Roller Outside Diameter mm	Dimensions					
	>	≤	$d_4$	$d_D$	$d_E$	t
16	26	3.9	10	2.7	3.7	4.5
30	40	5.9	12	4.7	4.7	7
47	90	7.9	15	6.7	6.7	10



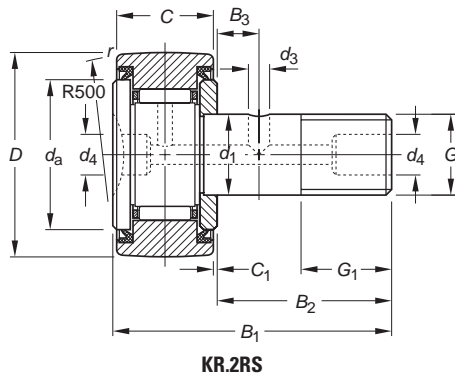
**NEEDLE ROLLER AND CAGE ASSEMBLIES,  
STUD TYPE (KR SERIES)**

**METRIC SERIES**



C

Outer Dia.	Dimensions mm/in.												
	mm	d <sub>1</sub>	h <sub>7</sub>	C	r <sub>s min</sub>	B <sub>1</sub>	B <sub>2</sub>	B <sub>3</sub>	G <sub>1</sub>	d <sub>4</sub>	d <sub>3</sub>	Thread	C <sub>1</sub>
16	6	6	16	11	0.3	28.2	16		8	4		M6x1	0.6
	0.2362	0.2362	0.6299	0.433	0.012	1.110	0.630		0.315	0.157		M6x1	0.024
19	8	8	19	11	0.3	32.2	20		10	4		M8x1.25	0.6
	0.3150	0.3150	0.7480	0.433	0.012	1.268	0.787		0.394	0.157		M8x1.25	0.024
22	10	10	22	12	0.3	36.0	23		12	4		M10x1	0.6
	0.3937	0.3937	0.8661	0.472	0.012	1.417	0.906		0.472	0.157		M10x1	0.024
26	10	10	26	12	0.3	36.0	23		12	4		M10x1	0.6
	0.3937	0.3937	1.0236	0.472	0.012	1.417	0.906		0.472	0.157		M10x1	0.024
30	12	12	30	14	0.6	40.0	25	6	13	6	3	M12x1.5	0.6
	0.4724	0.4724	1.1811	0.551	0.024	1.575	0.984	0.236	0.512	0.236	0.118	M12x1.5	0.024
32	12	12	32	14	0.6	40.0	25	6	13	6	3	M12x1.5	0.6
	0.4724	0.4724	1.2598	0.551	0.024	1.575	0.984	0.236	0.512	0.236	0.118	M12x1.5	0.024



d <sub>a</sub>	Bearing Designation	Load Ratings kN/lbf.					Tightening Torque Nm/in.-lbs.	Limiting Speed Grease RPM	Wt. kg/lbs.
		Dynamic	Static	As a Track Roller					
				Dynamic	Static	Static			
C	C <sub>0</sub>	C <sub>w</sub>	F <sub>r perm</sub>	F <sub>0r perm</sub>					
<b>11</b> 0.433	<b>KR16</b>	<b>3.60</b> 810	<b>3.58</b> 800	<b>2.97</b> 670	<b>2.85</b> 640	<b>3.58</b> 800	<b>7</b> 62.0	<b>17000</b>	<b>0.019</b> 0.042
<b>11</b> 0.433	<b>KR16.DZ</b>	<b>3.60</b> 810	<b>3.58</b> 800	<b>2.97</b> 670	<b>2.85</b> 640	<b>3.58</b> 800	<b>7</b> 62.0	<b>17000</b>	<b>0.019</b> 0.042
<b>13</b> 0.512	<b>KR19</b>	<b>4.18</b> 940	<b>4.65</b> 1050	<b>3.28</b> 740	<b>3.29</b> 740	<b>4.22</b> 950	<b>16</b> 142	<b>13000</b>	<b>0.031</b> 0.068
<b>13</b> 0.512	<b>KR19.DZ</b>	<b>4.18</b> 940	<b>4.65</b> 1050	<b>3.28</b> 740	<b>3.29</b> 740	<b>4.22</b> 950	<b>16</b> 142	<b>13000</b>	<b>0.031</b> 0.068
<b>15</b> 0.591	<b>KR22</b>	<b>5.35</b> 1200	<b>6.79</b> 1530	<b>3.94</b> 890	<b>4.04</b> 910	<b>5.45</b> 1230	<b>28</b> 248	<b>10000</b>	<b>0.046</b> 0.101
<b>15</b> 0.591	<b>KR22.DZ</b>	<b>5.35</b> 1200	<b>6.79</b> 1530	<b>3.94</b> 890	<b>4.04</b> 910	<b>5.45</b> 1230	<b>28</b> 248	<b>10000</b>	<b>0.046</b> 0.101
<b>15</b> 0.591	<b>KR26</b>	<b>5.35</b> 1200	<b>6.79</b> 1530	<b>4.55</b> 1020	<b>6.78</b> 1520	<b>7.24</b> 1630	<b>28</b> 248	<b>10000</b>	<b>0.059</b> 0.130
<b>15</b> 0.591	<b>KR26.DZ</b>	<b>5.35</b> 1200	<b>6.79</b> 1530	<b>4.55</b> 1020	<b>6.78</b> 1520	<b>7.24</b> 1630	<b>28</b> 248	<b>10000</b>	<b>0.059</b> 0.130
<b>21</b> 0.827	<b>KR30</b>	<b>7.89</b> 1770	<b>9.79</b> 2200	<b>6.32</b> 1420	<b>7.74</b> 1740	<b>9.31</b> 2090	<b>45</b> 398	<b>8200</b>	<b>0.087</b> 0.192
<b>21</b> 0.827	<b>KR30.DZ</b>	<b>7.89</b> 1770	<b>9.79</b> 2200	<b>6.32</b> 1420	<b>7.74</b> 1740	<b>9.31</b> 2090	<b>45</b> 398	<b>8200</b>	<b>0.087</b> 0.192
<b>21</b> 0.827	<b>KR32</b>	<b>7.89</b> 1770	<b>9.79</b> 2200	<b>6.65</b> 1490	<b>9.62</b> 2160	<b>10.3</b> 2320	<b>45</b> 398	<b>8200</b>	<b>0.095</b> 0.209
<b>21</b> 0.827	<b>KR32.DZ</b>	<b>7.89</b> 1770	<b>9.79</b> 2200	<b>6.65</b> 1490	<b>9.62</b> 2160	<b>10.3</b> 2320	<b>45</b> 398	<b>8200</b>	<b>0.098</b> 0.216

C

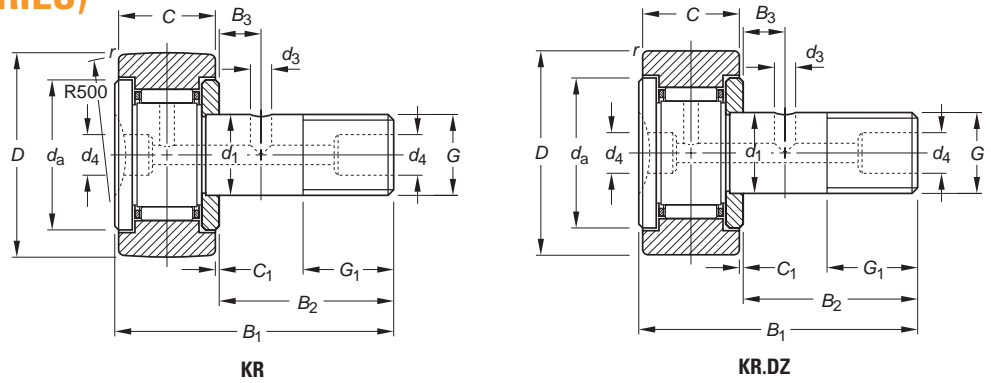






**NEEDLE ROLLER AND CAGE ASSEMBLIES, SEALED,  
STUD TYPE (KR...2S SERIES)**

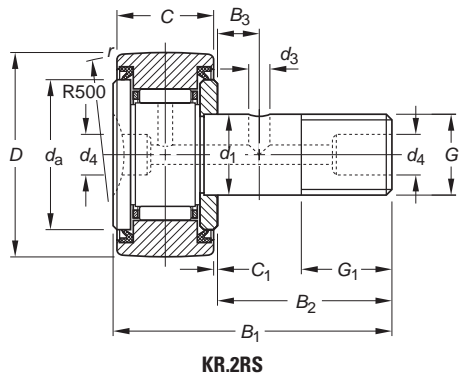
**METRIC SERIES**



C

Outer Dia.	Dimensions mm/in.											Thread	
	mm	d <sub>1</sub>	h <sub>7</sub>	C	r <sub>s</sub> min	B <sub>1</sub>	B <sub>2</sub>	B <sub>3</sub>	G <sub>1</sub>	d <sub>4</sub>	d <sub>3</sub>	G	C <sub>1</sub>
16	6	6	16	11	0.3	28.2	16		8	4		M6x1	0.6
	0.2362	0.2362	0.6299	0.433	0.012	1.110	0.630		0.315	0.157		M6x1	0.024
19	8	8	19	11	0.3	32.2	20		10	4		M8x1.25	0.6
	0.3150	0.3150	0.7480	0.433	0.012	1.268	0.787		0.394	0.157		M8x1.25	0.024
22	10	10	22	12	0.3	36.2	23		12	4		M10x1	0.6
	0.3937	0.3937	0.8661	0.472	0.012	1.425	0.906		0.472	0.157		M10x1	0.024
26	10	10	26	12	0.3	36.2	23		12	4		M10x1	0.6
	0.3937	0.3937	1.0236	0.472	0.012	1.425	0.906		0.472	0.157		M10x1	0.024
30	12	12	30	14	0.6	40.2	25	6	13	6	3	M12x1.5	0.6
	0.4724	0.4724	1.1811	0.551	0.024	1.583	0.984	0.236	0.512	0.236	0.118	M12x1.5	0.024
32	12	12	32	14	0.6	40.2	25	6	13	6	3	M12x1.5	0.6
	0.4724	0.4724	1.2598	0.551	0.024	1.583	0.984	0.236	0.512	0.236	0.118	M12x1.5	0.024





KR.2RS

d <sub>a</sub>	Bearing Designation	Load Ratings kN/lbf.					Tightening Torque Nm/in.-lbs.	Limiting Speed Grease RPM	Wt. kg/lbs.
		Dynamic	Static	As a Track Roller					
				Dynamic	Static	Static			
C	C <sub>0</sub>	C <sub>w</sub>	F <sub>r perm</sub>	F <sub>0r perm</sub>					
<b>11</b> 0.433	<b>KR16.2RS</b>	<b>3.60</b> 810	<b>3.58</b> 800	<b>2.97</b> 670	<b>2.85</b> 640	<b>3.58</b> 800	<b>7.0</b> 61.96	<b>17000</b>	<b>0.019</b> 0.042
<b>11</b> 0.433	<b>KR16.DZ.2RS</b>	<b>3.60</b> 810	<b>3.58</b> 800	<b>2.97</b> 670	<b>2.85</b> 640	<b>3.58</b> 800	<b>7.0</b> 61.96	<b>17000</b>	<b>0.01</b> 0.042
<b>13</b> 0.512	<b>KR19.2RS</b>	<b>4.18</b> 940	<b>4.65</b> 1050	<b>3.28</b> 740	<b>3.29</b> 740	<b>4.22</b> 950	<b>16</b> 141.61	<b>13000</b>	<b>0.031</b> 0.068
<b>13</b> 0.512	<b>KR19.DZ.2RS</b>	<b>4.18</b> 940	<b>4.65</b> 1050	<b>3.28</b> 740	<b>3.29</b> 740	<b>4.22</b> 950	<b>16</b> 141.61	<b>13000</b>	<b>0.031</b> 0.068
<b>15</b> 0.591	<b>KR22.2RS</b>	<b>5.35</b> 1200	<b>6.79</b> 1530	<b>3.94</b> 890	<b>4.04</b> 910	<b>5.45</b> 1230	<b>28</b> 247.82	<b>10000</b>	<b>0.046</b> 0.101
<b>15</b> 0.591	<b>KR22.DZ.2RS</b>	<b>5.35</b> 1200	<b>6.79</b> 1530	<b>3.94</b> 890	<b>4.04</b> 910	<b>5.45</b> 1230	<b>28</b> 247.82	<b>10000</b>	<b>0.046</b> 0.101
<b>15</b> 0.591	<b>KR26.2RS</b>	<b>5.35</b> 1200	<b>6.79</b> 1530	<b>4.55</b> 1020	<b>6.78</b> 1520	<b>7.24</b> 1630	<b>28</b> 247.82	<b>10000</b>	<b>0.059</b> 0.130
<b>15</b> 0.591	<b>KR26.DZ.2RS</b>	<b>5.35</b> 1200	<b>6.79</b> 1530	<b>4.55</b> 1020	<b>6.78</b> 1520	<b>7.24</b> 1630	<b>28</b> 247.82	<b>10000</b>	<b>0.059</b> 0.130
<b>21</b> 0.827	<b>KR30.2RS</b>	<b>7.89</b> 1770	<b>9.79</b> 2200	<b>6.32</b> 1420	<b>7.74</b> 1740	<b>9.31</b> 2090	<b>45</b> 398.28	<b>8200</b>	<b>0.087</b> 0.192
<b>21</b> 0.827	<b>KR30.DZ.2RS</b>	<b>7.89</b> 1770	<b>9.79</b> 2200	<b>6.32</b> 1420	<b>7.74</b> 1740	<b>9.31</b> 2090	<b>45</b> 398.28	<b>8200</b>	<b>0.087</b> 0.192
<b>21</b> 0.827	<b>KR32.2RS</b>	<b>7.89</b> 1770	<b>9.79</b> 2200	<b>6.65</b> 1490	<b>9.62</b> 2160	<b>10.3</b> 2320	<b>45</b> 398.28	<b>8200</b>	<b>0.098</b> 0.216
<b>21</b> 0.827	<b>KR32.DZ.2RS</b>	<b>7.89</b> 1770	<b>9.79</b> 2200	<b>6.65</b> 1490	<b>9.62</b> 2160	<b>10.3</b> 2320	<b>45</b> 398.28	<b>8200</b>	<b>0.098</b> 0.216

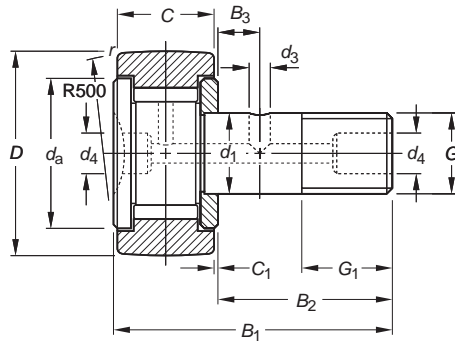
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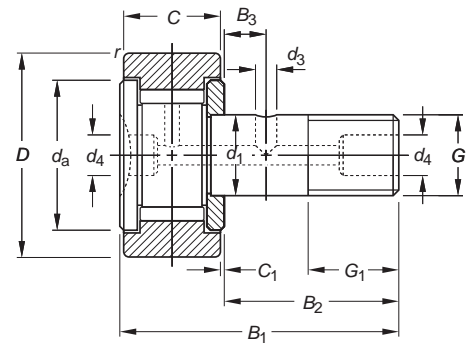


**FULL COMPLEMENT WITH NEEDLE ROLLER (KRV SERIES)  
OR CYLINDRICAL ROLLERS,  
STUD TYPE  
(NUKR SERIES)**

**METRIC SERIES**

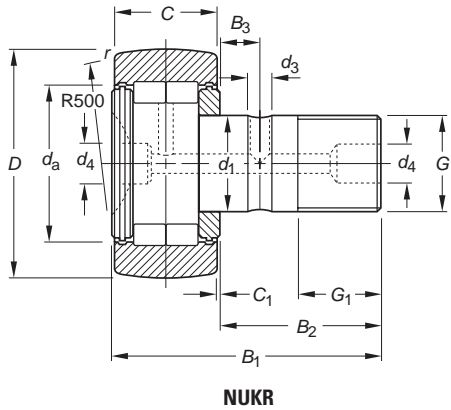


**KRV**

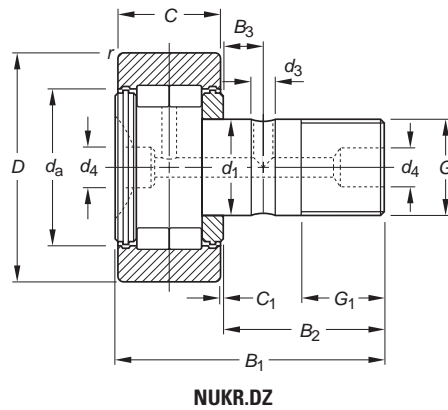


**KRV.DZ**

Outer Dia.	Dimensions mm/in.											Thread	
	mm	d <sub>1</sub>	D, h <sub>7</sub>	C	r <sub>s</sub> min	B <sub>1</sub>	B <sub>2</sub>	B <sub>3</sub>	G <sub>1</sub>	d <sub>4</sub>	d <sub>3</sub>		G
16	6	6	16	11	0.3	28.2	16		8	4		M6x1	0.6
	0.2362	0.2362	0.6299	0.433	0.012	1.110	0.630		0.315	0.157		M6x1	0.024
19	8	8	19	11	0.3	32.2	20		10	4		M8x1.25	0.6
	0.3150	0.3150	0.7480	0.433	0.012	1.268	0.787		0.394	0.157		M8x1.25	0.024
22	10	10	22	12	0.3	36.2	23		12	4		M10x1	0.6
	0.3937	0.3937	0.8661	0.472	0.012	1.425	0.906		0.472	0.157		M10x1	0.024
26	10	10	26	12	0.3	36.2	23		12	4		M10x1	0.6
	0.3937	0.3937	1.0236	0.472	0.012	1.425	0.906		0.472	0.157		M10x1	0.024
30	12	12	30	14	0.6	40.2	25	6	13	6	3	M12x1.5	0.6
	0.4724	0.4724	1.1811	0.551	0.024	1.583	0.984	0.236	0.512	0.236	0.118	M12x1.5	0.024
32	12	12	32	14	0.6	40.2	25	6	13	6	3	M12x1.5	0.6
	0.4724	0.4724	1.2598	0.551	0.024	1.583	0.984	0.236	0.512	0.236	0.118	M12x1.5	0.024
35	16	16	35	18	0.6	52	32.5	8	17	6	3	M16x1.5	0.8
	0.6299	0.6299	1.3780	0.709	0.024	2.047	1.280	0.315	0.669	0.236	0.118	M16x1.5	0.031
40	18	18	40	20	1	58	36.5	8	19	6	3	M18x1.5	0.8
	0.7087	0.7087	1.5748	0.787	0.039	2.283	1.437	0.315	0.748	0.236	0.118	M18x1.5	0.031
47	20	20	47	24	1	66	40.5	9	21	6	4	M20x1.5	0.8
	0.7874	0.7874	1.8504	0.945	0.039	2.598	1.594	0.354	0.827	0.236	0.157	M20x1.5	0.031
52	20	20	52	24	1	66	40.5	9	21	6	4	M20x1.5	0.8
	0.7874	0.7874	2.0472	0.945	0.039	2.598	1.594	0.354	0.827	0.236	0.157	M20x1.5	0.031
62	24	24	62	29	1	80	49.5	11	25	8	4	M24x1.5	0.8
	0.9449	0.9449	2.4409	1.142	0.039	3.150	1.949	0.433	0.984	0.315	0.157	M24x1.5	0.031
72	24	24	72	29	1.1	80	49.5	11	25	8	4	M24x1.5	0.8
	0.9449	0.9449	2.8346	1.142	0.043	3.150	1.949	0.433	0.984	0.315	0.157	M24x1.5	0.031
80	30	30	80	35	1.1	100	63	15	32	8	4	M30x1.5	1.0
	1.1811	1.1811	3.1496	1.378	0.043	3.937	2.480	0.591	1.260	0.315	0.157	M30x1.5	0.039
90	30	30	90	35	1.1	100	63	15	32	8	4	M30x1.5	1.0
	1.1811	1.1811	3.5433	1.378	0.043	3.937	2.480	0.591	1.260	0.315	0.157	M30x1.5	0.039



NUKR



NUKR.DZ

d <sub>a</sub>	Bearing Designation	Load Ratings kN/lbf.					Tightening Torque Nm/in.-lbs.	Limiting Speed Grease RPM	Wt. kg/lbs.
		Dynamic	Static	As a Track Roller					
				C	C <sub>0</sub>	Dynamic			
C	C <sub>0</sub>	C <sub>w</sub>	F <sub>r perm</sub>	F <sub>Dr perm</sub>					
11 0.433	KRV16	6.90 1550	8.40 1890	5.11 1150	3.49 780	6.28 1410	7 62.0	5700	0.019 0.042
11 0.433	KRV16.DZ	6.90 1550	8.40 1890	5.11 1150	3.49 780	6.28 1410	7 62.0	5700	0.019 0.042
13 0.512	KRV19	8.08 1820	11.0 2470	5.66 1270	4.13 930	7.43 1670	16 142	4300	0.031 0.068
13 0.512	KRV19.DZ	8.08 1820	11.0 2470	5.66 1270	4.13 930	7.43 1670	16 142	4300	0.031 0.068
15 0.591	KRV22	9.45 2120	14.3 3210	6.32 1420	5.04 1130	9.07 2040	28 248	3400	0.046 0.101
15 0.591	KRV22.DZ	9.45 2120	14.3 3210	6.32 1420	5.04 1130	9.07 2040	28 248	3400	0.046 0.101
15 0.591	KRV26	9.45 2120	14.3 3210	7.30 1640	8.60 1930	12.7 2860	28 248	3400	0.059 0.130
15 0.591	KRV26.DZ	9.45 2120	14.3 3210	7.30 1640	8.60 1930	12.7 2860	28 248	3400	0.059 0.130
21 0.827	KRV30	13.4 3010	19.8 4450	9.85 2210	9.20 2070	15.7 3530	45 398	2800	0.087 0.192
21 0.827	KRV30.DZ	13.4 3010	19.8 4450	9.85 2210	9.20 2070	15.7 3530	45 398	2800	0.087 0.192
21 0.827	KRV32	13.4 3010	19.8 4450	10.4 2340	11.3 2540	17.4 3910	45 398	2800	0.098 0.216
21 0.827	KRV32.DZ	13.4 3010	19.8 4450	10.4 2340	11.3 2540	17.4 3910	45 398	2800	0.098 0.216
25 0.984	NUKR35.2SK	24.7 5550	29.4 6610	16.2 3640	10.1 2270	16.1 3620	53.2 471	6100	0.170 0.375
27 1.063	NUKR40.2SK	26.6 5980	33.3 7490	18.7 4200	15.0 3370	23.9 5370	77.5 686	5300	0.250 0.551
33 1.299	NUKR47.2SK	41.4 9310	53.2 12000	28.1 6320	20.5 4610	32.7 7350	109 965	4500	0.380 0.838
37 1.457	NUKR52.2SK	45.8 10300	63.1 14200	29.6 6650	22.2 4990	35.4 7960	109 965	3700	0.461 1.016
45 1.772	NUKR62.2SK	62.7 14100	83.1 18700	40.9 9190	29.6 6650	47.2 10600	193 1708	3200	0.790 1.742
51 2.008	NUKR72.2SK	68.9 15500	97.8 22000	46.1 10400	39.6 8900	63.1 14200	193 1708	2600	1.040 2.293
52 2.047	NUKR80.2SK	95.4 21400	130 29200	69.7 15700	63.2 14200	101 22700	390 3452	2900	1.550 3.417
52 2.047	NUKR90.2SK	95.4 21400	130 29200	77.8 17500	97.8 22000	128 28800	390 3452	2900	2.020 4.453

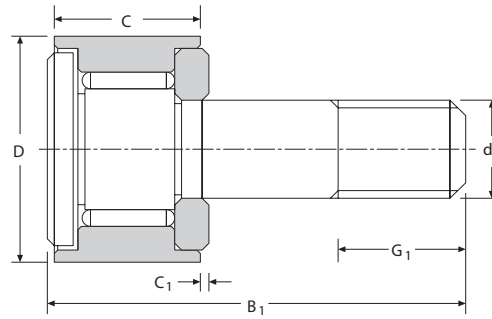


# NEEDLE ROLLER BEARINGS

## FULL COMPLEMENT, SMALL SERIES, UNSEALED, STUD TYPE (GC SERIES)

### METRIC SERIES

GC: convex outer ring  
GCL: cylindrical outer ring



GC Series

C

Outer Dia.	Dimensions mm/in.								Profiled Designation
	mm	D	d <sub>1</sub>	C	C <sub>1</sub>	r <sub>s min</sub>	B <sub>1</sub>	G <sub>1</sub>	
10	10	4	8	0.25	0.2	19.5	6	GC 10	
	0.3937	0.1575	0.315	0.010	0.008	0.768	0.236		
11	11	4	8	0.25	0.2	19.5	6	GC 11	
	0.4331	0.1575	0.315	0.010	0.008	0.768	0.236		
12	12	5	9	0.25	0.2	22.5	7	GC 12	
	0.4724	0.1969	0.354	0.010	0.008	0.886	0.276		
13	13	5	9	0.25	0.2	22.5	7	GC 13	
	0.5118	0.1969	0.354	0.010	0.008	0.886	0.276		
14	14	6	9.5	0.25	0.3	26	8	GC 14	
	0.5512	0.2362	0.374	0.010	0.012	1.024	0.315		
15	15	6	9.5	0.25	0.3	26	8	GC 15	
	0.5906	0.2362	0.374	0.010	0.012	1.024	0.315		

Cylindrical Designation	Tightening Torque Nm/in.-lbs.	Load Ratings kN/lbf.			Limiting Speed Grease RPM	Wt. kg/lbs.
		Dynamic C <sub>1</sub>	F <sub>r perm</sub>	Static F <sub>0</sub>		
GCL 10	0.9	2.13	0.52	0.96	14000	0.006 0.014
	7.97	479	117	216		
GCL 11	0.9	2.48	0.52	0.96	14000	0.007 0.016
	7.97	558	117	216		
GCL 12	1.8	2.98	0.90	1.68	11000	0.011 0.024
	15.93	670	202	378		
GCL 13	1.8	3.35	0.90	1.68	11000	0.011 0.024
	15.93	753	202	378		
GCL 14	3.0	3.5	1.48	2.75	10000	0.016 0.035
	26.55	787	333	618		
GCL 15	3.0	3.75	1.48	2.75	10000	0.018 0.039
	26.55	843	333	618		



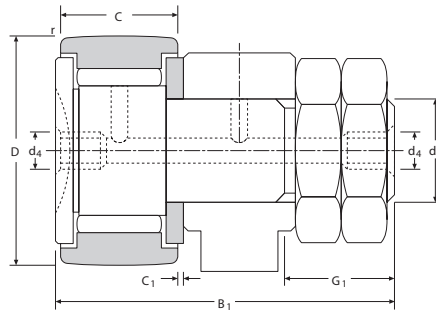


# NEEDLE ROLLER BEARINGS

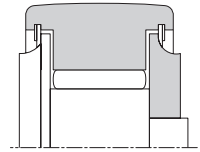
## FULL COMPLEMENT, STANDARD SERIES, WITH OR WITHOUT SEALS, STUD TYPE (GC SERIES)

### METRIC SERIES

GC: convex outer ring  
GCL: cylindrical outer ring



GC/GCL



GC...EE, GC...EM

C

Outer Dia.	Dimensions mm/in.							Profiled Designation
	mm	D	d <sub>1</sub>	C	C <sub>1</sub>	r <sub>s min</sub>	B <sub>1</sub>	
16	16	6	11	0.60	0.3	28.3	8	GC 16
	0.6299	0.2362	0.433	0.024	0.012	1.114	0.315	
19	19	8	11	0.60	0.3	32.3	10	GC 19
	0.748	0.315	0.433	0.024	0.012	1.272	0.394	
22	22	10	12	0.60	0.3	36.3	12	GC 22
	0.8661	0.3937	0.472	0.024	0.012	1.429	0.472	
24	24	10	12	0.60	0.3	36.3	12	GC 24
	0.9449	0.3937	0.472	0.024	0.012	1.429	0.472	
26	26	10	12	0.60	0.3	36.3	12	GC 26 <sup>(4)</sup>
	1.0236	0.3937	0.472	0.024	0.012	1.429	0.472	
28	28	10	12	0.60	0.3	36.3	12	GC 28
	1.1024	0.3937	0.472	0.024	0.012	1.429	0.472	
30	30	12	14	0.60	0.6	40.3	13	GC 30
	1.1811	0.4724	0.51	0.024	0.024	1.587	0.512	
32	32	12	14	0.60	0.6	40.3	13	GC 32
	1.2598	0.4724	0.51	0.024	0.024	1.587	0.512	
35	35	16	18	0.80	0.6	52.3	17	GC 35
	1.378	0.6299	0.709	0.031	0.024	2.059	0.669	
47	47	20	24	0.80	1	66.3	21	GC 47
	1.8504	0.7874	0.45	0.031	0.039	2.61	0.827	
52	52	20	24	0.80	1	66.3	21	GC 52
	2.0472	0.7874	0.45	0.031	0.039	2.61	0.827	
62	62	24	29	0.80	1	80.3	25	GC 62
	2.4409	0.9449	1.142	0.031	0.039	3.161	0.984	
72	72	24	29	0.80	1	80.3	25	GC 72
	2.8346	0.9449	1.142	0.031	0.039	3.161	0.984	
80	80	30	35	1.00	1	100.3	32	GC 80
	3.1496	1.1811	1.378	0.039	0.039	3.949	1.26	
85	85	30	35	1.00	1	100.3	32	GCL 85 EE
	3.3465	1.1811	1.378	0.039	0.039	3.949	1.26	
	85	30	35	1.00	1	100.3	32	GCL 85 EEM
	3.3465	1.1811	1.378	0.039	0.039	3.949	1.26	
90	90	30	35	1.00	1	100.3	32	GC 90
	3.5433	1.1811	1.378	0.039	0.039	3.949	1.26	

Tightening Torque Nm/in.-lbs.	Load Ratings kN/lbf.			Limiting Speed Grease RPM	mm wrench	mm/in.	Wt. kg/lbs.
	Dynamic C	$F_{rperm}$	Static $F_0$				
<b>3</b> 26.6	<b>5.05</b> 1140	<b>1.18</b> 265	<b>2.2</b> 495	<b>9300</b>	<b>N/A</b>	<b>4</b> 0.157	<b>0.021</b> 0.046
<b>8</b> 70.8	<b>5.75</b> 1290	<b>2.83</b> 636	<b>5.2</b> 1170	<b>7600</b>	<b>N/A</b>	<b>4</b> 0.157	<b>0.034</b> 0.075
<b>20</b> 177	<b>6.3</b> 1420	<b>4.9</b> 1100	<b>8.1</b> 1820	<b>6300</b>	<b>N/A</b>	<b>4</b> 0.157	<b>0.058</b> 0.128
<b>20</b> 177	<b>6.9</b> 1550	<b>5.2</b> 1170	<b>9.2</b> 2070	<b>6300</b>	<b>N/A</b>	<b>4</b> 0.157	<b>0.067</b> 0.148
<b>20</b> 177	<b>8.9</b> 2000	<b>5.2</b> 1170	<b>9.6</b> 2160	<b>5500</b>	<b>N/A</b>	<b>4</b> 0.157	<b>0.072</b> 0.159
<b>20</b> 177	<b>9.6</b> 2160	<b>5.2</b> 1170	<b>9.6</b> 2160	<b>5500</b>	<b>N/A</b>	<b>4</b> 0.157	<b>0.08</b> 0.176
<b>26</b> 230	<b>12.9</b> 2900	<b>7.7</b> 1730	<b>14.3</b> 3210	<b>4800</b>	<b>8</b>	<b>4</b> 0.157	<b>0.115</b> 0.254
<b>26</b> 230	<b>13.8</b> 3100	<b>7.7</b> 1730	<b>14.3</b> 3210	<b>4800</b>	<b>8</b>	<b>4</b> 0.157	<b>0.12</b> 0.265
<b>64</b> 566	<b>19.2</b> 4320	<b>11.4</b> 2560	<b>24</b> 5400	<b>3850</b>	<b>10</b>	<b>6</b> 0.236	<b>0.208</b> 0.459
<b>120</b> 1060	<b>28.3</b> 6360	<b>21.4</b> 4810	<b>40</b> 8990	<b>2700</b>	<b>14</b>	<b>6</b> 0.236	<b>0.477</b> 1.052
<b>120</b> 1060	<b>34</b> 7640	<b>21.4</b> 4810	<b>40</b> 8990	<b>2700</b>	<b>14</b>	<b>6</b> 0.236	<b>0.542</b> 1.195
<b>220</b> 1950	<b>42</b> 9440	<b>31</b> 6970	<b>57.5</b> 12900	<b>2330</b>	<b>12</b>	<b>6</b> 0.236	<b>0.944</b> 2.081
<b>220</b> 1950	<b>44</b> 9890	<b>31</b> 6970	<b>57.5</b> 12900	<b>2330</b>	<b>12</b>	<b>6</b> 0.236	<b>1.165</b> 2.568
<b>450</b> 3980	<b>60</b> 13500	<b>50</b> 11200	<b>93</b> 20900	<b>1700</b>	<b>14</b>	<b>8</b> 0.315	<b>1.915</b> 4.222
<b>450</b> 3980	<b>64</b> 14400	<b>50</b> 11200	<b>93</b> 20900	<b>1700</b>	<b>14</b>	<b>8</b> 0.315	<b>2.096</b> 4.621
<b>450</b> 3980	<b>64</b> 14400	<b>50</b> 11200	<b>93</b> 20900	<b>1700</b>	<b>14</b>	<b>8</b> 0.315	<b>2.096</b> 4.621
<b>450</b> 3980	<b>65</b> 14600	<b>50</b> 11200	<b>93</b> 20900	<b>1700</b>	<b>14</b>	<b>8</b> 0.315	<b>2.287</b> 5.042

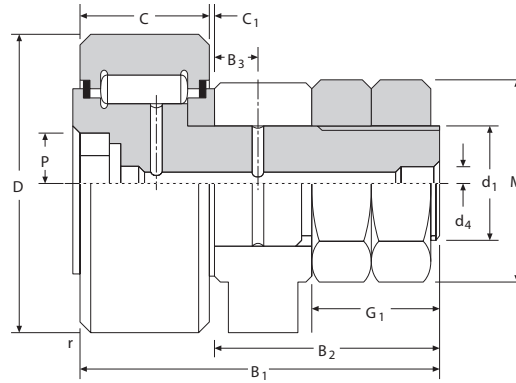




**FULL COMPLEMENT,  
WITH METAL SEALS,  
STUD TYPE (GCU...MM SERIES)**

**METRIC SERIES**

GCU: convex outer ring  
GCUL: cylindrical outer ring



**GCU, GCUL**

Outside Dia.	Dimensions mm/in.							Profiled Designation	Cylindrical Designation
mm	D	d <sub>1</sub>	C	C <sub>1</sub>	B <sub>1</sub>	G <sub>1</sub>	r <sub>smin</sub>		
<b>35</b>	<b>35</b> 1.3780	<b>16</b> 0.6299	<b>18</b> 0.709	<b>0.85</b> 0.033	<b>52.3</b> 2.059	<b>17</b> 0.669	<b>0.6</b> 0.024	<b>GCU 35 MM</b>	<b>GCUL 35 MM</b>
<b>40</b>	<b>40</b> 1.5748	<b>18</b> 0.7087	<b>20</b> 0.787	<b>0.85</b> 0.033	<b>58.3</b> 2.295	<b>19</b> 0.748	<b>1.0</b> 0.039	<b>GCU 40</b>	
	<b>40</b> 1.5748	<b>18</b> 0.7087	<b>20</b> 0.787	<b>0.85</b> 0.033	<b>58.3</b> 2.295	<b>19</b> 0.748	<b>1.0</b> 0.039	<b>GCU 40 MM</b>	<b>GCUL 40 MM</b>
<b>47</b>	<b>47</b> 1.8504	<b>20</b> 0.7874	<b>24</b> 0.945	<b>0.85</b> 0.033	<b>66.3</b> 2.610	<b>21</b> 0.827	<b>1.0</b> 0.039	<b>GCU 47 MM</b>	<b>GCUL 47 MM</b>
<b>52</b>	<b>52</b> 2.0472	<b>20</b> 0.7874	<b>24</b> 0.945	<b>0.85</b> 0.033	<b>66.3</b> 2.610	<b>21</b> 0.827	<b>1.0</b> 0.039		<b>GCUL 52</b>
	<b>52</b> 2.0472	<b>20</b> 0.7874	<b>24</b> 0.945	<b>0.85</b> 0.033	<b>66.3</b> 2.610	<b>21</b> 0.827	<b>1.0</b> 0.039	<b>GCU 52 MM</b>	<b>GCUL 52 MM</b>
<b>62</b>	<b>62</b> 2.4409	<b>24</b> 0.9449	<b>29</b> 1.142	<b>0.85</b> 0.033	<b>80.3</b> 3.161	<b>25</b> 0.984	<b>1.0</b> 0.039	<b>GCU 62 MM</b>	
<b>72</b>	<b>72</b> 2.8346	<b>24</b> 0.9449	<b>29</b> 1.142	<b>0.85</b> 0.033	<b>80.3</b> 3.161	<b>25</b> 0.984	<b>1.1</b> 0.043		<b>GCUL 72 MM</b>
<b>80</b>	<b>80</b> 3.1496	<b>30</b> 1.1811	<b>35</b> 1.378	<b>1.10</b> 0.043	<b>100.3</b> 3.949	<b>32</b> 1.260	<b>1.1</b> 0.043	<b>GCU 80 MM</b>	
<b>90</b>	<b>90</b> 3.5433	<b>30</b> 1.1811	<b>35</b> 1.378	<b>1.10</b> 0.043	<b>100.3</b> 3.949	<b>32</b> 1.260	<b>1.1</b> 0.043		<b>GCUL 90</b>
	<b>90</b> 3.5433	<b>30</b> 1.1811	<b>35</b> 1.378	<b>1.10</b> 0.043	<b>100.3</b> 3.949	<b>32</b> 1.260	<b>1.1</b> 0.043	<b>GCU 90 MM</b>	
<b>100</b>	<b>100</b> 3.9370	<b>36</b> 1.4173	<b>40</b> 1.575	<b>1.10</b> 0.043	<b>117.3</b> 4.618	<b>38</b> 1.496	<b>2.0</b> 0.079	<b>GCU 100</b>	
	<b>100</b> 3.9370	<b>36</b> 1.4173	<b>40</b> 1.575	<b>1.10</b> 0.043	<b>117.3</b> 4.618	<b>38</b> 1.496	<b>2.0</b> 0.079	<b>GCU 100 MM</b>	
<b>110</b>	<b>110</b> 4.3307	<b>36</b> 1.4173	<b>40</b> 1.575	<b>1.10</b> 0.043	<b>117.3</b> 4.618	<b>38</b> 1.496	<b>2.0</b> 0.079	<b>GCU 110 MM</b>	<b>GCUL 110 MM</b>
<b>120</b>	<b>120</b> 4.7244	<b>42</b> 1.6535	<b>46</b> 1.811	<b>1.10</b> 0.043	<b>136.3</b> 5.366	<b>44</b> 1.732	<b>2.0</b> 0.079	<b>GCU 120 MM</b>	
<b>130</b>	<b>130</b> 5.1181	<b>42</b> 1.6535	<b>46</b> 1.811	<b>1.10</b> 0.043	<b>136.3</b> 5.366	<b>44</b> 1.732	<b>2.0</b> 0.079		<b>GCUL 130</b>
	<b>130</b> 5.1181	<b>42</b> 1.6535	<b>46</b> 1.811	<b>1.10</b> 0.043	<b>136.3</b> 5.366	<b>44</b> 1.732	<b>2.0</b> 0.079	<b>GCU 130 MM</b>	



Tightening Torque Nm/in.-lbs.	Load Ratings kN/lbf.			Limiting Speed Grease RPM	mm wrench	mm/in.		Wt. kg/lbs.
	Dynamic		Static			B <sub>3</sub>	d <sub>4</sub>	
	C	F <sub>r perm</sub>	F <sub>01</sub>					
64 566	17.0 3820	7.80 1750	17.2 3870	5700	10	8 0.315	6 0.236	0.200 0.441
90 797	20.0 4500	11.5 2590	22.0 4950	5200	12	8 0.315	6 0.236	0.289 0.637
90 797	20.0 4500	11.5 2590	22.0 4950	5200	12	8 0.315	6 0.236	0.289 0.637
120 1060	29.5 6630	15.5 3480	33.0 7420	4400	14	9 0.354	6 0.236	0.450 0.992
120 1060	36.5 8210	21.5 4830	40.0 8990	4400	14	9 0.354	6 0.236	0.520 1.146
120 1060	36.5 8210	21.5 4830	40.0 8990	4400	14	9 0.354	6 0.236	0.520 1.146
220 1950	52.0 11700	31.0 6970	58.0 13000	3700	12	11 0.433	6 0.236	0.910 2.006
220 1950	63.0 14200	31.0 6970	58.0 13000	3700	12	11 0.433	6 0.236	1.140 2.513
450 3980	76.0 17100	48.0 10800	93.0 20900	2700	14	15 0.591	8 0.315	1.870 4.123
450 3980	94.0 21100	50.0 11200	93.0 20900	2700	14	15 0.591	8 0.315	2.230 4.916
450 3980	94.0 21100	50.0 11200	93.0 20900	2700	14	15 0.591	8 0.315	2.230 4.914
740 6550	115 25900	76.0 17100	142 31900	2300	17	20 0.787	8 0.315	3.290 7.253
740 6550	115 25900	76.0 17100	142 31900	2300	17	20 0.787	8 0.315	3.290 7.253
740 6550	129 29000	76.0 17100	142 31900	2300	17	20 0.787	8 0.315	3.800 8.378
1 200 10620	150 33700	120 27000	200 45000	2000	19	24 0.945	8 0.315	5.422 1.953
1 200 10620	163 36600	121 27200	223 50100	2000	19	24 0.945	8 0.315	5.780 12.743
1 200 10620	163 36600	121 27200	223 50100	2000	19	24 0.945	8 0.315	5.780 12.743



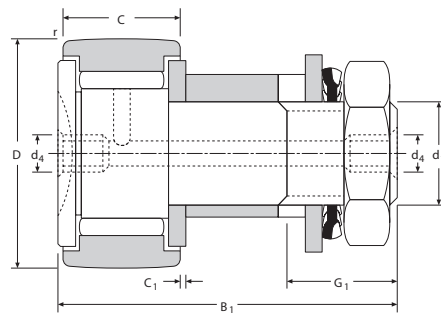


# NEEDLE ROLLER BEARINGS

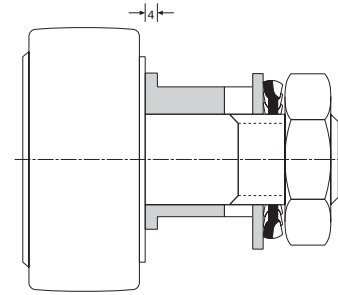
## FULL COMPLEMENT, ECCENTRIC, STUD TYPE (GCR SERIES)

### METRIC SERIES

GCR: convex outer ring  
GCRL: cylindrical outer ring



GCR 16-52



GCR 62-90

Outer Dia.	Dimensions mm/in.								Profiled Designation	Cylindrical Designation
	mm	D	d <sub>1</sub>	C	C <sub>1</sub>	B <sub>1</sub>	G <sub>1</sub>	r <sub>a min</sub>		
16	16	16	6	11	0.60	28.3	8	0.3	GCR 16	
	0.6299	0.6299	0.2362	0.433	0.024	1.114	0.315	0.012	GCR 16 EE	GCRL 16 EE
16	16	16	6	11	0.60	28.3	8	0.3	GCR 16 EEM	GCRL 16 EEM
	0.6299	0.6299	0.2362	0.433	0.024	1.114	0.315	0.012		
19	19	19	8	11	0.60	32.3	10	0.3	GCR 19	
	0.748	0.748	0.315	0.433	0.024	1.272	0.394	0.012	GCR 19 EE	GCRL 19 EE
19	19	19	8	11	0.60	32.3	10	0.3	GCR 19 EEM	
	0.748	0.748	0.315	0.433	0.024	1.272	0.394	0.012		
22	22	22	10	12	0.60	36.3	12	0.3	GCR 22 EE	GCRL 22 EE
	0.8661	0.8661	0.3937	0.472	0.024	1.429	0.472	0.012	GCR 22 EEM	GCRL 22 EEM
22	22	22	10	12	0.60	36.3	12	0.3	GCR 24	
	0.8661	0.8661	0.3937	0.472	0.024	1.429	0.472	0.012	GCR 24 EE	GCRL 24 EE
24	24	24	10	12	0.60	36.3	12	0.3	GCR 24 EEM	GCRL 24 EEM
	0.9449	0.9449	0.3937	0.472	0.024	1.429	0.472	0.012		
26	26	26	10	12	0.60	36.3	12	0.3	GCR 26	
	1.0236	1.0236	0.3937	0.472	0.024	1.429	0.472	0.012	GCR 26 EE	GCRL 26 EE
26	26	26	10	12	0.60	36.3	12	0.3	GCR 28 EE	
	1.0236	1.0236	0.3937	0.472	0.024	1.429	0.472	0.012	GCR 28 EEM	GCRL 28 EEM
28	28	28	10	12	0.60	36.3	12	0.3	GCR 30 EE	GCRL 30 EE
	1.1024	1.1024	0.3937	0.472	0.024	1.429	0.472	0.012	GCR 30 EEM	GCRL 30 EEM
28	28	28	10	12	0.60	36.3	12	0.3	GCR 32	
	1.1024	1.1024	0.3937	0.472	0.024	1.429	0.472	0.012	GCR 32 EE	GCRL 32 EE
30	30	30	12	14	0.60	40.3	13	0.6	GCR 32 EEM	
	1.1811	1.1811	0.4724	0.551	0.024	1.587	0.512	0.024		
30	30	30	12	14	0.60	40.3	13	0.6	GCR 35	
	1.1811	1.1811	0.4724	0.551	0.024	1.587	0.512	0.024	GCR 35 EE	GCRL 35 EE
32	32	32	12	14	0.60	40.3	13	0.6	GCR 35 EEM	GCRL 35 EEM
	1.2598	1.2598	0.4724	0.551	0.024	1.587	0.512	0.024		
32	32	32	12	14	0.60	40.3	13	0.6	GCR 35	
	1.2598	1.2598	0.4724	0.551	0.024	1.587	0.512	0.024	GCR 35 EE	GCRL 35 EE
35	35	35	16	18	0.80	52.3	17	0.6	GCR 35 EEM	GCRL 35 EEM
	1.378	1.378	0.6299	0.709	0.031	2.059	0.669	0.024		
35	35	35	16	18	0.80	52.3	17	0.6	GCR 35	
	1.378	1.378	0.6299	0.709	0.031	2.059	0.669	0.024	GCR 35 EE	GCRL 35 EE
35	35	35	16	18	0.80	52.3	17	0.6	GCR 35 EEM	GCRL 35 EEM
	1.378	1.378	0.6299	0.709	0.031	2.059	0.669	0.024		

Tightening Torque Nm/in.-lbs.	Load Ratings kN/lbf.			Limiting Speed Grease RPM	mm/in. d4	Wt. kg/lbs.
	Dynamic		Static			
	C <sub>0</sub>	F <sub>r perm</sub>	F <sub>0</sub>			
2 17.7	5.05 1140	1.18 265	2.20 495	9300	4 0.157	0.024 0.053
2 17.7	5.05 1140	1.18 265	2.20 495	9300	4 0.157	0.024 0.053
2 17.7	5.05 1140	1.18 265	2.20 495	9300	4 0.157	0.024 0.053
5 44.3	5.75 1290	2.83 636	4.50 1010	7600	4 0.157	0.039 0.086
5 44.3	5.75 1290	2.83 636	4.50 1010	7600	4 0.157	0.039 0.086
5 44.3	5.75 1290	2.83 636	4.50 1010	7600	4 0.157	0.039 0.086
16 142	6.30 1420	4.90 1100	5.60 1260	6300	4 0.157	0.057 0.126
16 142	6.30 1420	4.90 1100	5.60 1260	6300	4 0.157	0.057 0.126
16 142	6.90 1550	5.20 1170	5.60 1260	6300	4 0.157	0.072 0.159
16 142	6.90 1550	5.20 1170	5.60 1260	6300	4 0.157	0.072 0.159
16 142	6.90 1550	5.20 1170	5.60 1260	6300	4 0.157	0.072 0.159
16 142	8.90 2000	5.20 1170	6.10 1370	5500	4 0.157	0.080 0.176
16 142	8.90 2000	5.20 1170	6.10 1370	5500	4 0.157	0.080 0.176
16 142	9.60 2160	5.20 1170	6.10 1370	5500	4 0.157	0.088 0.194
16 142	9.60 2160	5.20 1170	6.10 1370	5500	4 0.157	0.088 0.194
22 195	12.9 2900	7.70 1730	10.4 2340	4800	4 0.157	0.118 0.260
22 195	12.9 2900	7.70 1730	10.4 2340	4800	4 0.157	0.118 0.260
22 195	13.8 3100	7.70 1730	10.4 2340	4800	4 0.157	0.126 0.278
22 195	13.8 3100	7.70 1730	10.4 2340	4800	4 0.157	0.126 0.278
22 195	13.8 3100	7.70 1730	10.4 2340	4800	4 0.157	0.126 0.278
55 487	19.2 4320	11.4 2560	11.0 2470	3850	6 0.236	0.220 0.485
55 487	19.2 4320	11.4 2560	11.0 2470	3850	6 0.236	0.220 0.485
55 487	19.2 4320	11.4 2560	11.0 2470	3850	6 0.236	0.220 0.485

Continued on next page.

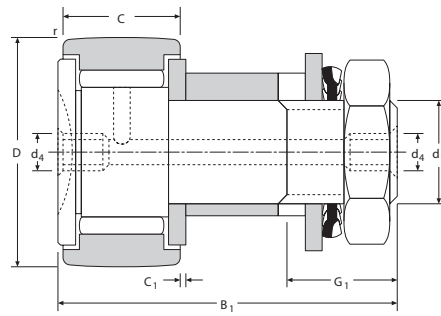


# NEEDLE ROLLER BEARINGS

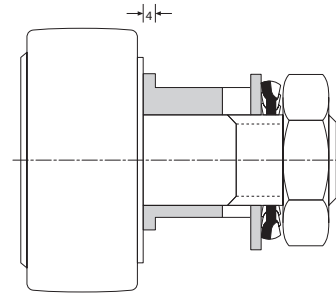
## FULL COMPLEMENT, ECCENTRIC, STUD TYPE (GCR SERIES) – continued

### METRIC SERIES

GCR: convex outer ring  
GCRL: cylindrical outer ring



GCR 16-52



GCR 62-90

Outer Dia.	Dimensions mm/in.							Profiled Designation	Cylindrical Designation	
	mm	D	d <sub>1</sub>	C	C <sub>1</sub>	B <sub>1</sub>	G <sub>1</sub>			r <sub>a</sub> min
40	40	40	18	20	0.80	58.3	19	1	GCR 40	GCRL 40
	1.5748	1.5748	0.7087	0.787	0.709	2.295	0.748	0.039	GCR 40 EE	GCRL 40 EE
	40	40	18	20	0.80	58.3	19	1	GCR 40 EEM	GCRL 40 EEM
47	47	47	20	24	0.80	66.3	21	1	GCR 47 EE	
	1.8504	1.8504	0.7874	0.945	0.709	2.61	0.827	0.039	GCR 47 EEM	GCRL 47 EEM
	47	47	20	24	0.80	66.3	21	1	GCR 47 EEM	GCRL 47 EEM
52	52	52	20	24	0.80	66.3	21	1	GCR 52	
	2.0472	2.0472	0.7874	0.945	0.709	2.61	0.827	0.039	GCR 52 EE	GCRL 52 EE
	52	52	20	24	0.80	66.3	21	1	GCR 52 EEM	GCRL 52 EEM
62	62	62	24	29	0.80	80.3	25	1	GCR 62	
	2.4409	2.4409	0.9449	1.142	0.709	3.161	0.984	0.039	GCR 62 EE	
	62	62	24	29	0.80	80.3	25	1	GCR 62 EEM	GCRL 62 EEM
72	72	72	24	29	0.80	80.3	25	1	GCR 72 EE	GCRL 72 EE
	2.8346	2.8346	0.9449	1.142	0.709	3.161	0.984	0.039		GCRL 72 EEM
	72	72	24	29	0.80	80.3	25	1	GCR 72 EE	GCRL 72 EE
80	80	80	30	35	1.00	100.3	32	1	GCR 80	
	3.1496	3.1496	1.1811	1.378	0.039	3.949	1.26	0.039	GCR 80 EE	GCRL 80 EE
	80	80	30	35	1.00	100.3	32	1	GCR 80 EEM	GCRL 80 EEM
90	90	90	30	35	1.00	100.3	32	1	GCR 90	GCRL 90
	3.5433	3.5433	1.1811	1.378	0.039	3.949	1.26	0.039	GCR 90 EE	
	90	90	30	35	1.00	100.3	32	1	GCR 90 EEM	

Tightening Torque Nm/in.-lbs.	Load Ratings kN/lbf.			Limiting Speed Grease RPM	mm/in. d4	Wt. kg/lbs.
	Dynamic		Static			
	C <sub>0</sub>	F <sub>r perm</sub>	F <sub>0</sub>			
<b>75</b> 664	<b>20.0</b> 4500	<b>14.2</b> 3190	<b>12.3</b> 2770	<b>3150</b>	<b>6</b> 0.236	<b>0.321</b> 0.708
<b>75</b> 664	<b>20.0</b> 4500	<b>14.2</b> 3190	<b>12.3</b> 2770	<b>3150</b>	<b>6</b> 0.236	<b>0.321</b> 0.708
<b>75</b> 664	<b>20.0</b> 4500	<b>14.2</b> 3190	<b>12.3</b> 2770	<b>3150</b>	<b>6</b> 0.236	<b>0.321</b> 0.708
<b>100</b> 885	<b>28.3</b> 6360	<b>21.4</b> 4810	<b>23.7</b> 5330	<b>2700</b>	<b>6</b> 0.236	<b>0.500</b> 1.102
<b>100</b> 885	<b>28.3</b> 6360	<b>21.4</b> 4810	<b>23.7</b> 5330	<b>2700</b>	<b>6</b> 0.236	<b>0.500</b> 1.102
<b>100</b> 885	<b>34.0</b> 7640	<b>21.4</b> 4810	<b>23.7</b> 5330	<b>2700</b>	<b>6</b> 0.236	<b>0.568</b> 1.252
<b>100</b> 885	<b>34.0</b> 7640	<b>21.4</b> 4810	<b>23.7</b> 5330	<b>2700</b>	<b>6</b> 0.236	<b>0.568</b> 1.252
<b>100</b> 885	<b>34.0</b> 7640	<b>21.4</b> 4810	<b>23.7</b> 5330	<b>2700</b>	<b>6</b> 0.236	<b>0.568</b> 1.252
<b>180</b> 1590	<b>42.0</b> 9440	<b>31.0</b> 6970	<b>28.8</b> 6470	<b>2330</b>	<b>8</b> 0.315	<b>1.035</b> 2.282
<b>180</b> 1590	<b>42.0</b> 9440	<b>31.0</b> 6970	<b>28.8</b> 6470	<b>2330</b>	<b>8</b> 0.315	<b>1.035</b> 2.282
<b>180</b> 1590	<b>42.0</b> 9440	<b>31.0</b> 6970	<b>28.8</b> 6470	<b>2330</b>	<b>8</b> 0.315	<b>1.035</b> 2.282
<b>180</b> 1590	<b>44.0</b> 9890	<b>31.0</b> 6970	<b>28.8</b> 6470	<b>2330</b>	<b>8</b> 0.315	<b>1.278</b> 2.818
<b>180</b> 1590	<b>44.0</b> 9890	<b>31.0</b> 6970	<b>28.8</b> 6470	<b>2330</b>	<b>8</b> 0.315	<b>1.278</b> 2.818
<b>370</b> 3270	<b>60.0</b> 13500	<b>50.0</b> 11200	<b>54.0</b> 12100	<b>1700</b>	<b>8</b> 0.315	<b>2.074</b> 4.572
<b>370</b> 3270	<b>60.0</b> 13500	<b>50.0</b> 11200	<b>54.0</b> 12100	<b>1700</b>	<b>8</b> 0.315	<b>2.074</b> 4.572
<b>370</b> 3270	<b>60.0</b> 13500	<b>50.0</b> 11200	<b>54.0</b> 12100	<b>1700</b>	<b>8</b> 0.315	<b>2.074</b> 4.572
<b>370</b> 3270	<b>65.0</b> 14600	<b>50.0</b> 11200	<b>54.0</b> 12100	<b>1700</b>	<b>8</b> 0.315	<b>2.435</b> 5.368
<b>370</b> 3270	<b>65.0</b> 14600	<b>50.0</b> 11200	<b>54.0</b> 12100	<b>1700</b>	<b>8</b> 0.315	<b>2.435</b> 5.368
<b>370</b> 3270	<b>65.0</b> 14600	<b>50.0</b> 11200	<b>54.0</b> 12100	<b>1700</b>	<b>8</b> 0.315	<b>2.435</b> 5.368



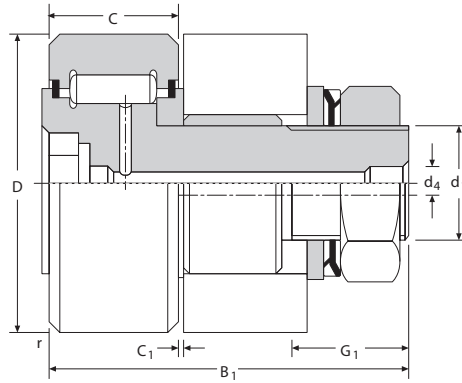


# NEEDLE ROLLER BEARINGS

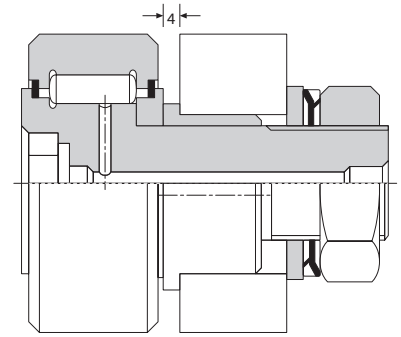
## FULL COMPLEMENT ECCENTRIC, WITH METAL SEALS, STUD TYPE (GCUR...MM SERIES)

### METRIC SERIES

GCUR: convex outer ring  
GCURL: cylindrical outer ring



GCUR 35-52



GCUR 62-130

Outside Dia.	Dimensions mm/in.							Profiled Designation	Cylindrical Designation
	mm	D	d <sub>1</sub>	C	C <sub>1</sub>	B <sub>1</sub>	G <sub>1</sub>		
35	35	16	18	0.85	52.3	17	0.6	GCUR 35	
	1.3780	0.6299	0.709	0.033	2.059	0.669	0.024		
40	40	18	20	0.85	58.3	19	1.0	GCUR 40	
	1.5748	0.7087	0.787	0.033	2.295	0.748	0.039		
	40	18	20	0.85	58.3	19	1.0		GCURL 40 MM
	1.5748	0.7087	0.787	0.033	2.295	0.748	0.039		
52	52	20	24	0.85	66.3	21	1.0	GCUR 52 MM	
	2.0472	0.7874	0.945	0.033	2.610	0.827	0.039		
62	62	24	29	0.85	80.3	25	1.0	GCUR 62	
	2.4409	0.9449	1.142	0.033	3.161	0.984	0.039		
	62	24	29	0.85	80.3	25	1.0	GCUR 62 MM	
	2.4409	0.9449	1.142	0.033	3.161	0.984	0.039		
72	72	24	29	0.85	80.3	25	1.1	GCUR 72	
	2.8346	0.9449	1.142	0.033	3.161	0.984	0.043		
	72	24	29	0.85	80.3	25	1.1	GCUR 72 MM	
	2.8346	0.9449	1.142	0.033	3.161	0.984	0.043		
80	80	30	35	1.10	100.3	32	1.1	GCUR 80	
	3.1496	1.1811	1.378	0.014	3.949	1.260	0.043		
	80	30	35	1.10	100.3	32	1.1	GCUR 80 MM	
	3.1496	1.1811	1.378	0.043	3.949	1.260	0.043		
90	90	30	35	1.10	100.3	32	1.1	GCUR 90	
	3.5433	1.1811	1.378	0.043	3.949	1.260	0.043		
100	100	36	40	1.10	117.3	38	2.0	GCUR 100	
	3.9370	1.4173	1.575	0.043	4.618	1.496	0.079		
	100	36	40	1.10	117.3	38	2.0	GCUR 100 MM	
	3.9370	1.4173	1.575	0.043	4.618	1.496	0.079		
110	110	36	40	1.10	117.3	38	2.0	GCUR 110 MM	
	4.3307	1.4173	1.575	0.043	4.618	1.496	0.079		
120	120	42	46	1.10	136.3	44	2.0	GCUR 120 MM	
	4.7244	1.6535	1.811	0.043	5.366	1.732	0.079		
130	130	42	46	1.10	136.3	44	2.0	GCUR 130	
	5.1181	1.6535	1.811	0.043	5.366	1.732	0.079		
	130	42	46	1.10	136.3	44	2.0	GCUR 130 MM	
	5.1181	1.6535	1.811	0.043	5.366	1.732	0.079		

Tightening Torque Nm/in.-lbs.	Load Ratings kN/lbf.			Limiting Speed Grease RPM	mm wrench	mm/in. d <sub>4</sub>	Wt. kg/lbs.
	Dynamic		Static				
	C	F <sub>r perm</sub>	F <sub>01</sub>				
55 487	17.0 3820	7.8 1750	10.0 2250	5700	10	6 0.236	0.215 0.474
75 664	20.0 4500	10.9 2450	10.9 2450	5200	12	6 0.236	0.313 0.690
75 664	20.0 4500	10.9 2450	10.9 2450	5200	12	6 0.236	0.313 0.690
100 885	36.5 8210	21.3 4790	21.3 4790	4400	14	6 0.236	0.555 1.224
180 1593	52.0 11690	28.8 6470	28.8 6470	3700	12	6 0.236	1.022 2.253
180 1593	52.0 11690	28.8 6470	28.8 6470	3700	12	6 0.236	1.022 2.253
180 1593	63.0 14160	28.8 6470	28.8 6470	3700	12	6 0.236	0.113 0.249
180 1593	63.0 14160	28.8 6470	28.8 6470	3700	12	6 0.236	0.113 0.249
370 3275	76.0 17090	48.0 10790	54.0 12140	2700	14	8 0.315	0.182 0.401
370 3275	76.0 17090	48.0 10790	54.0 12140	2700	14	8 0.315	0.182 0.401
370 3275	94.0 21130	50.0 11240	54.0 12140	2700	14	8 0.315	0.182 0.402
610 5399	115 25850	76.0 17090	83.0 18660	2300	17	8 0.315	0.244 0.539
610 5399	115 25850	76.0 17090	83.0 18660	2300	17	8 0.315	0.244 0.539
610 5399	129 29000	76.0 17090	83.0 18660	2300	17	8 0.315	0.245 0.540
1000 8851	150 33720	120 26980	130 29230	2000	19	8 0.315	0.328 0.724
1000 8851	150 33720	121 27200	130 29230	2000	19	8 0.315	0.329 0.725
1000 8851	150 33720	121 27200	130 29230	2000	19	8 0.315	0.329 0.725

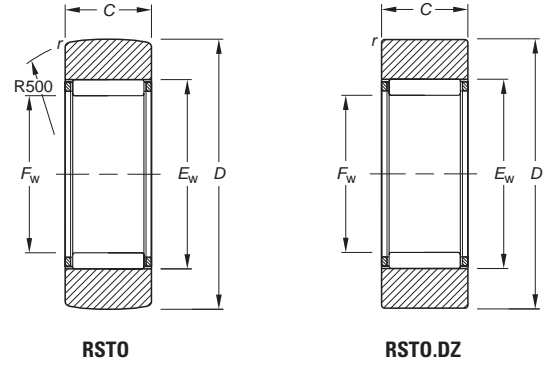




# NEEDLE ROLLER BEARINGS

## CAGED, WITHOUT INNER RING, NO END WASHERS, YOKE TYPE (RSTO SERIES)

### METRIC SERIES



C

Outer Dia.	Dimensions						Bearing Designation	Load Ratings kN/lbf.					Limiting Speed Grease RPM	Wt. kg/lbs.	
	mm	D	B	C	F <sub>w</sub>	E <sub>w</sub>		r <sub>s</sub>	As a Bearing		As a Track Roller				
									Dynamic	Static	Dynamic	F <sub>r perm</sub>			F <sub>0r perm</sub>
								C	C <sub>0</sub>	C <sub>w</sub>	F <sub>r perm</sub>	F <sub>0r perm</sub>			
<b>16</b>	<b>16</b>	<b>8</b>	<b>7.8</b>	<b>7</b>	<b>10</b>	<b>0.3</b>	<b>RST05A.TN</b>	<b>2.74</b> 616	<b>2.44</b> 549	<b>2.49</b> 560	<b>2.97</b> 668	<b>2.44</b> 549	<b>19000</b>	<b>0.009</b> 0.020	
	<b>16</b>	<b>8</b>	<b>7.8</b>	<b>7</b>	<b>10</b>	<b>0.3</b>	<b>RST05ADZ.TN</b>	<b>2.74</b> 616	<b>2.44</b> 549	<b>2.49</b> 560	<b>2.97</b> 668	<b>2.44</b> 549	<b>19000</b>	<b>0.009</b> 0.020	
<b>19</b>	<b>19</b>	<b>10</b>	<b>9.8</b>	<b>10</b>	<b>13</b>	<b>0.3</b>	<b>RST06</b>	<b>5.40</b> 1210	<b>6.43</b> 1450	<b>4.15</b> 933	<b>4.04</b> 908	<b>5.63</b> 1270	<b>13000</b>	<b>0.014</b> 0.031	
	<b>19</b>	<b>10</b>	<b>9.8</b>	<b>10</b>	<b>13</b>	<b>0.3</b>	<b>RST06DZ</b>	<b>5.40</b> 1210	<b>6.43</b> 1450	<b>4.15</b> 933	<b>4.04</b> 908	<b>5.63</b> 1270	<b>13000</b>	<b>0.014</b> 0.031	
	<b>19</b>	<b>10</b>	<b>9.8</b>	<b>10</b>	<b>13</b>	<b>0.3</b>	<b>RST06TN</b>	<b>5.40</b> 1210	<b>6.43</b> 1450	<b>4.15</b> 933	<b>4.04</b> 908	<b>5.63</b> 1270	<b>13000</b>	<b>0.014</b> 0.031	
<b>24</b>	<b>24</b>	<b>10</b>	<b>9.8</b>	<b>12</b>	<b>15</b>	<b>0.3</b>	<b>RST08</b>	<b>5.85</b> 1320	<b>7.51</b> 1690	<b>4.79</b> 1080	<b>6.67</b> 1500	<b>7.44</b> 1670	<b>10000</b>	<b>0.023</b> 0.051	
	<b>24</b>	<b>10</b>	<b>9.8</b>	<b>12</b>	<b>15</b>	<b>0.3</b>	<b>RST08DZ</b>	<b>5.85</b> 1320	<b>7.51</b> 1690	<b>4.79</b> 1080	<b>6.67</b> 1500	<b>7.44</b> 1670	<b>10000</b>	<b>0.023</b> 0.051	
<b>30</b>	<b>30</b>	<b>12</b>	<b>11.8</b>	<b>14</b>	<b>20</b>	<b>0.3</b>	<b>RST010</b>	<b>10.40</b> 2340	<b>10.6</b> 2380	<b>8.62</b> 1940	<b>7.69</b> 1730	<b>10.6</b> 2380	<b>9400</b>	<b>0.044</b> 0.097	
	<b>30</b>	<b>12</b>	<b>11.8</b>	<b>14</b>	<b>20</b>	<b>0.3</b>	<b>RST010DZ</b>	<b>10.40</b> 2340	<b>10.6</b> 2380	<b>8.62</b> 1940	<b>7.69</b> 1730	<b>10.6</b> 2380	<b>9400</b>	<b>0.044</b> 0.097	
<b>32</b>	<b>32</b>	<b>12</b>	<b>11.8</b>	<b>16</b>	<b>22</b>	<b>0.3</b>	<b>RST012</b>	<b>11.20</b> 2520	<b>11.9</b> 2680	<b>8.80</b> 1980	<b>7.65</b> 1720	<b>10.9</b> 2450	<b>8100</b>	<b>0.049</b> 0.108	
	<b>32</b>	<b>12</b>	<b>11.8</b>	<b>16</b>	<b>22</b>	<b>0.3</b>	<b>RST012DZ</b>	<b>11.20</b> 2520	<b>11.9</b> 2680	<b>8.80</b> 1980	<b>7.65</b> 1720	<b>10.9</b> 2450	<b>8100</b>	<b>0.049</b> 0.108	
<b>35</b>	<b>35</b>	<b>12</b>	<b>11.8</b>	<b>20</b>	<b>26</b>	<b>0.3</b>	<b>RST015</b>	<b>12.90</b> 2900	<b>15.3</b> 3440	<b>9.13</b> 2050	<b>6.95</b> 1560	<b>11.2</b> 2520	<b>6300</b>	<b>0.052</b> 0.115	
	<b>35</b>	<b>12</b>	<b>11.8</b>	<b>20</b>	<b>26</b>	<b>0.3</b>	<b>RST015DZ</b>	<b>12.90</b> 2900	<b>15.3</b> 3440	<b>9.13</b> 2050	<b>6.95</b> 1560	<b>11.2</b> 2520	<b>6300</b>	<b>0.052</b> 0.115	

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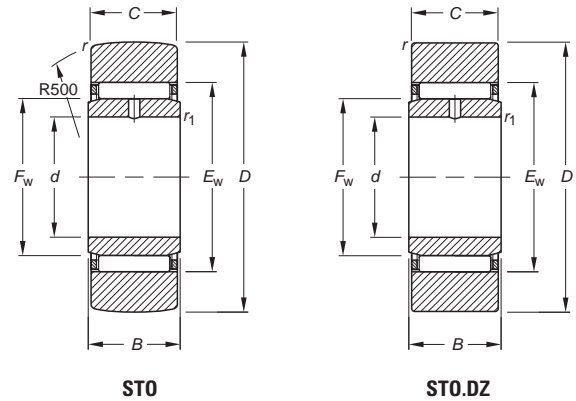
Outer Dia.	Dimensions						Bearing Designation	Load Ratings kN/lbf.					Limiting Speed Grease	Wt. kg/lbs.
	mm	D	B	C	F <sub>w</sub>	E <sub>w</sub>		r <sub>s</sub>	As a Bearing Dynamic	As a Bearing Static	As a Track Roller			
								C	C <sub>0</sub>	C <sub>w</sub>	F <sub>r perm</sub>	F <sub>0r perm</sub>		
40	40	16	15.8	22	29	0.3	RST017	19.00	23.3	13.8	11.4	18.2	5800	0.095
	1.5748	0.630	0.622	0.8661	1.142	0.012		4270	5240	3100	2560	4090		
40	40	16	15.8	22	29	0.3	RST017DZ	19.00	23.3	13.8	11.4	18.2	5800	0.095
	1.5748	0.630	0.622	0.8661	1.142	0.012		4270	5240	3100	2560	4090		
47	47	16	15.8	25	32	0.3	RST020	20.00	25.3	15.3	16.5	22.2	5000	0.134
	1.8504	0.630	0.622	0.9843	1.260	0.012		4500	5690	3440	3710	4990		
47	47	16	15.8	25	32	0.3	RST020DZ	20.00	25.3	15.3	16.5	22.2	5000	0.134
	1.8504	0.630	0.622	0.9843	1.260	0.012		4500	5690	3440	3710	4990		
52	52	16	15.8	30	37	0.3	RST025	22.40	31.0	16.0	16.9	23.7	4100	0.155
	2.0472	0.630	0.622	1.1811	1.457	0.012		5040	6970	3600	3800	5330		
52	52	16	15.8	30	37	0.3	RST025DZ	22.30	31.0	16.0	16.9	23.7	4100	0.155
	2.0472	0.630	0.622	1.1811	1.457	0.012		5010	6970	3600	3800	5330		
62	62	20	19.8	38	46	0.6	RST030	33.30	51.0	22.3	23.2	34.2	3200	0.258
	2.4409	0.787	0.780	1.4961	1.811	0.024		7490	11470	5010	5220	7690		
62	62	20	19.8	38	46	0.6	RST030DZ	33.30	51.0	22.3	23.2	34.2	3200	0.258
	2.4409	0.787	0.780	1.4961	1.811	0.024		7490	11470	5010	5220	7690		
72	72	20	19.8	42	50	0.6	RST035	35.20	56.6	25.2	33.3	43.0	2900	0.37
	2.8346	0.787	0.780	1.6535	1.969	0.024		7910	12720	5670	7490	9670		
72	72	20	19.8	42	50	0.6	RST035DZ	35.20	56.6	25.2	33.3	43.0	2900	0.370
	2.8346	0.787	0.780	1.6535	1.969	0.024		7910	12720	5670	7490	9670		
80	80	20	19.8	50	58	0.6	RST040	38.80	67.8	25.9	34.7	45.0	2400	0.430
	3.1496	0.787	0.780	1.9685	2.283	0.024		8720	15240	5820	7800	10120		
80	80	20	19.8	50	58	0.6	RST040DZ	38.80	67.8	25.9	34.7	45.0	2400	0.430
	3.1496	0.787	0.780	1.9685	2.283	0.024		8720	15240	5820	7800	10120		
85	85	20	19.8	55	63	0.6	RST045	40.30	73.5	26.0	35.8	45.5	2200	0.447
	3.3465	0.787	0.780	2.1654	2.480	0.024		9060	16520	5850	8050	10230		
90	90	20	19.8	60	68	0.6	RST050	41.80	79.2	26.0	37.1	45.8	2000	0.495
	3.5433	0.787	0.780	2.3622	2.677	0.024		9400	17800	5850	8340	10300		





**CAGED, WITH INNER RING,  
NO END WASHERS  
YOKE TYPE (STO SERIES)**

**METRIC SERIES**



**STO**

**STO.DZ**

Outer Dia.	Dimensions									Bearing Designation	Load Ratings kN/lbf.					Limiting Speed Grease RPM	Wt. kg/lbs.
	D	d	B	C	F <sub>w</sub>	E <sub>w</sub>	r <sub>s</sub>	r <sub>1s</sub>	As a Bearing Dynamic		As a Bearing Static	As a Track Roller					
mm	D	d	B	C	F <sub>w</sub>	E <sub>w</sub>	r <sub>s</sub>	r <sub>1s</sub>	C	C <sub>0</sub>	C <sub>w</sub>	F <sub>r perm</sub>	F <sub>0r perm</sub>				
19	19	6	10	9.8	10	13	0.3	0.3	STO6	5.40	6.43	4.15	4.04	5.63	9400	0.018	
	0.7480	0.2362	0.394	0.386	0.3937	0.5118	0.012	0.012		1210	1450	933	908	1270			
19	19	6	10	9.8	10	13	0.3	0.3	STO6DZ	5.40	6.43	4.15	4.04	5.63	9400	0.018	
	0.7480	0.2362	0.394	0.386	0.3937	0.5118	0.012	0.012		1210	1450	933	908	1270			
24	24	8	10	9.8	12	15	0.3	0.3	STO8	5.85	7.51	4.79	6.67	7.44	8100	0.028	
	0.9449	0.3150	0.394	0.386	0.4724	0.5906	0.012	0.012		1320	1690	1080	1500	1670			
24	24	8	10	9.8	12	15	0.3	0.3	STO8DZ	5.85	7.51	4.79	6.67	7.44	8100	0.028	
	0.9449	0.3150	0.394	0.386	0.4724	0.5906	0.012	0.012		1320	1690	1080	1500	1670			
30	30	10	12	11.8	14	20	0.3	0.3	STO10	10.4	10.6	8.62	7.69	10.6	6300	0.065	
	1.1811	0.3937	0.472	0.465	0.5512	0.7874	0.012	0.012		2340	2380	1940	1730	2380			
30	30	10	12	11.8	14	20	0.3	0.3	STO10DZ	10.4	10.6	8.62	7.69	10.6	6300	0.065	
	1.1811	0.3937	0.472	0.465	0.5512	0.7874	0.012	0.012		2340	2380	1940	1730	2380			
32	32	12	12	11.8	16	22	0.3	0.3	STO12	11.2	11.9	8.80	7.65	10.9	5800	0.114	
	1.2598	0.4724	0.472	0.465	0.6299	0.8661	0.012	0.012		2520	2680	1980	1720	2450			
32	32	12	12	11.8	16	22	0.3	0.3	STO12DZ	11.2	11.9	8.80	7.65	10.9	5800	0.114	
	1.2598	0.4724	0.472	0.465	0.6299	0.8661	0.012	0.012		2520	2680	1980	1720	2450			
35	35	15	12	11.8	20	26	0.3	0.3	STO15	12.9	15.3	9.13	6.95	11.2	5000	0.160	
	1.3780	0.5906	0.472	0.465	0.7874	1.0236	0.012	0.012		2900	3440	2050	1560	2520			
35	35	15	12	11.8	20	26	0.3	0.3	STO15DZ	12.9	15.3	9.13	6.95	11.2	5000	0.156	
	1.3780	0.5906	0.472	0.465	0.7874	1.0236	0.012	0.012		2900	3440	2050	1560	2520			
40	40	17	16	15.8	22	29	0.3	0.3	STO17	19.1	23.3	13.8	11.4	18.2	4100	0.114	
	1.5748	0.6693	0.630	0.622	0.8661	1.1417	0.012	0.012		4290	5240	3100	2560	4090			
40	40	17	16	15.8	22	29	0.3	0.3	STO17DZ	19.1	23.3	13.8	11.4	18.2	4100	0.114	
	1.5748	0.6693	0.630	0.622	0.8661	1.1417	0.012	0.012		4290	5240	3100	2560	4090			
47	47	20	16	15.8	25	32	0.3	0.3	STO20	19.8	25.3	15.3	16.5	22.2	3200	0.325	
	1.8504	0.7874	0.630	0.622	0.9843	1.2598	0.012	0.012		4450	5690	3440	3710	4990			
47	47	20	16	15.8	25	32	0.3	0.3	STO20DZ	20.0	25.3	15.3	16.5	22.2	3200	0.156	
	1.8504	0.7874	0.630	0.622	0.9843	1.2598	0.012	0.012		4500	5690	3440	3710	4990			

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Outer Dia.	Dimensions								Bearing Designation	Load Ratings kN/lbf.					Limiting Speed Grease	Wt. kg/lbs.
	mm	As a Bearing		As a Track Roller			RPM									
D		d	B	C	F <sub>w</sub>	E <sub>w</sub>		r <sub>s</sub>	r <sub>is</sub>	C	C <sub>o</sub>	C <sub>w</sub>	F <sub>T perm</sub>	F <sub>O<sub>r</sub> perm</sub>		
52	52	25	16	15.8	30	37	0.3	0.3	STO25	22.4	31.0	16.0	16.9	23.7	2900	0.435
	2.0472	0.9843	0.630	0.622	1.1811	1.4567	0.012	0.012		5040	6970	3600	3800	5330		
52	52	25	16	15.8	30	37	0.3	0.3	STO25DZ	22.4	31.0	16.0	16.9	23.7	2900	0.435
	2.0472	0.9843	0.630	0.622	1.1811	1.4567	0.012	0.012		5040	6970	3600	3800	5330		
62	62	30	20	19.8	38	46	0.6	0.6	STO30	33.3	51.0	22.3	23.2	34.2	2400	0.325
	2.4409	1.1811	0.787	0.780	1.4961	1.8110	0.024	0.024		7490	11470	5010	5220	7690		
62	62	30	20	19.8	38	46	0.6	0.6	STO30DZ	33.3	51.0	22.3	23.2	34.2	2400	0.325
	2.4409	1.1811	0.787	0.780	1.4961	1.8110	0.024	0.024		7490	11470	5010	5220	7690		
72	72	35	20	19.8	42	50	0.6	0.6	STO35	35.2	56.6	25.2	33.3	43.0	2200	0.435
	2.8346	1.3780	0.787	0.780	1.6535	1.9685	0.024	0.024		7910	12720	5670	7490	9670		
72	72	35	20	19.8	42	50	0.6	0.6	STO35DZ	35.2	56.6	25.2	33.3	43.0	2200	0.435
	2.8346	1.3780	0.787	0.780	1.6535	1.9685	0.024	0.024		7910	12720	5670	7490	9670		
80	80	40	20	19.8	50	58	0.6	1.0	STO40	38.8	67.8	25.9	34.7	45.0	2000	0.540
	3.1496	1.5748	0.787	0.780	1.9685	2.2835	0.024	0.039		8720	15240	5820	7800	10120		
80	80	40	20	19.8	50	58	0.6	1.0	STO40DZ	38.8	67.8	25.9	34.7	45.0	2000	0.540
	3.1496	1.5748	0.787	0.780	1.9685	2.2835	0.024	0.039		8720	15240	5820	7800	10120		
85	85	45	20	19.8	55	63	0.6	1.0	STO45	40.3	73.5	26.0	35.8	45.5	13000	0.580
	3.3465	1.7717	0.787	0.780	2.1654	2.4803	0.024	0.039		9060	16520	5850	8050	10230		
85	85	45	20	19.8	55	63	0.6	1.0	STO45DZ	40.3	73.5	26.0	35.8	45.5	13000	0.580
	3.3465	1.7717	0.787	0.780	2.1654	2.4803	0.024	0.039		9060	16520	5850	8050	10230		
90	90	50	20	19.8	60	68	0.6	1.0	STO50	41.8	79.2	26.0	37.1	45.8	10000	0.650
	3.5433	1.9685	0.787	0.780	2.3622	2.6772	0.024	0.039		9400	17800	5850	8340	10300		
90	90	50	20	19.8	60	68	0.6	1.0	STO50DZ	41.8	79.2	26.0	37.1	45.8	10000	0.650
	3.5433	1.9685	0.787	0.780	2.3622	2.6772	0.024	0.039		9400	17800	5850	8340	10300		

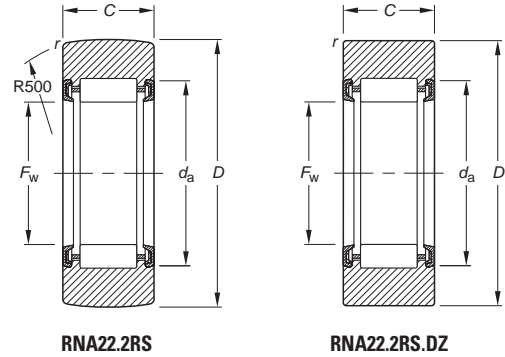




# NEEDLE ROLLER BEARINGS

**CAGED, WITHOUT INNER RING,  
NO END WASHERS, SEALED,  
YOKE TYPE (RNA22 SERIES)**

**METRIC SERIES**



C

Outer Dia.	Dimensions					Bearing Designation	Load Ratings kN/lbf.					Limiting Speed Grease RPM	Wt kg/lbs.
	D	C	F <sub>w</sub>	E <sub>w</sub>	r <sub>s</sub>		As a Bearing		As a Track Roller				
mm	D	C	F <sub>w</sub>	E <sub>w</sub>	r <sub>s</sub>		C	C <sub>0</sub>	C <sub>w</sub>	F <sub>T perm</sub>	F <sub>Or perm</sub>		
19	19	11.8	10	14	0.3	RNA22/6.2RS	4.70	5.43	4.13	3.06	4.59	13000	0.014
	0.7480	0.465	0.3937	0.551	0.012		1060	1220	928	688	1030		0.031
19	19	11.8	10	14	0.3	RNA22/6.2RS.DZ	4.70	5.43	4.13	3.06	4.59	13000	0.014
	0.7480	0.465	0.3937	0.551	0.012		1060	1220	928	688	1030		0.031
24	24	11.8	12	18	0.3	RNA22/8.2RS	6.70	6.08	5.31	3.37	5.22	11000	0.025
	0.9449	0.465	0.4724	0.709	0.012		1510	1370	1190	758	1170		0.055
24	24	11.8	12	18	0.3	RNA22/8.2RS.DZ	6.70	6.08	5.31	3.37	5.22	11000	0.025
	0.9449	0.465	0.4724	0.709	0.012		1510	1370	1190	758	1170		0.055
30	30	13.8	14	20	0.6	RNA2200.2RS	8.50	9.45	8.03	7.85	9.45	9400	0.049
	1.1811	0.543	0.5512	0.787	0.024		1910	2120	1810	1760	2120		0.108
30	30	13.8	14	20	0.6	RNA2200.2RS.DZ	8.50	9.45	8.03	7.85	9.45	9400	0.049
	1.1811	0.543	0.5512	0.787	0.024		1910	2120	1810	1760	2120		0.108
32	32	13.8	16	22	0.6	RNA2201.2RS	9.00	10.5	8.2	7.78	10.1	8100	0.053
	1.2598	0.543	0.6299	0.866	0.024		2020	2360	1840	1750	2270		0.117
32	32	13.8	16	22	0.6	RNA2201.2RS.DZ	9.00	10.5	8.2	7.78	10.1	8100	0.053
	1.2598	0.543	0.6299	0.866	0.024		2020	2360	1840	1750	2270		0.117
35	35	13.8	20	27	0.6	RNA2202.2RS	12.2	14.5	9.24	6.00	10.2	6300	0.055
	1.3780	0.543	0.7874	1.063	0.024		2740	3260	2080	1350	2290		0.121
35	35	13.8	20	27	0.6	RNA2202.2RS.DZ	12.2	14.5	9.24	6.00	10.2	6300	0.055
	1.3780	0.543	0.7874	1.063	0.024		2740	3260	2080	1350	2290		0.121
40	40	15.8	22	30	1.0	RNA2203.2RS	16.3	17.8	11.9	8.50	13.7	5900	0.090
	1.5748	0.622	0.8661	1.181	0.039		3660	4000	2680	1910	3080		0.198
40	40	15.8	22	30	1.0	RNA2203.2RS.DZ	16.3	17.8	11.9	8.50	13.7	5900	0.090
	1.5748	0.622	0.8661	1.181	0.039		3660	4000	2680	1910	3080		0.198
47	47	17.8	25	35	1.0	RNA2204.2RS	19.6	20.2	14.8	11.0	16.7	5200	0.150
	1.8504	0.701	0.9843	1.378	0.039		4410	4540	3330	2470	3750		0.331
47	47	17.8	25	35	1.0	RNA2204.2RS.DZ	19.6	20.2	14.8	11.0	16.7	5200	0.150
	1.8504	0.701	0.9843	1.378	0.039		4410	4540	3330	2470	3750		0.331

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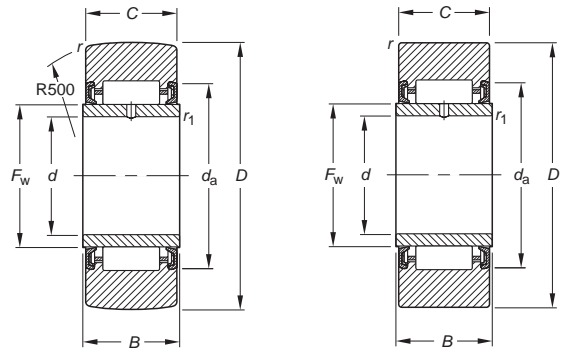
Outer Dia.	Dimensions					Bearing Designation	Load Ratings kN/lbf.					Limiting Speed Grease	Wt. kg/lbs.
	D	C	F <sub>w</sub>	E <sub>w</sub>	r <sub>s</sub>		As a Bearing		As a Track Roller				
mm							Dynamic	Static	Dynamic	F <sub>T perm</sub>	F <sub>Or perm</sub>	RPM	
52	52	17.8	30	40	1.0	RNA2205.2RS	21.6	24.3	15.5	11.3	17.7	4300	0.171
	2.0472	0.701	1.1811	1.575	0.039		4860	5460	3480	2540	3980		
52	52	17.8	30	40	1.0	RNA2205.2RS.DZ	21.6	24.3	15.5	11.3	17.7	4300	0.171
	2.0472	0.701	1.1811	1.575	0.039		4860	5460	3480	2540	3980		
62	62	19.8	35	47	1.0	RNA2206.2RS	29.0	32.8	21.2	15.8	24.8	3700	0.285
	2.4409	0.780	1.3780	1.850	0.039		6520	7370	4770	3550	5580		
62	62	19.8	35	47	1.0	RNA2206.2RS.DZ	29.7	32.8	21.2	15.8	24.8	3700	0.285
	2.4409	0.780	1.3780	1.850	0.039		6680	7370	4770	3550	5580		
72	72	22.8	42	54	1.1	RNA2207.2RS	40.5	52.5	28.6	24.2	37.9	3000	0.490
	2.8346	0.898	1.6535	2.126	0.043		9100	11800	6430	5440	8520		
72	72	22.8	42	54	1.1	RNA2207.2RS.DZ	40.5	52.5	28.6	24.2	37.9	3000	0.420
	2.8346	0.898	1.6535	2.126	0.043		9100	11800	6430	5440	8520		
80	80	22.8	48	60	1.1	RNA2208.2RS	44.0	60.0	30.4	27.8	42.0	2600	0.515
	3.1496	0.898	1.8898	2.362	0.043		9890	13490	6830	6250	9440		
80	80	22.8	48	60	1.1	RNA2208.2RS.DZ	44.3	60.0	30.4	27.8	42.0	2600	0.515
	3.1496	0.898	1.8898	2.362	0.043		9960	13490	6830	6250	9440		
85	85	22.8	52	64	1.1	RNA2209.2RS	45.6	63.9	30.9	29.7	43.7	2400	0.565
	3.3465	0.898	2.0472	2.520	0.043		10250	14370	6950	6680	9820		
85	85	22.8	52	64	1.1	RNA2209.2RS.DZ	45.6	63.9	30.9	29.7	43.7	2400	0.565
	3.3465	0.898	2.0472	2.520	0.043		10250	14370	6950	6680	9820		
90	90	22.8	58	70	1.1	RNA2210.2RS	48.5	71.3	31.0	29.4	43.4	2100	0.590
	3.5433	0.898	2.2835	2.756	0.043		10900	16030	6970	6610	9760		
90	90	22.8	58	70	1.1	RNA2210.2RS.DZ	48.5	71.3	31.0	29.4	43.4	2100	0.590
	3.5433	0.898	2.2835	2.756	0.043		10900	16030	6970	6610	9760		





**CAGED, WITH INNER RING,  
NO END WASHERS, SEALED,  
YOKE TYPE (NA SERIES)**

**METRIC SERIES**



**NA22.2RS**

**NA22.2RS.DZ**

Outer Dia.	Dimensions									Bearing Designation	Load Ratings kN/lbf.						Speed Grease RPM	Wt. kg/lbs.
	D	d	B	C	F <sub>w</sub>	E <sub>w</sub>	r <sub>s</sub>	r <sub>1s</sub>	As a Bearing Dynamic		As a Bearing Static	As a Track Roller						
mm	D	d	B	C	F <sub>w</sub>	E <sub>w</sub>	r <sub>s</sub>	r <sub>1s</sub>	C	C <sub>0</sub>	C <sub>w</sub>	F <sub>r perm</sub>	F <sub>0r perm</sub>					
19	19	6	12	11.8	10	14	0.3	0.3	NA22/6.2RS	4.70	5.43	4.13	3.06	4.59	13000	0.018		
	0.7480	0.2362	0.472	0.465	0.3937	0.5512	0.012	0.012		1060	1220	928	688	1030				
19	19	6	12	11.8	10	14	0.3	0.3	NA22/6.2RS.DZ	4.70	4.55	4.13	3.06	4.59	13000	0.018		
	0.7480	0.2362	0.472	0.465	0.3937	0.5512	0.012	0.012		1060	1020	928	688	1030				
24	24	8	12	11.8	12	18	0.3	0.3	NA22/8.2RS	6.70	6.08	5.31	3.37	5.22	11000	0.031		
	0.9449	0.3150	0.472	0.465	0.4724	0.7087	0.012	0.012		1510	1370	1190	758	1170				
24	24	8	12	11.8	12	18	0.3	0.3	NA22/8.2RS.DZ	6.70	6.08	5.31	3.37	5.22	11000	0.031		
	0.9449	0.3150	0.472	0.465	0.4724	0.7087	0.012	0.012		1510	1370	1190	758	1170				
30	30	10	14	13.8	14	20	0.6	0.3	NA2200.2RS	8.50	9.45	8.03	7.85	9.45	9400	0.057		
	1.1811	0.3937	0.551	0.543	0.5512	0.7874	0.024	0.012		1910	2120	1810	1760	2120				
30	30	10	14	13.8	14	20	0.6	0.3	NA2200.2RS.DZ	8.50	9.45	8.03	7.85	9.45	9400	0.057		
	1.1811	0.3937	0.551	0.543	0.5512	0.7874	0.024	0.012		1910	2120	1810	1760	2120				
32	32	12	14	13.8	16	22	0.6	0.3	NA2201.2RS	9.00	10.5	8.20	7.78	10.1	8100	0.063		
	1.2598	0.4724	0.551	0.543	0.6299	0.8661	0.024	0.012		2020	2360	1840	1750	2270				
32	32	12	14	13.8	16	22	0.6	0.3	NA2201.2RS.DZ	9.00	10.5	8.20	7.78	10.1	8100	0.063		
	1.2598	0.4724	0.551	0.543	0.6299	0.8661	0.024	0.012		2020	2360	1840	1750	2270				
35	35	15	14	13.8	20	27	0.6	0.3	NA2202.2RS	12.2	14.5	9.24	6.00	10.2	6300	0.070		
	1.3780	0.5906	0.551	0.543	0.7874	1.0630	0.024	0.012		2740	3260	2080	1350	2290				
35	35	15	14	13.8	20	27	0.6	0.3	NA2202.2RS.DZ	12.2	14.5	9.24	6.00	10.2	6300	0.070		
	1.3780	0.5906	0.551	0.543	0.7874	1.0630	0.024	0.012		2740	3260	2080	1350	2290				
40	40	17	16	15.8	22	30	1.0	0.3	NA2203.2RS	16.3	17.8	11.9	8.50	13.7	5900	0.107		
	1.5748	0.6693	0.630	0.622	0.8661	1.1811	0.039	0.012		3660	4000	2680	1910	3080				
40	40	17	16	15.8	22	30	1.0	0.3	NA2203.2RS.DZ	16.3	17.8	11.9	8.50	13.7	5900	0.107		
	1.5748	0.6693	0.630	0.622	0.8661	1.1811	0.039	0.012		3660	4000	2680	1910	3080				
47	47	20	18	17.8	25	35	1.0	0.3	NA2204.2RS	19.6	20.2	14.8	11.0	16.7	5200	0.175		
	1.8504	0.7874	0.709	0.701	0.9843	1.3780	0.039	0.012		4410	4540	3330	2470	3750				
47	47	20	18	17.8	25	35	1.0	0.3	NA2204.2RS.DZ	19.6	20.2	14.8	11.0	16.7	5200	0.175		
	1.8504	0.7874	0.709	0.701	0.9843	1.3780	0.039	0.012		4410	4540	3330	2470	3750				

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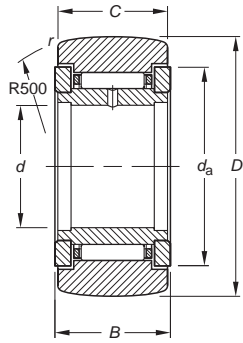
Outer Dia.	Dimensions									Bearing Designation	Load Ratings kN/lbf.					Speed Grease	Wt. kg/lbs.
	D	d	B	C	F <sub>w</sub>	E <sub>w</sub>	r <sub>s</sub>	r <sub>ts</sub>	As a Bearing Dynamic		As a Bearing Static	As a Track Roller			RPM		
mm										C	C <sub>0</sub>	C <sub>w</sub>	F <sub>r perm</sub>	F <sub>0r perm</sub>			
52	52	25	18	17.8	30	40	1.0	0.3	NA2205.2RS	21.6	24.3	15.5	11.3	17.7	4300	0.202	
	2.0472	0.9843	0.709	0.701	1.1811	1.5748	0.039	0.012		4860	5460	3480	2540	3980			
52	52	25	18	17.8	30	40	1.0	0.3	NA2205.2RS.DZ	21.6	24.3	15.5	11.3	17.7	4300	0.202	
	2.0472	0.9843	0.709	0.701	1.1811	1.5748	0.039	0.012		4860	5460	3480	2540	3980			
62	62	30	20	19.8	35	47	1.0	0.3	NA2206.2RS	29.0	32.8	21.2	15.8	24.8	3700	0.324	
	2.4409	1.1811	0.787	0.780	1.3780	1.8504	0.039	0.012		6520	7370	4770	3550	5580			
62	62	30	20	19.8	35	47	1.0	0.3	NA2206.2RS.DZ	29.0	32.8	21.2	15.8	24.8	3700	0.324	
	2.4409	1.1811	0.787	0.780	1.3780	1.8504	0.039	0.012		6520	7370	4770	3550	5580			
72	72	35	23	22.8	42	54	1.1	0.6	NA2207.2RS	40.5	52.5	28.6	24.2	37.9	3000	0.490	
	2.8346	1.3780	0.906	0.898	1.6535	2.1260	0.043	0.024		9100	11800	6430	5440	8520			
72	72	35	23	22.8	42	54	1.1	0.6	NA2207.2RS.DZ	40.5	52.5	28.6	24.2	37.9	3000	0.490	
	2.8346	1.3780	0.906	0.898	1.6535	2.1260	0.043	0.024		9100	11800	6430	5440	8520			
80	80	40	23	22.8	48	60	1.1	0.6	NA2208.2RS	44.0	60.0	30.4	27.8	42.0	2600	0.615	
	3.1496	1.5748	0.906	0.898	1.8898	2.3622	0.043	0.024		9890	13500	6830	6250	9440			
80	80	40	23	22.8	48	60	1.1	0.6	NA2208.2RS.DZ	44.0	60.0	30.4	27.8	42.0	2600	0.615	
	3.1496	1.5748	0.906	0.898	1.8898	2.3622	0.043	0.024		9890	13500	6830	6250	9440			
85	85	45	23	22.8	52	64	1.1	0.6	NA2209.2RS	45.0	63.9	30.9	29.7	43.7	2400	0.661	
	3.3465	1.7717	0.906	0.898	2.0472	2.5197	0.043	0.024		10100	14400	6950	6680	9820			
85	85	45	23	22.8	52	64	1.1	0.6	NA2209.2RS.DZ	45.0	63.9	30.9	29.7	43.7	2400	0.661	
	3.3465	1.7717	0.906	0.898	2.0472	2.5197	0.043	0.024		10100	14400	6950	6680	9820			
90	90	50	23	22.8	58	70	1.1	0.6	NA2210.2RS	48.0	71.3	31.0	29.4	43.4	2100	0.712	
	3.5433	1.9685	0.906	0.898	2.2835	2.7559	0.043	0.024		10800	16000	6970	6610	9760			
90	90	50	23	22.8	58	70	1.1	0.6	NA2210.2RS.DZ	48.0	71.3	31.0	29.4	43.4	2100	0.712	
	3.5433	1.9685	0.906	0.898	2.2835	2.7559	0.043	0.024		10800	16000	6970	6610	9760			



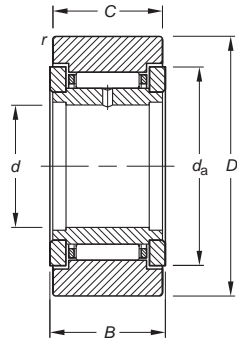


**CAGED, WITH INNER RING, WITH END WASHERS,  
YOKE TYPE (NATR, STO...ZZ SERIES)**

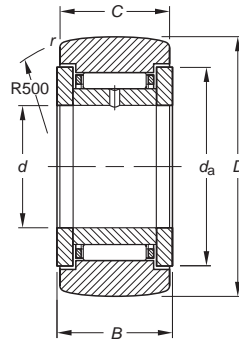
**METRIC SERIES**



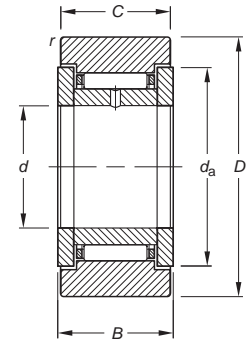
**NATR**



**NATR.DZ**



**STO.ZZ**



**STO.ZZ.DZ**

Outer Dia.	Dimensions						Bearing Designation	Load Ratings kN/bf.					Limiting Speed Grease	Wt. kg/lbs.
	mm	D	d	B	C	d <sub>a</sub>		As a Bearing		As a Track Roller				
								Dynamic	Static	C <sub>w</sub>	F <sub>r perm</sub>	F <sub>0r perm</sub>		
16	16	5	12	11.0	13	0.3	NATR5	4.62	5.19	3.34	2.62	4.01	13000	0.017
	0.6299	0.1969	0.472	0.433	0.512	0.012		1040	1170	751	589	901		
16	16	5	12	11.0	13	0.3	NATR5DZ	4.62	5.19	3.34	2.62	4.01	13000	0.017
	0.6299	0.1969	0.472	0.433	0.512	0.012		1040	1170	751	589	901		
19	19	6	12	11.0	16	0.3	NATR6	4.84	5.66	3.84	4.28	5.28	12000	0.022
	0.7480	0.2362	0.472	0.433	0.630	0.012		1090	1270	863	962	1190		
19	19	6	12	11.0	16	0.3	NATR6DZ	5.84	6.66	3.84	4.28	5.28	12000	0.022
	0.7480	0.2362	0.472	0.433	0.630	0.012		1310	1500	863	962	1190		
19	19	6	14	13.8	15	0.3	STO6ZZ	5.37	6.47	4.31	5.23	6.17	12000	0.024
	0.7480	0.2362	0.551	0.543	0.591	0.012		1210	1450	969	1180	1390		
19	19	6	14	13.8	15	0.3	STO6ZZ.DZ	5.37	6.47	4.31	5.23	6.17	12000	0.024
	0.7480	0.2362	0.551	0.543	0.591	0.012		1210	1450	969	1180	1390		
24	24	8	14	13.8	18	0.3	STO8ZZ	5.82	7.54	4.97	7.54	8.14	9900	0.040
	0.9449	0.3150	0.551	0.543	0.709	0.012		1310	1700	1120	1700	1830		
24	24	8	14	13.8	18	0.3	STO8ZZ.DZ	5.82	7.54	4.97	7.54	8.14	9900	0.040
	0.9449	0.3150	0.551	0.543	0.709	0.012		1310	1700	1120	1700	1830		
24	24	8	15	14.0	20	0.3	NATR8	8.39	8.67	6.66	5.79	8.08	10000	0.043
	0.9449	0.3150	0.591	0.551	0.787	0.012		1890	1950	1500	1300	1820		
24	24	8	15	14.0	20	0.3	NATR8DZ	9.39	9.67	6.66	5.79	8.08	10000	0.043
	0.9449	0.3150	0.591	0.551	0.787	0.012		2110	2170	1500	1300	1820		
30	30	10	15	14.0	24	0.6	NATR10	9.57	9.45	8.15	8.58	10.1	9400	0.068
	1.1811	0.3937	0.591	0.551	0.945	0.024		2150	2120	1830	1930	2270		
30	30	10	15	14.0	24	0.6	NATR10DZ	9.57	9.45	8.15	8.58	10.1	9400	0.068
	1.1811	0.3937	0.591	0.551	0.945	0.024		2150	2120	1830	1930	2270		
30	30	10	16	15.8	23	0.3	STO10ZZ	10.4	10.6	8.94	9.64	11.4	9400	0.071
	1.1811	0.3937	0.630	0.622	0.906	0.012		2340	2380	2010	2170	2560		
30	30	10	16	15.8	23	0.3	STO10ZZ.DZ	10.4	10.6	8.94	9.64	11.4	9400	0.071
	1.1811	0.3937	0.630	0.622	0.906	0.012		2340	2380	2010	2170	2560		
32	32	12	15	14.0	26	0.6	NATR12	10.2	10.5	8.32	8.50	10.4	8100	0.075
	1.2598	0.4724	0.591	0.551	1.024	0.024		2290	2360	1870	1910	2340		
32	32	12	15	14.0	26	0.6	NATR12DZ	10.2	10.5	8.32	8.50	10.4	8100	0.075
	1.2598	0.4724	0.591	0.551	1.024	0.024		2290	2360	1870	1910	2340		
32	32	12	16	15.8	25	0.3	STO12ZZ	11.2	11.9	9.13	9.54	11.7	8100	0.078
	1.2598	0.4724	0.630	0.622	0.984	0.012		2520	2680	2050	2140	2630		
32	32	12	16	15.8	25	0.3	STO12ZZ.DZ	11.2	11.9	9.13	9.54	11.7	8100	0.078
	1.2598	0.4724	0.630	0.622	0.984	0.012		2520	2680	2050	2140	2630		

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Outer Dia.	Dimensions						Bearing Designation	Load Ratings kN/bf.					Limiting Speed Grease RPM	Wt. kg/lbs.	
	mm	D	d	B	C	d <sub>a</sub>		r <sub>s</sub>	As a Bearing		As a Track Roller				
		C	C <sub>0</sub>	C <sub>w</sub>	F <sub>r perm</sub>	F <sub>0r perm</sub>									
35	35	15	16	15.8	30	0.3	ST015ZZ	12.9	15.3	9.47	8.52	12.1	6300	0.089	
	1.3780	0.5906	0.630	0.622	1.181	0.012		2900	3440	2130	1920	2720			
35	35	15	16	15.8	30	0.3	ST015ZZ.DZ	12.9	15.3	9.47	8.52	12.1	6300	0.089	
	1.3780	0.5906	0.630	0.622	1.181	0.012		2900	3440	2130	1920	2720			
40	40	17	20	19.8	33	0.3	ST017ZZ	19.0	23.3	14.2	13.4	19.3	5600	0.145	
	1.5748	0.6693	0.787	0.780	1.299	0.012		4270	5240	3190	3010	4340			
40	40	17	20	19.8	33	0.3	ST017ZZ.DZ	19.0	23.3	14.2	13.4	19.3	5600	0.145	
	1.5748	0.6693	0.787	0.780	1.299	0.012		4270	5240	3190	3010	4340			
47	47	20	20	19.8	37	0.3	ST020ZZ	20.0	25.4	15.7	19.5	23.5	4900	0.200	
	1.8504	0.7874	0.787	0.780	1.457	0.012		4500	5710	3530	4380	5280			
47	47	20	20	19.8	37	0.3	ST020ZZ.DZ	20.0	25.4	15.7	19.5	23.5	4900	0.200	
	1.8504	0.7874	0.787	0.780	1.457	0.012		4500	5710	3530	4380	5280			
52	52	25	20	19.8	42	0.3	ST025ZZ	22.4	31.1	16.4	19.8	25.1	4100	0.240	
	2.0472	0.9843	0.787	0.780	1.654	0.012		5040	6990	3690	4450	5640			
52	52	25	20	19.8	42	0.3	ST025ZZ.DZ	22.4	31.1	16.4	19.8	25.1	4100	0.240	
	2.0472	0.9843	0.787	0.780	1.654	0.012		5040	6990	3690	4450	5640			
62	62	30	25	24.8	52	0.6	ST030ZZ	33.3	51.0	23.0	26.9	36.2	3200	0.412	
	2.4409	1.1811	0.984	0.976	2.047	0.024		7490	11500	5170	6050	8140			
62	62	30	25	24.8	52	0.6	ST030ZZ.DZ	33.3	51.0	23.0	26.9	36.2	3200	0.412	
	2.4409	1.1811	0.984	0.976	2.047	0.024		7490	11500	5170	6050	8140			
72	72	35	25	24.8	56	0.6	ST035ZZ	35.2	56.6	25.9	39.2	45.5	2900	0.555	
	2.8346	1.3780	0.984	0.976	2.205	0.024		7910	12700	5820	8810	10200			
72	72	35	25	24.8	56	0.6	ST035ZZ.DZ	35.2	56.6	25.9	39.2	45.5	2900	0.555	
	2.8346	1.3780	0.984	0.976	2.205	0.024		7910	12700	5820	8810	10200			
80	80	40	26	25.8	64	0.6	ST040ZZ	38.8	67.8	26.8	41.5	48.1	2400	0.700	
	3.1496	1.5748	1.024	1.016	2.520	0.024		8720	15200	6020	9330	10800			
80	80	40	26	25.8	64	0.6	ST040ZZ.DZ	38.8	67.8	26.8	41.5	48.1	2400	0.700	
	3.1496	1.5748	1.024	1.016	2.520	0.024		8720	15200	6020	9330	10800			
85	85	45	26	25.8	69	0.6	ST045ZZ	40.3	73.5	26.9	42.4	48.6	2200	0.770	
	3.3465	1.7717	1.024	1.016	2.717	0.024		9060	16500	6050	9530	10900			
85	85	45	26	25.8	69	0.6	ST045ZZ.DZ	40.3	73.5	26.9	42.4	48.6	2200	0.770	
	3.3465	1.7717	1.024	1.016	2.717	0.024		9060	16500	6050	9530	10900			

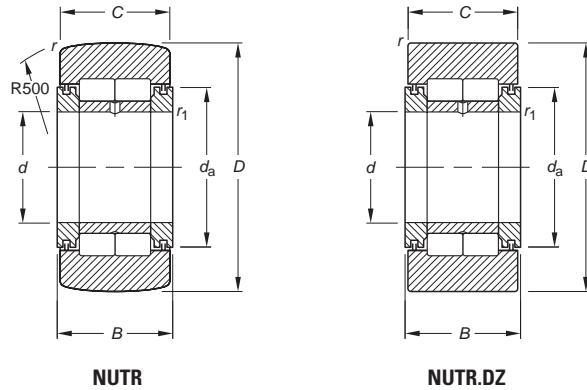




# NEEDLE ROLLER BEARINGS

**FULL COMPLEMENT,  
WITH INNER RING,  
WITH END WASHERS,  
CYLINDRICAL ROLLERS,  
YOKE TYPE (NUTR SERIES)**

**METRIC SERIES**



C

Outer Dia.	Dimensions							Bearing Designation	Load Ratings kN/lbf.					Limiting Speed Grease RPM	Wt. kg/lbs.
	D	d	B	C	da	rs	rs		As a Bearing Dynamic	As a Bearing Static	As a Track Roller Dynamic				
mm	D	d	B	C	da	rs	rs		C	Co	Cw	F <sub>r perm</sub>	F <sub>or perm</sub>		
35	35	15	19	18	24	0.6	0.3	NUTR15	24.7	29.3	16.2	10.1	16.1	6100	0.105
	1.3780	0.5906	0.748	0.709	0.945	0.024	0.012		5550	6590	3640	2270	3620		
35	35	15	19	18	24	0.6	0.3	NUTR15DZ	22.8	29.4	16.2	10.1	16.1	6100	0.105
	1.3780	0.5906	0.748	0.709	0.945	0.024	0.012		5130	6610	3640	2270	3620		
40	40	17	21	20	27	1.0	0.3	NUTR17	26.6	33.4	18.7	15.0	23.9	5300	0.154
	1.5748	0.6693	0.827	0.787	1.063	0.039	0.012		5980	7510	4200	3370	5370		
40	40	17	21	20	27	1.0	0.3	NUTR17DZ	24.5	33.3	18.7	15.0	23.9	5300	0.154
	1.5748	0.6693	0.827	0.787	1.063	0.039	0.012		5510	7490	4200	3370	5370		
42	42	15	19	18	24	0.6	0.3	NUTR1542	22.8	29.4	20.0	21.2	28.4	6100	0.166
	1.6535	0.5906	0.748	0.709	0.945	0.024	0.012		5130	6610	4500	4770	6380		
42	42	15	19	18	24	0.6	0.3	NUTR1542DZ	22.8	29.4	20.0	21.2	28.4	6100	0.166
	1.6535	0.5906	0.748	0.709	0.945	0.024	0.012		5130	6610	4500	4770	6380		
47	47	17	21	20	27	1.0	0.3	NUTR1747	24.5	33.3	22.0	28.1	33.6	5300	0.230
	1.8504	0.6693	0.827	0.787	1.063	0.039	0.012		5510	7490	4950	6320	7550		
47	47	17	21	20	27	1.0	0.3	NUTR1747DZ	24.5	33.3	22.0	28.1	33.6	5300	0.230
	1.8504	0.6693	0.827	0.787	1.063	0.039	0.012		5510	7490	4950	6320	7550		
47	47	20	25	24	32	1.0	0.3	NUTR20	39.0	53.2	28.1	20.5	32.7	4500	0.254
	1.8504	0.7874	0.984	0.945	1.260	0.039	0.012		8770	12000	6320	4610	7350		
47	47	20	25	24	32	1.0	0.3	NUTR20DZ	39.0	53.2	28.1	20.5	32.7	4500	0.254
	1.8504	0.7874	0.984	0.945	1.260	0.039	0.012		8770	12000	6320	4610	7350		
52	52	20	25	24	32	1.0	0.3	NUTR2052	39.0	53.2	31.6	31.0	45.9	4500	0.326
	2.0472	0.7874	0.984	0.945	1.260	0.039	0.012		8770	12000	7100	6970	10300		
52	52	20	25	24	32	1.0	0.3	NUTR2052DZ	39.0	53.2	31.6	31.0	45.9	4500	0.326
	2.0472	0.7874	0.984	0.945	1.260	0.039	0.012		8770	12000	7100	6970	10300		
52	52	25	25	24	37	1.0	0.3	NUTR25	43.0	63.1	29.6	22.2	35.4	3700	0.291
	2.0472	0.9843	0.984	0.945	1.457	0.039	0.012		9670	14200	6650	4990	7960		
52	52	25	25	24	37	1.0	0.3	NUTR25DZ	43.0	63.1	29.6	22.2	35.4	3700	0.291
	2.0472	0.9843	0.984	0.945	1.457	0.039	0.012		9670	14200	6650	4990	7960		
62	62	25	25	24	37	1.0	0.3	NUTR2562	43.0	63.1	36.0	43.9	57.8	3700	0.460
	2.4409	0.9843	0.984	0.945	1.457	0.039	0.012		9670	14200	8090	9870	13000		
62	62	25	25	24	37	1.0	0.3	NUTR2562DZ	43.0	63.1	36.0	43.9	57.8	3700	0.460
	2.4409	0.9843	0.984	0.945	1.457	0.039	0.012		9670	14200	8090	9870	13000		
62	62	30	29	28	44	1.0	0.3	NUTR30	60.0	83.1	40.8	29.0	46.2	3200	0.480
	2.4409	1.1811	1.142	1.102	1.732	0.039	0.012		13500	18700	9170	6520	10400		
62	62	30	29	28	44	1.0	0.3	NUTR30DZ	60.0	83.1	40.8	29.0	46.2	3200	0.480
	2.4409	1.1811	1.142	1.102	1.732	0.039	0.012		13500	18700	9170	6520	10400		

Continued on next page.

Outer Dia.	Dimensions							Bearing Designation	Load Ratings kN/lbf.					Limiting Speed Grease RPM	Wt. kg/lbs.
	D	d	B	C	d <sub>a</sub>	r <sub>s</sub>	r <sub>is</sub>		As a Bearing Dynamic	As a Bearing Static	As a Track Roller				
mm								C	C <sub>0</sub>	C <sub>w</sub>	F <sub>r perm</sub>	F <sub>0r perm</sub>			
72	72	30	29	28	44	1.0	0.3	NUTR3072	60.0	83.1	48.6	53.2	74.2	3200	0.711 1.567
	2.8346	1.1811	1.142	1.102	1.732	0.039	0.012		13500	18700	10900	12000	16700		
	72	30	29	28	44	1.0	0.3	NUTR3072DZ	60.0	83.1	48.6	53.2	74.2	3200	0.711 1.567
	2.8346	1.1811	1.142	1.102	1.732	0.039	0.012		13500	18700	10900	12000	16700		
	72	35	29	28	50	1.1	0.6	NUTR35	65.5	97.8	45.9	38.7	61.7	2600	0.655 1.444
	2.8346	1.3780	1.142	1.102	1.969	0.043	0.024		14700	22000	10300	8700	13900		
	72	35	29	28	50	1.1	0.6	NUTR35DZ	65.5	97.8	45.9	38.7	61.7	2600	0.655 1.444
	2.8346	1.3780	1.142	1.102	1.969	0.043	0.024		14700	22000	10300	8700	13900		
80	80	35	29	28	50	1.1	0.6	NUTR3580	65.5	97.8	51.7	58.7	81.9	2600	0.865 1.907
	3.1496	1.3780	1.142	1.102	1.969	0.043	0.024		14700	22000	11600	13200	18400		
	80	35	29	28	50	1.1	0.6	NUTR3580DZ	65.5	97.8	51.7	58.7	81.9	2600	0.865 1.907
	3.1496	1.3780	1.142	1.102	1.969	0.043	0.024		14700	22000	11600	13200	18400		
	80	40	32	30	55	1.1	0.6	NUTR40	88.0	132	60.6	48.0	76.5	2500	0.848 1.870
	3.1496	1.5748	1.260	1.181	2.165	0.043	0.024		19800	29700	13600	10800	17200		
	80	40	32	30	55	1.1	0.6	NUTR40DZ	88.0	132	60.6	48.0	76.5	2500	0.848 1.870
	3.1496	1.5748	1.260	1.181	2.165	0.043	0.024		19800	29700	13600	10800	17200		
85	85	45	32	30	60	1.1	0.6	NUTR45	93.0	146	62.0	50.2	80.0	2200	0.917 2.022
	3.3465	1.7717	1.260	1.181	2.362	0.043	0.024		20900	32800	13900	11300	18000		
	85	45	32	30	60	1.1	0.6	NUTR45DZ	93.0	146	62.0	50.2	80.0	2200	0.917 2.022
	3.3465	1.7717	1.260	1.181	2.362	0.043	0.024		20900	32800	13900	11300	18000		
90	90	40	32	30	55	1.1	0.6	NUTR4090	88.0	132	69.1	75.4	111	2500	1.162 2.562
	3.5433	1.5748	1.260	1.181	2.165	0.043	0.024		19800	29700	15500	17000	25000		
	90	40	32	30	55	1.1	0.6	NUTR4090DZ	88.0	132	69.1	75.4	111	2500	1.162 2.562
	3.5433	1.5748	1.260	1.181	2.165	0.043	0.024		19800	29700	15500	17000	25000		
	90	50	32	30	65	1.1	0.6	NUTR50	98.0	160	63.3	52.9	84.3	2000	0.988 2.178
	3.5433	1.9685	1.260	1.181	2.559	0.043	0.024		22000	36000	14200	11900	19000		
	90	50	32	30	65	1.1	0.6	NUTR50DZ	98.0	160	63.3	52.9	84.3	2000	0.988 2.178
	3.5433	1.9685	1.260	1.181	2.559	0.043	0.024		22000	36000	14200	11900	19000		
100	100	45	32	30	60	1.1	0.6	NUTR45100	93.0	146	74.3	92.2	127	2200	1.412 3.113
	3.9370	1.7717	1.260	1.181	2.362	0.043	0.024		20900	32800	16700	20700	28600		
	100	45	32	30	60	1.1	0.6	NUTR45100DZ	93.0	146	74.3	92.2	127	2200	1.412 3.113
	3.9370	1.7717	1.260	1.181	2.362	0.043	0.024		20900	32800	16700	20700	28600		
110	110	50	32	30	65	1.1	0.6	NUTR50110	98.0	160	79.0	110	141	2000	1.727 3.807
	4.3307	1.9685	1.260	1.181	2.559	0.043	0.024		22000	36000	17800	24700	31700		
	110	50	32	30	65	1.1	0.6	NUTR50110DZ	98.0	160	79.0	110	141	2000	1.727 3.807
	4.3307	1.9685	1.260	1.181	2.559	0.043	0.024		22000	36000	17800	24700	31700		

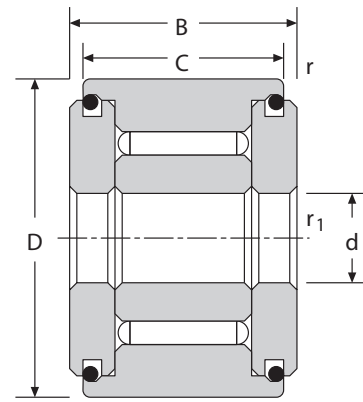




**FULL COMPLEMENT, NON-SEPARABLE,  
SMALL SERIES, UNSEALED,  
YOKE TYPE (FP SERIES)**

**METRIC SERIES**

FP: convex outer ring  
FPL: cylindrical outer ring



FP, FPL

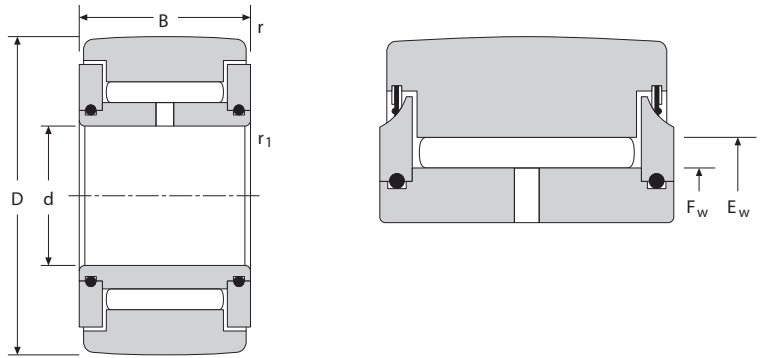
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Outside Dia.	Dimensions mm/in.						Designation		Load Ratings kN/lbf.			Limiting Speed	Wt. kg/lbs.
	D	d	C	B	r <sub>smin</sub>	r <sub>1smin</sub>	Profiled Track Roller	Cylindrical Track Roller	Dynamic	Static	Grease		
mm	D	d	C	B	r <sub>smin</sub>	r <sub>1smin</sub>			C	F <sub>r perm</sub>	F <sub>0r perm</sub>	RPM	
10	10 0.3937	3 0.1181	8 0.315	8.7 0.343	0.2 0.008	0.15 0.006	FP 3 10	FPL 3 10	2.13 480	1.16 260	2.05 460	13800	0.004 0.009
12	12 0.4724	4 0.1575	9 0.354	9.7 0.382	0.2 0.008	0.15 0.006	FP 4 12	FPL 4 12	2.98 670	1.82 410	3.35 750	11400	0.006 0.013
13	13 0.5118	4 0.1575	9 0.354	9.7 0.382	0.2 0.008	0.15 0.006	FP 4 13	FPL 4 13	3.35 750	2.45 550	3.95 890	11400	0.008 0.018
14	14 0.5512	4 0.1575	9 0.354	10.2 0.402	0.3 0.012	0.15 0.006	FP 4 14		3.50 790	2.55 570	4.35 980	10100	0.010 0.022
15	15 0.5906	4 0.1575	9 0.354	10.2 0.402	0.3 0.012	0.15 0.006	FP 4 15		3.50 790	3.20 720	4.75 1070	10100	0.011 0.024

**FULL COMPLEMENT,  
NON-SEPARABLE,  
SEALED OR UNSEALED,  
YOKE TYPE (FG SERIES)**

**METRIC SERIES**

FG: convex outer ring  
FGL: cylindrical outer ring



FG, FGL

Outside Dia.	Dimensions mm/in.							Designation		Load Ratings kN/bf.			Limiting Speed	Wt. kg/lbs.
	D	d	B	F <sub>w</sub>	E <sub>w</sub>	r <sub>sm</sub>	r <sub>1sm</sub>	Profiled Track Roller	Cylindrical Track Roller	Dynamic	Static		Grease	
mm	D	d	B	F <sub>w</sub>	E <sub>w</sub>	r <sub>sm</sub>	r <sub>1sm</sub>			C	F <sub>r perm</sub>	F <sub>0r perm</sub>	RPM	
16	16	5	12	7.7	10.7	0.3	0.3	FG 5 16	FGL 5 16	5.05 1140	3.25 730	5.40 1210	9300	0.016 0.035
	16	5	12	7.7	10.7	0.3	0.3	FG 5 16 EE	FGL 5 16 EE	5.05 1140	3.25 730	5.40 1210	9300	0.016 0.035
	16	5	12	7.7	10.7	0.3	0.3	FG 5 16 EEM		5.05 1140	3.25 730	5.40 1210	9300	0.016 0.035
19	19	6	12	9.7	12.7	0.3	0.3	FG 6 19	FGL 6 19	5.80 1300	4.05 910	6.70 1510	7600	0.019 0.042
	19	6	12	9.7	12.7	0.3	0.3	FG 6 19 EE	FGL 6 19 EE	5.80 1300	4.05 910	6.70 1510	7600	0.019 0.042
	19	6	12	9.7	12.7	0.3	0.3	FG 6 19 EEM	FGL 6 19 EEM	5.80 1300	4.05 910	6.70 1510	7600	0.019 0.042
24	24	8	13	12.0	15.0	0.3	0.3	FG 8 24	FGL 8 24	6.90 1550	6.60 1480	9.20 2070	6300	0.037 0.082
	24	8	13	12.0	15.0	0.3	0.3	FG 8 24 EE	FGL 8 24 EE	6.90 1550	6.60 1480	9.20 2070	6300	0.037 0.082
	24	8	13	12.0	15.0	0.3	0.3	FG 8 24 EEM	FGL 8 24 EEM	6.90 1550	6.60 1480	9.20 2070	6300	0.037 0.082
	24	8	15	12.0	15.0	0.3	0.3	FG 8 24 15	FGL 8 24 15	8.70 1960	8.50 1910	12.3 2770	6300	0.044 0.097
	24	8	15	12.0	15.0	0.3	0.3	FG 8 24 15 EE	FGL 8 24 15 EE	8.70 1960	8.50 1910	12.3 2770	6300	0.044 0.097
	24	8	15	12.0	15.0	0.3	0.3	FG 8 24 15 EEM	FGL 8 24 15 EEM	8.70 1960	8.50 1910	12.3 2770	6300	0.044 0.097
30	30	10	15	15.2	20.2	0.6	0.3	FG 10 30	FGL 10 30	12.9 2900	8.50 1910	15.5 3480	4800	0.066 0.146
	30	10	15	15.2	20.2	0.6	0.3	FG 10 30 EE	FGL 10 30 EE	12.9 2900	8.50 1910	15.5 3480	4800	0.066 0.146
	30	10	15	15.2	20.2	0.6	0.3	FG 10 30 EEM	FGL 10 30 EEM	12.9 2900	8.50 1910	15.5 3480	4800	0.066 0.146
32	32	12	15	17.6	22.6	0.6	0.3	FG 12 32	FGL 12 32	12.9 2900	8.30 1870	16.2 3640	4200	0.077 0.170
	32	12	15	17.6	22.6	0.6	0.3	FG 12 32 EE	FGL 12 32 EE	12.9 2900	8.30 1870	16.2 3640	4200	0.077 0.170
	32	12	15	17.6	22.6	0.6	0.3	FG 12 32 EEM	FGL 12 32 EEM	12.9 2900	8.30 1870	16.2 3640	4200	0.077 0.170
35	35	15	19	20.1	25.2	0.6	0.3	FG 15 35	FGL 15 35	18.0 4050	12.2 2740	25.6 5760	3750	0.103 0.227
	35	15	19	20.1	25.2	0.6	0.3	FG 15 35 EE	FGL 15 35 EE	18.0 4050	12.2 2740	25.6 5760	3750	0.103 0.227
	35	15	19	20.1	25.2	0.6	0.3	FG 15 35 EEM	FGL 15 35 EEM	18.0 4050	12.2 2740	25.6 5760	3750	0.103 0.227

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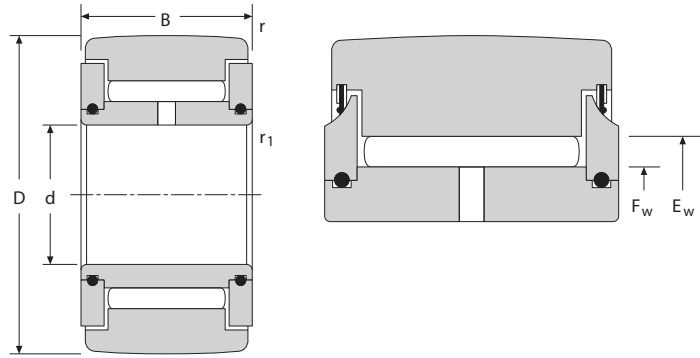


# NEEDLE ROLLER BEARINGS

**FULL COMPLEMENT,  
NON-SEPARABLE,  
SEALED OR UNSEALED,  
YOKE TYPE (FG SERIES) — *continued***

## METRIC SERIES

FG: convex outer ring  
FGL: cylindrical outer ring



FG, FGL

Outside Dia.	Dimensions mm/in.							Designation		Load Ratings kN/lbf.			Limiting Speed	Wt. kg/lbs.
	D	d	B	F <sub>w</sub>	E <sub>w</sub>	r <sub>smin</sub>	r <sub>1smin</sub>	Profiled Track Roller	Cylindrical Track Roller	Dynamic	Static	Grease		
mm	D	d	B	F <sub>w</sub>	E <sub>w</sub>	r <sub>smin</sub>	r <sub>1smin</sub>			C	F <sub>r perm</sub>	F <sub>0r perm</sub>	RPM	
40	40	17	21	24.0	30.0	0.6	0.3	FG 17 40	FGL 17 40	22.3	14.2	31.0	3150	0.155
	1.5748	0.6693	0.827	0.9449	1.1811	0.024	0.012			5010	3190	6970		0.342
	40	17	21	24.0	30.0	0.6	0.3	FG 17 40 EE	FGL 17 40 EE	22.3	14.2	31.0	3150	0.155
47	47	20	25	28.7	34.7	1.0	0.3	FG 20 47	FGL 20 47	28.3	21.4	44.5	2700	0.295
	1.8504	0.7874	0.984	1.1299	1.3661	0.039	0.012			6360	4810	10000		0.650
	47	20	25	28.7	34.7	1.0	0.3	FG 20 47 EE	FGL 20 47 EE	28.3	21.4	44.5	2700	0.295
52	52	25	25	33.5	39.5	1.0	0.3	FG 25 52	FGL 25 52	29.0	23.6	48.0	2330	0.310
	2.0472	0.9843	0.984	1.3189	1.5551	0.039	0.012			6520	5310	10800		0.683
	52	25	25	33.5	39.5	1.0	0.3	FG 25 52 EE	FGL 25 52 EE	29.0	23.6	48.0	2330	0.310
62	62	30	29	38.2	44.2	1.0	0.3	FG 30 62	FGL 30 62	38.5	38.0	73.0	2050	0.490
	2.4409	1.1811	1.142	1.5039	1.7402	0.039	0.012			8660	8540	16400		1.080
	62	30	29	38.2	44.2	1.0	0.3	FG 30 62 EE	FGL 30 62 EE	38.5	38.0	73.0	2050	0.490
72	72	35	29	44.0	50.0	1.0	0.6	FG 35 72	FGL 35 72	43.5	49.0	90.0	1800	0.670
	2.8346	1.3780	1.142	1.7323	1.9685	0.039	0.024			9780	11000	20200		1.477
	72	35	29	44.0	50.0	1.0	0.6	FG 35 72 EE	FGL 35 72 EE	43.5	49.0	90.0	1800	0.670
80	80	40	32	49.7	55.7	1.0	0.6	FG 40 80	FGL 40 80	54.0	66.0	123	1620	0.890
	3.1496	1.5748	1.260	1.9567	2.1929	0.039	0.024			12100	14800	27700		1.962
	80	40	32	49.7	55.7	1.0	0.6	FG 40 80 EE	FGL 40 80 EE	54.0	66.0	123	1620	0.890
85	85	45	32	55.4	61.4	1.0	0.6	FG 45 85	FGL 45 85	53.0	69.0	125	1450	0.970
	3.3465	1.7717	1.260	2.1811	2.4173	0.039	0.024			11900	15500	28100		2.138
	85	45	32	55.4	61.4	1.0	0.6	FG 45 85 EEM	FGL 45 85 EEM	53.0	69.0	125	1450	0.970
90	90	50	32	62.1	68.1	1.0	0.6	FG 50 90	FGL 50 90	51.0	74.0	123	1300	1.04
	3.5433	1.9685	1.260	2.4449	2.6811	0.039	0.024			11500	16600	27700		2.293

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Outside Dia.	Dimensions mm/in.							Designation		Load Ratings kN/lbf.			Limiting Speed	Wt. kg/lbs.	
	mm	D	B	C	F <sub>w</sub>	E <sub>w</sub>	r <sub>smin</sub>	r <sub>1smin</sub>	Profiled Track Roller	Cylindrical Track Roller	Dynamic	Static	Grease		
											C	F <sub>r perm</sub>	F <sub>0r perm</sub>	RPM	
	90	50	32	62.1	68.1	1.0	0.6	FG 50 90 EE	FGL 50 90 EE	51.0	74.0	123	1300	1.04	
	3.5433	1.9685	1.260	2.4449	2.6811	0.039	0.024			11500	16600	27700		2.293	
	90	50	32	62.1	68.1	1.0	0.6	FG 50 90 EEM	FGL 50 90 EEM	51.0	74.0	123	1300	1.04	
	3.5433	1.9685	1.260	2.4449	2.6811	0.039	0.024			11500	16600	27700		2.29	
100	100	55	36	70.0	77.0	1.5	0.6	FG 55 100	FGL 55 100	60.0	88.0	142	1150	1.35	
	3.9370	2.1654	1.417	2.7559	3.0315	0.059	0.024			13500	19800	31900		2.976	
	100	55	36	70.0	77.0	1.5	0.6	FG 55 100 EEM	FGL 55 100 EEM	60.0	88.0	142	1150	1.35	
	3.9370	2.1654	1.417	2.7559	3.0315	0.059	0.024			13500	19800	31900		2.976	
110	110	60	36	75.0	82.0	1.5	0.6	FG 60 110		67.0	102	168	1090	1.65	
	4.3307	2.3622	1.417	2.9528	3.2283	0.059	0.024			15100	22900	37800		3.638	
	110	60	36	75.0	82.0	1.5	0.6	FG 60 110 EEM	FGL 60 110 EEM	67.0	102	168	1090	1.65	
	4.3307	2.3622	1.417	2.9528	3.2283	0.059	0.024			15100	22900	37800		3.638	
120	120	65	42	80.0	87.0	1.5	0.6	FG 65 120		83.0	135	223	1020	2.35	
	4.7244	2.5591	1.654	3.1496	3.4252	0.059	0.024			18700	30300	50100		5.181	
	120	65	42	80.0	87.0	1.5	0.6	FG 65 120 EEM	FGL 65 120 EEM	83.0	135	223	1020	2.35	
	4.7244	2.5591	1.654	3.1496	3.4252	0.059	0.024			18700	30300	50100		5.181	
125	125	70	42	85.0	92.0	1.5	0.6	FG 70 125 EEM	FGL 70 125 EEM	83.0	144	228	960	2.50	
	4.9213	2.7559	1.654	3.3465	3.6220	0.059	0.024			18700	32400	51300		5.512	
130	130	75	42	90.0	97.0	1.5	0.6	FG 75 130 EEM		84.0	155	234	910	2.65	
	5.1181	2.9528	1.654	3.5433	3.8189	0.059	0.024			18900	34800	52600		5.842	
140	140	80	48	100.0	108.0	2.0	1.0	FG 80 140		99.0	197	275	820	3.40	
	5.5118	3.1496	1.890	3.9370	4.2520	0.079	0.039			22300	44300	61800		7.496	
	140	80	48	100.0	108.0	2.0	1.0	FG 80 140 EEM	FGL 80 140 EEM	99.0	197	275	820	3.40	
	5.5118	3.1496	1.890	3.9370	4.2520	0.079	0.039			22300	44300	61800		7.496	
150	150	85	48	107.0	115.0	2.0	1.0	FG 85 150		105	220	300	770	4.00	
	5.9055	3.3465	1.890	4.2126	4.5276	0.079	0.039			23600	49500	67400		8.818	
	150	85	48	107.0	115.0	2.0	1.0	FG 85 150 EEM		105	220	300	770	4.00	
	5.9055	3.3465	1.890	4.2126	4.5276	0.079	0.039			23600	49500	67400		8.818	
160	160	90	54	115.0	123.0	2.0	1.0	FG 90 160 EEM		120	288	370	710	5.30	
	6.2992	3.5433	2.126	4.5276	4.8425	0.079	0.039			27000	64700	83200		11.7	
170	170	95	54	120.0	128.0	2.0	1.0	FG 95 170 EEM		129	302	410	690	6.00	
	6.6929	3.7402	2.126	4.7244	5.0394	0.079	0.039			29000	67900	92200		13.2	
180	180	100	65	126.0	136.0	2.0	1.5	FG 100 180		175	353	530	650	8.05	
	7.0866	3.9370	2.559	4.9606	5.3543	0.079	0.059			39300	79400	119100		17.8	
	180	100	65	126.0	136.0	2.0	1.5	FG 100 180 EEM	FGL 100 180 EEM	175	353	530	650	8.05	
	7.0866	3.9370	2.559	4.9606	5.3543	0.079	0.059			39300	79400	119100		17.7	
200	200	110	65	140.0	150.0	2.0	1.5	FG 110 200 EEM		189	420	600	590	10.00	
	7.8740	4.3307	2.559	5.5118	5.9055	0.079	0.059			42500	94400	134900		22.0	
215	215	120	65	150.0	160.0	2.0	1.5	FG 120 215 EEM		199	486	660	550	11.50	
	8.4646	4.7244	2.559	5.9055	6.2992	0.079	0.059			44700	109300	148400		25.3	
270	270	150	78	186.0	198.0	3.0	1.5	FG 150 270 EEM		290	710	1020	440	22.00	
	10.6299	5.9055	3.071	7.3228	7.7953	0.118	0.059			65200	159600	229300		48.5	

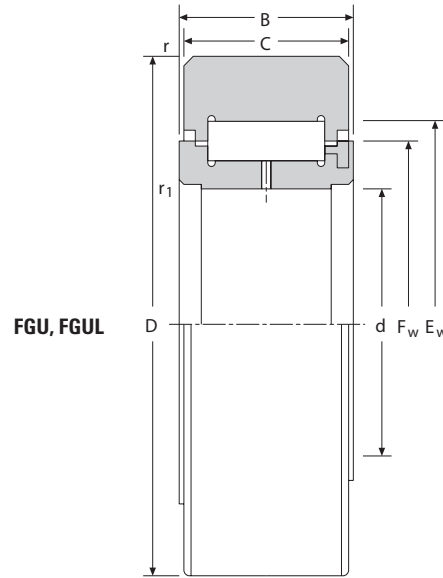




**FULL COMPLEMENT, NON-SEPARABLE,  
LIGHT SERIES, WITH METAL SEALS  
YOKE TYPE (FGU...MM SERIES)**

**METRIC SERIES**

FGU: convex outer ring  
FGUL: cylindrical outer ring



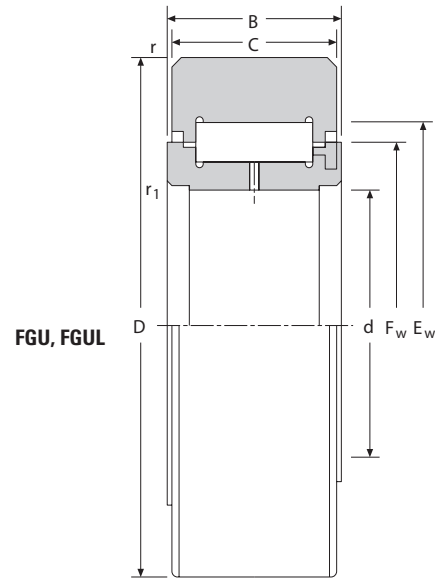
Outside Dia.	Dimensions mm/in.								Designation		Load Ratings kN/lbf.			Limiting Speed	Wt. kg/lbs.
	D	d	C	B	F <sub>w</sub>	E <sub>w</sub>	r <sub>s</sub> min	r <sub>1s</sub> min	Profiled Track Roller	Cylindrical Track Roller	Dynamic	Static	Grease	RPM	
mm	D	d	C	B	F <sub>w</sub>	E <sub>w</sub>	r <sub>s</sub> min	r <sub>1s</sub> min			C	F <sub>r perm</sub>	F <sub>0r perm</sub>		
35	35	15	18	19	20.4	28.4	0.6	0.3	FGU 15 35		7.80	17.0	17.0	5700	0.096 0.212
	1.3780	0.5906	0.709	0.748	0.8031	1.1181	0.024	0.012			1750	3820	3820		
40	35	15	18	19	20.4	28.4	0.6	0.3	FGU 15 35 MM	FGUL 15 35 MM	7.80	17.0	17.0	5700	0.096 0.212
	1.3780	0.5906	0.709	0.748	0.8031	1.1181	0.024	0.012		1750	3820	3820			
40	40	17	20	21	23.0	31.0	0.6	0.3	FGU 17 40 MM		11.5	20.0	21.5	5200	0.142 0.313
	1.5748	0.6693	0.787	0.827	0.9055	1.2205	0.024	0.012			2590	4500	4830		
47	47	20	24	25	27.1	37.1	1.0	0.3	FGU 20 47 MM	FGUL 20 47 MM	15.5	29.5	32.3	4400	0.235 0.518
	1.8504	0.7874	0.945	0.984	1.0669	1.4606	0.039	0.012			3480	6630	7260		
52	52	25	24	25	31.8	41.8	1.0	0.3	FGU 25 52		17.3	31.5	36.0	3800	0.268 0.591
	2.0472	0.9843	0.945	0.984	1.2520	1.6457	0.039	0.012			3890	7080	8090		
52	52	25	24	25	31.8	41.8	1.0	0.3	FGU 25 52 MM	FGUL 25 52 MM	17.3	31.5	36.0	3800	0.268 0.591
	2.0472	0.9843	0.945	0.984	1.2520	1.6457	0.039	0.012		3890	7080	8090			
62	62	30	28	29	38.2	50.2	1.0	0.3	FGU 30 62 MM		24.5	44.5	54.00	3200	0.454 1.001
	2.4409	1.1811	1.102	1.142	1.5039	1.9764	0.039	0.012			5510	10000	12100		
72	72	35	28	29	45.9	57.9	1.0	0.6	FGU 35 72 MM	FGUL 35 72 MM	31.3	50.0	66.0	2700	0.611 1.347
	2.8346	1.3780	1.102	1.142	1.8071	2.2795	0.039	0.024			7040	11200	14800		
80	80	40	30	32	51.6	63.6	1.0	0.6	FGU 40 80		40.6	59.0	84.0	2400	0.822 1.812
	3.1496	1.5748	1.181	1.260	2.0315	2.5039	0.039	0.024		9130	13300	18900			
80	80	40	30	32	51.6	63.6	1.0	0.6	FGU 40 80 MM	FGUL 40 80 MM	40.6	59.0	84.0	2400	0.822 1.812
	3.1496	1.5748	1.181	1.260	2.0315	2.5039	0.039	0.024		9130	13300	18900			
110	110	60	34	36	71.2	87.2	1.5	0.6	FGU 60 110 MM		64.0	88.0	129	1800	1.625 3.583
	4.3307	2.3622	1.339	1.417	2.8031	3.4331	0.059	0.024			14400	19800	29000		
120	120	65	40	42	76.4	92.4	1.5	0.6	FGU 65 120		89.0	110	174	1700	2.300 5.071
	4.7244	2.5591	1.575	1.654	3.0079	3.6378	0.059	0.024			20000	24700	39100		
120	120	65	40	42	76.4	92.4	1.5	0.6	FGU 65 120 MM		89.0	110	174	1700	2.300 5.071
	4.7244	2.5591	1.575	1.654	3.0079	3.6378	0.059	0.024		20000	24700	39100			
125	125	70	40	42	81.5	97.5	1.5	0.6	FGU 70 125 MM		93.0	110	180	1600	2.070 4.564
	4.9213	2.7559	1.575	1.654	3.2087	3.8386	0.059	0.024			20900	24700	40500		
140	140	80	46	48	91.7	107.7	2.0	1.0	FGU 80 140 MM		130	138	250	1400	3.450 7.606
	5.5118	3.1496	1.811	1.890	3.6102	4.2402	0.079	0.039			29200	31000	56200		
160	160	90	52	54	101.8	121.8	2.0	1.0	FGU 90 160 MM		166	188	327	1300	5.185 11.431
	6.2992	3.5433	2.047	2.126	4.0079	4.7953	0.079	0.039			37300	42300	73500		
170	170	95	52	54	108.2	128.2	2.0	1.0	FGU 95 170 MM		184	198	356	1200	5.925 13.062
	6.6929	3.7402	2.047	2.126	4.2598	5.0472	0.079	0.039			41400	44500	80000		
200	200	110	63	65	124.1	144.1	2.0	1.5	FGU 110 200 MM		310	280	590	1100	10.200 22.487
	7.8740	4.3307	2.480	2.559	4.8858	5.6732	0.079	0.059			69700	62900	132600		
215	215	120	63	65	133.6	157.6	2.0	1.5	FGU 120 215		310	310	600	960	11.560 25.485
	8.4646	4.7244	2.480	2.559	5.2598	6.2047	0.079	0.059			69700	69700	134900		



**FULL COMPLEMENT, NON-SEPARABLE,  
HEAVY SERIES WITH METAL SEALS  
YOKE TYPE (FGU...MM SERIES)**

**METRIC SERIES**

FGU: convex outer ring  
FGUL: cylindrical outer ring



Outside Dia.	Dimensions mm/in.								Designation		Load Ratings kN/bf.			Limiting Speed	Wt. kg/lbs.
	D	d	C	B	F <sub>w</sub>	E <sub>w</sub>	r <sub>sm</sub>	r <sub>1sm</sub>	Profiled Track Roller	Cylindrical Track Roller	Dynamic	Static	Grease RPM		
mm	D	d	C	B	F <sub>w</sub>	E <sub>w</sub>	r <sub>sm</sub>	r <sub>1sm</sub>			C	F <sub>r perm</sub>	F <sub>0r perm</sub>	RPM	
42	42	15	18	19	20.4	28.4	1.0	0.3	FGU 15 42	FGUL 15 42 MM	16.5	24.0	27.0	5700	0.153
	1.6535	0.5906	0.709	0.748	0.8031	1.1181	0.039	0.012			3710	5400	6070		0.337
47	47	17	20	21	20.0	28.0	1.0	0.3		FGUL 17 47 MM	22.0	26.7	32.0	5200	0.214
	1.8504	0.6693	0.787	0.827	0.7874	1.1024	0.039	0.012			4950	6000	7190		0.472
52	52	20	24	25	27.1	37.1	1.0	0.3		FGUL 20 52 MM	23.7	36.5	42.5	4350	0.268
	2.0472	0.7874	0.945	0.984	1.0669	1.4606	0.039	0.012			5330	8210	9550		0.591
62	62	25	24	25	31.8	41.8	1.0	0.3	FGU 25 62 MM		34.4	44.0	57.0	3800	0.435
	2.4409	0.9843	0.945	0.984	1.2520	1.6457	0.039	0.012			7730	9890	12800		0.959
72	72	30	28	29	38.2	50.2	1.0	0.3	FGU 30 72 MM	FGUL 30 72 MM	43.4	60.0	80.0	3150	0.681
	2.8346	1.1811	1.102	1.142	1.5039	1.9764	0.039	0.012			9760	13500	18000		1.501
80	80	35	28	29	45.9	57.9	1.0	0.6	FGU 35 80	FGUL 35 80	45.6	62.0	88.0	2700	0.82
	3.1496	1.3780	1.102	1.142	1.8071	2.2795	0.039	0.024			10300	13900	19800		1.808
	80	35	28	29	45.9	57.9	1.0	0.6	FGU 35 80 MM		45.6	62.0	88.0	2700	0.82
	3.1496	1.3780	1.102	1.142	1.8071	2.2795	0.039	0.024			10300	13900	19800		1.808
90	90	40	30	32	51.6	63.6	1.0	0.6	FGU 40 90 MM		61.0	75.0	116	2440	1.125
	3.5433	1.5748	1.181	1.260	2.0315	2.5039	0.039	0.024			13700	16900	26100		2.480
100	100	45	30	32	55.4	67.4	1.5	0.6	FGU 45 100 MM		78.0	85.0	138	2290	1.395
	3.9370	1.7717	1.181	1.260	2.1811	2.6535	0.059	0.024			17500	19100	31000		3.075
110	110	50	30	32	61.1	73.1	1.5	0.6	FGU 50 110		91.0	91.0	157	2100	1.683
	4.3307	1.9685	1.181	1.260	2.4055	2.8780	0.059	0.024			20500	20500	35300		3.710
	110	50	30	32	61.1	73.1	1.5	0.6	FGU 50 110 MM		91.0	91.0	157	2100	1.683
	4.3307	1.9685	1.181	1.260	2.4055	2.8780	0.059	0.024			20500	20500	35300		3.710
120	120	55	34	36	66.1	82.1	1.5	0.6	FGU 55 120		98.0	113	176	1900	2.235
	4.7244	2.1654	1.339	1.417	2.6024	3.2323	0.059	0.024			22000	25400	39600		4.927
	120	55	34	36	66.1	82.1	1.5	0.6	FGU 55 120 MM	FGUL 55 120 MM	98.0	113	176	1900	2.235
	4.7244	2.1654	1.339	1.417	2.6024	3.2323	0.059	0.024			22000	25400	39600		4.927
130	130	60	34	36	71.2	87.2	1.5	0.6	FGU 60 130 MM		114	121	197	1770	2.62
	5.1181	2.3622	1.339	1.417	2.8031	3.4331	0.059	0.024			25600	27200	44300		5.776
140	140	65	40	42	76.4	92.4	2.0	0.6	FGU 65 140 MM		153	145	254	1650	3.56
	5.5118	2.5591	1.575	1.654	3.0079	3.6378	0.079	0.024			34400	32600	57100		7.848
150	150	70	40	42	81.5	97.5	2.0	0.6	FGU 70 150 MM		172	153	277	1570	4.09
	5.9055	2.7559	1.575	1.654	3.2087	3.8386	0.079	0.024			38700	34400	62300		9.017
160	160	75	40	42	86.6	102.6	2.0	0.6	FGU 75 160		193	160	300	1480	4.65
	6.2992	2.9528	1.575	1.654	3.4094	4.0394	0.079	0.024			43400	36000	67400		10.3
	160	75	40	42	86.6	102.6	2.0	0.6	FGU 75 160 MM		193	160	300	1480	4.65
	6.2992	2.9528	1.575	1.654	3.4094	4.0394	0.079	0.024			43400	36000	67400		10.3

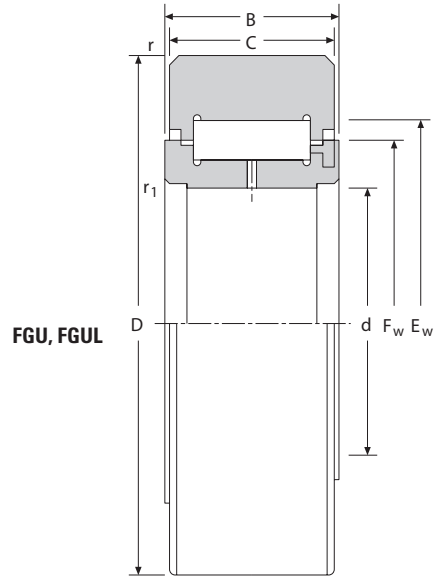
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**FULL COMPLEMENT, NON-SEPARABLE,  
HEAVY SERIES WITH METAL SEALS  
YOKE TYPE (FGU...MM SERIES) – *continued***

**METRIC SERIES**

FGU: convex outer ring  
FGUL: cylindrical outer ring



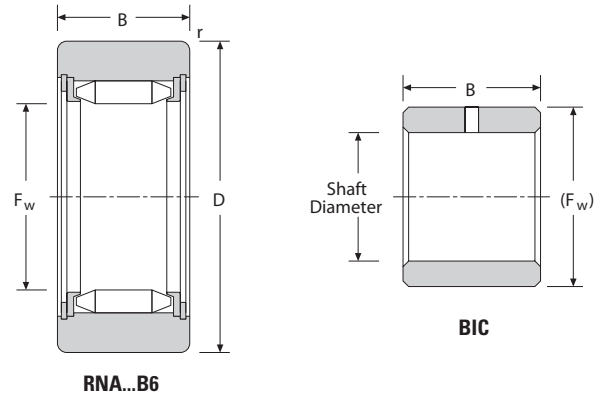
C

Outside Dia.	Dimensions mm/in.								Designation		Load Ratings kN/bf.			Limiting Speed	Wt. kg/lbs.
	D	d	C	B	F <sub>w</sub>	E <sub>w</sub>	r <sub>smin</sub>	r <sub>1smin</sub>	Profiled Track Roller	Cylindrical Track Roller	Dynamic	Static	Grease		
mm	D	d	C	B	F <sub>w</sub>	E <sub>w</sub>	r <sub>smin</sub>	r <sub>1smin</sub>			C	F <sub>r perm</sub>	F <sub>0r perm</sub>	RPM	
170	170	80	46	48	91.7	107.7	2.0	1.0	FGU 80 170		247	190	380	1400	6.07
	6.6929	3.1496	1.811	1.890	3.6102	4.2402	0.079	0.039			55500	42700	85400		
	170	80	46	48	91.7	107.7	2.0	1.0	FGU 80 170 MM		247	190	380	1400	6.07
	6.6929	3.1496	1.811	1.890	3.6102	4.2402	0.079	0.039			55500	42700	85400		13.4
180	180	85	46	48	95.5	115.5	2.0	1.0	FGU 85 180		243	215	390	1330	6.724
	7.0866	3.3465	1.811	1.890	3.7598	4.5472	0.079	0.039			54600	48300	87700		14.8
	180	85	46	48	95.5	115.5	2.0	1.0	FGU 85 180 MM	FGUL 85 180 MM	243	215	390	1330	6.724
	7.0866	3.3465	1.811	1.890	3.7598	4.5472	0.079	0.039			54600	48300	87700		14.8
190	190	90	52	54	101.8	121.8	2.0	1.0	FGU 90 190 MM		297	250	480	1250	8.515
	7.4803	3.5433	2.047	2.126	4.0079	4.7953	0.079	0.039			66800	56200	108000		18.8
260	260	120	63	65	133.6	157.6	3.0	1.5	FGU 120 260 MM		570	395	830	960	19.750
	10.2362	4.7244	2.480	2.559	5.2598	6.2047	0.118	0.059			128000	88800	187000		43.6
300	300	140	75	78	152.6	176.6	3.0	1.5	FGU 140 300 MM		860	500	1 160	850	31.265
	11.8110	5.5118	2.953	3.071	6.0079	6.9528	0.118	0.059			193000	112000	261000		68.9

**FULL COMPLEMENT,  
WITHOUT INNER RING,  
UNSEALED, YOKE TYPE  
(RNA...B6, RNAB, RNAL SERIES)**

**SEPARATE INNER RINGS  
(BIC SERIES)**

**METRIC SERIES**



RNA...B6: Convex outer ring to maximum slope of 0.15%. Tolerance h9 on dim. D.  
 RNAB: Convex outer ring to maximum slope of 1.5%. Tolerance h9 on dim. D.  
 RNAL: Cylindrical outer ring. Tolerance h7 on dim. D.

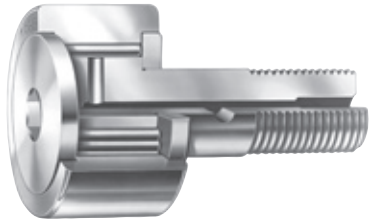
Outside Dia.	Dimensions mm/in.						Bearing Designation Series			Load Ratings kN/lbf.			Limiting Speed	Wt. kg/lbs.	Inner Ring Designation	Shaft Dia.
	mm	D	d	B	F <sub>w</sub>	E <sub>w</sub>	r <sub>sm</sub>	RNA...B6	RNAB	RNAL	Dynamic	Static	Grease			
19	19	7.3	12	7.3	12.3	0.35	RNA 11005 B6	RNAB 11005		5.10	4.05	4.05	8700	0.019		
	0.7480	0.2874	0.472	0.287	0.484	0.014				1150	910	910		0.042		
22	22	9.7	12	9.7	14.7	0.35	RNA 11007 B6	RNAB 11007	RNAL 11007	6.00	5.10	5.20	7000	0.022		
	0.8661	0.3819	0.472	0.382	0.579	0.014				1350	1150	1170		0.049		
28	28	12.1	12	12.1	17.1	0.35	RNA 11009 B6	RNAB 11009	RNAL 11009	7.40	7.10	7.10	5800	0.028		
	1.1024	0.4764	0.472	0.476	0.673	0.014				1660	1600	1600		0.062		
32	32	17.6	15	17.6	22.6	0.35	RNA 11012 B6	RNAB 11012	RNAL 11012	10.8	9.10	12.7	4200	0.032	BIC 1012	12
	1.2598	0.6929	0.591	0.693	0.890	0.014				2430	2050	2860		0.071		
35	35	20.8	15	20.8	25.8	0.65	RNA 11015 B6	RNAB 11015		10.8	9.10	13.4	3650	0.035	BIC 1015	15
	1.3780	0.8189	0.591	0.819	1.016	0.026				2430	2050	3010		0.077		
42	42	23.9	15	23.9	28.9	0.65	RNA 11017 B6	RNAB 11017	RNAL 11017	13.4	13.9	18.5	3200	0.042	BIC 1017	17
	1.6535	0.9409	0.591	0.941	1.138	0.026				3010	3120	4160		0.093		
47	47	28.7	18	28.7	34.7	0.65	RNA 11020 B6	RNAB 11020	RNAL 11020	16.8	15.4	23.0	2700	0.047	BIC 2020	20
	1.8504	1.1299	0.709	1.130	1.366	0.026				3780	3460	5170		0.104		
52	52	33.5	18	33.5	39.5	0.65	RNA 11025 B6	RNAB 11025		17.2	16.5	24.7	2330	0.052	BIC 1025	25
	2.0472	1.3189	0.709	1.319	1.555	0.026				3870	3710	5550		0.115		
62	62	38.2	22	38.2	44.2	0.65	RNA 11030 B6	RNAB 11030		28.5	31.5	49.5	2050	0.062	BIC 2030	30
	2.4409	1.5039	0.866	1.504	1.740	0.026				6410	7080	11100		0.137		
72	72	44.0	22	44.0	50.0	0.65	RNA 11035 B6			32.0	41.0	61.0	1800	0.072	BIC 2035	35
	2.8346	1.7323	0.866	1.732	1.969	0.026				7190	9220	13700		0.159		
80	80	49.7	22	49.7	55.7	0.85		RNAB 11040		34.0	47.0	68.0	1620	0.080	BIC 2040	40
	3.1496	1.9567	0.866	1.957	2.193	0.033				7640	10600	15300		0.176		
90	90	62.1	24	62.1	68.1	0.85	RNA 11050 B6			32.5	51.0	68.0	1300	0.090	BIC 11050	50
	3.5433	2.4449	0.945	2.445	2.681	0.033				7310	11500	15300		0.198		



## STUD TYPE AND YOKE TYPE TRACK ROLLERS

### INCH SERIES

Inch series track rollers listed in this catalog have been designed with the outer rings of large radial cross section to withstand heavy rolling or shock loads on track type or cam-controlled equipment.



CR with Stud



YCR for Yoke Mounting

### REFERENCE STANDARD:

- **ANSI/ABMA Std. 18.2** – Needle roller bearings – radial, inch design.

Before selecting specific inch series track rollers, the engineering section of this catalog should be reviewed.

C

### IDENTIFICATION

The type, special construction features, and size are designated by an identification code consisting of prefix letters followed by a dash and suffix numbers.

The initial prefix letters denote the type of track roller/cam follower. Additional prefix letters are used when it is necessary to denote special construction features. The suffix numbers following the prefix letters denote the size of the track roller. See Table 1.

The basic types are listed below:

CR - regular stud type, full complement needle rollers, inch series

YCR - yoke type, full complement needle rollers, inch series

Construction feature code letters for inch series track rollers are used as required, in the following order:

S - seals with internal thrust washers

B - hexagonal wrench socket in stud head (stud type only)

C - profiled outer ring

E - eccentric stud (stud type only)

Descriptions of typical examples, with complete letter codes combining basic type of bearing and construction features follow. See Table 2.

Since the entire identification code might not appear on the bearing itself, the manufacturer's parts list or another reliable source should always be consulted when ordering bearings for field or service replacement, to make certain that the correct unit with the correct lubricant is specified.

TABLE 1 – IDENTIFICATION CODE – INCH SERIES

Prefix Letters			Suffix Numbers			Complete
type	plus	construction features	plus	O.D. size	equals	Designation
CR	plus	SBE	plus	-16	equals	CRSBE-16
CR	plus			-16	equals	CR-16

TABLE 2 – CODE DESCRIPTION – INCH SERIES

Stud Types	
Description	Prefix Code
with seals and internal thrust washers	CRS
with seals, internal thrust washers and profiled outer ring	CRSC
with seals, internal thrust washers, hex socket and profiled outer ring	CRSBC
with seals, internal thrust washers, hex socket, profiled outer ring and eccentric stud	CRSBCE
Yoke Types	
with seals and internal thrust washers	YCRS
with seals, internal thrust washers and profiled outer ring	YCRSC

## CONSTRUCTION

Timken products listed on the following pages have been designed with the outer ring of large radial cross section to withstand heavy rolling and shock loads on track type or cam-controlled equipment.

Regular stud type (CR) are designed with integral studs for cantilever mounting. When a regular stud type track roller is used within the permissible dynamic load ( $F_{r\text{ perm}}$ ) given in the tabular data, the ductile core of the stud provides the necessary toughness for and resistance to shock loads. A screwdriver slot or a hexagonal wrench socket in the head of the stud facilitates mounting.

Yoke type (YCR) are designed for straddle mounting. Each type is available with a full complement of needle rollers.

All inch series track roller have a black-oxide finish on all external surfaces.

## SEALED TRACK ROLLERS – INCH SERIES

Inch series sealed track rollers contain a lip type seal and an internal thrust washer. On some sizes of track rollers, the thrust washer and seal have been incorporated into a single component. Regardless of configuration, the thrust washer fits between the shoulders of the outer ring and inside faces of the steel retaining washer and flange of the stud. These washers reduce sliding friction and serve to increase the life of the bearing, particularly when it is infrequently relubricated or where misalignment occurs. In all cases, the external dimensions of the sealed bearings are the same as the unsealed bearings. The seals are thermally stable in a temperature range between -25° F and +225° F.

## PROFILED TRACK ROLLERS

These units are available with cylindrical or profiled outer rings.

Track rollers are designed with a profiled outer ring to alleviate the uneven bearing loading resulting from deflection, bending or misalignment in mounting.

To specify a profiled ring for any inch series track roller having a cylindrical outer ring, add the letter "C" at the end of the prefix code. For example:

- prefix CR – regular stud type, full complement of needle rollers and cylindrical outer ring
- prefix CRC – same as above, but with profiled outer ring.

The O.D. tolerance of profiled track rollers is +0.000 - 0.002 inch. The profile radii are listed in Table 3.

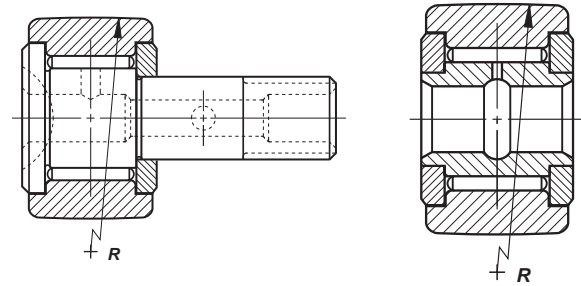
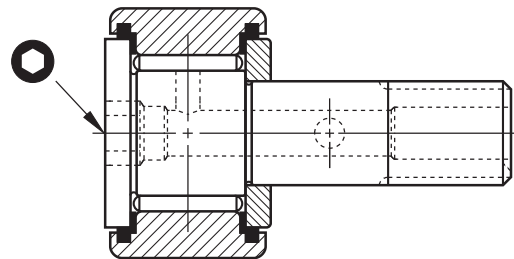


TABLE 3 – PROFILE RADIUS FOR TYPES CRC, CRSC, CRSBC, YCRC, YCRSC

Size Designation (suffix)	R Profile Radius (approx.) inch	Size Designation (suffix)	R Profile Radius (approx.) inch
-8	6	-28	20
-8-1	7	-30	20
-10	7	-32	24
-10-1	8	-36	24
-12	10	-40	30
-14	10	-44	30
-16	12	-48	30
-18	12	-52	30
-20	14	-56	30
-22	14	-64	30
-24	20		
-26	20		

## HEXAGONAL SOCKETS

Smaller sizes of regular inch series stud type units have a screwdriver slot or a hexagonal socket in the flanged end of the stud to facilitate mounting. Larger sizes have a socket to accommodate a hexagonal wrench. Wrench sizes are listed in Table 4.



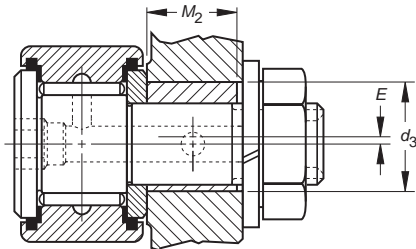


## ECCENTRIC STUDS

To provide radial adjustment of the outer ring toward the track or cam surface at the time of installation, the regular inch series stud types are available with eccentric studs which are specified by adding the letter "E" to the construction feature code:

prefix CRSBE – regular stud type track roller with full complement of needle rollers, two seals, with internal thrust washers, hexagonal wrench socket in stud head, and eccentric stud.

Pertinent dimensions of the eccentric stud are listed in Table 5.



Since a track roller with an eccentric stud is usually adjusted upon installation by turning the stud in the mounting hole, a close clearance fit between the outside diameter of the bushing and the mounting hole is necessary. For turning the stud, a hexagonal wrench is generally more convenient than a screwdriver, and an option for a hexagonal wrench socket in the head of the stud should be exercised.

Some applications may require more secure positioning than provided by the tightened stud nut. If so, it is suggested that the housing and eccentric bushing be drilled at the time of installation to accept a locating dowel pin.

TABLE 4 – HEXAGONAL WRENCH SIZES – INCH SERIES

Size Designation (suffix)	Wrench Size Inch	Size Designation (suffix)	Wrench Size Inch
-8	1/8	-28	5/16
-8-1	1/8	-30	5/16
-10	1/8	-32	7/16
-10-1	1/8	-36	7/16
-12	3/16	-40	1/2
-14	3/16	-44	1/2
-16	1/4	-48	3/4
-18	1/4	-52	3/4
-20	1/4	-56	3/4
-22	1/4	-64	3/4
-24	5/16		
-26	5/16		

TABLE 5 – ECCENTRIC BUSHING DIMENSIONS  
REGULAR STUD TYPE (TYPE CR)

Size Designation (suffix)	Bushing Outside Diameter +0.001 -0.001 $D_e$	Inch Bushing Width +0.000 -0.010 $B_e$	Eccentricity $e$
-8-1	0.250	0.375	0.010
-10-1	0.375	0.437	0.015
-12	0.500	0.500	0.015
-14	0.500	0.500	0.015
-16	0.625	0.500	0.030
-18	0.625	0.500	0.030
-20	0.687	0.625	0.030
-22	0.687	0.625	0.030
-24	0.875	0.750	0.030
-26	0.875	0.750	0.030
-28	1.000	0.875	0.030
-30	1.000	0.875	0.030
-32	1.187	1.000	0.030
-36	1.187	1.000	0.030
-40	1.375	1.125	0.030
-44	1.375	1.125	0.030
-48	1.750	1.250	0.060
-52	1.750	1.250	0.060
-56	1.812	1.375	0.060
-64	2.000	2.000	0.060

\* To ensure proper clamping of the stud, the housing should be slightly wider than the maximum width of the eccentric bushing.

## LOAD RATINGS

### DYNAMIC LOADING AS A TRACK ROLLER

When the outer ring of a stud type or yoke type track roller runs on a track, the contact under a radial load causes elastic (oval) deformation of the outer ring. As a result, a smaller zone of the raceway is loaded and the load is distributed on fewer needle rollers. This in turn affects the track roller's dynamic and static load ratings. Also, this deformation generates bending stress in the outer ring which must not exceed the maximum permitted for the material of the outer ring. The maximum permissible dynamic ( $F_{Rperm}$ ) radial load condition is determined by this requirement.

The rating life of a stud type or yoke type track roller should be calculated using the dynamic load ratings  $C_w$  shown in the tables. The tables also show the maximum permissible radial load,  $F_{Rperm}$  that can be dynamically applied on the stud type or yoke type track rollers. However, to calculate the  $L_{10}$  life of a track roller, the applied radial load must not be greater than  $C_w/4$  based on ideal operating conditions of alignment, lubrication, temperature, speed and accelerations.

### STATIC LOADING

In addition to the basic static load rating  $C_0$ , the tables also list the maximum permissible static radial load  $F_{Or\ perm}$  that may be applied to a stud type or yoke type track roller. The values of  $F_{Or\ perm}$  result in a minimum static factor  $f_s$  of 0.7 for the worst condition of internal load distribution in inch series track roller operation. The  $F_{Or\ perm}$  values must not be exceeded. The static factor  $f_s$  can be calculated using the following formula:

$$f_s \geq 0.7 \cdot \frac{F_{Or\ perm}}{P_{Or}}$$

where

$F_{Or\ perm}$  = Maximum permissible static radial load

$P_{Or}$  = Equivalent static load

$P_{Or} = F_{Or}$  for yoke type track rollers

$F_{Or}$  = Static radial load

$f_s$  = Static factor whose values should not be smaller than those suggested in table 6

**TABLE 6 – SUGGESTED VALUES FOR STATIC FACTORS  $f_s$  FOR INCH SERIES TRACK ROLLERS**

Requirements For Yoke Type Track Rollers And Stud Type Track Rollers	Suggested $f_s$ Values
High shock-type loads	
Quiet running	1.5...2.5
Normal loading	
Normal quietness of running	1...1.5
Minor impact loads and rotary motion particularly quiet running not required	0.7...1

### MOUNTING

The surface of the hole in the machine element, which supports the stud or the mounting shaft, must not deform under the expected load, and the support should be sufficiently rigid to resist bending loads.

Deformation and bending will cause uneven loading of the outer ring.

In mounting the stud type track roller, the retaining washer must be firmly backed up by a flat shoulder which is square with the stud center line. The shoulder diameter must be no smaller than the minimum clamping diameter ( $d_a$ ) listed in the tabular data.

The maximum inherent strength of the stud is obtained when the unit is supported as close as possible to the retaining washer, which minimizes the bending moment. For this reason, the edge of the housing which supports the stud shank should be kept as sharp as possible, but free from burrs.

To minimize deflection in mounted stud type track rollers, the stud shank should be housed with the fit ( $d_b$ ) shown in the tabular data. The clamping nut should not be tightened with a torque value higher than the maximum listed. A screwdriver slot or hexagonal socket in the end of the stud is provided for a tool to prevent the stud from turning when the nut is being tightened. Since the bottom of the screwdriver slot is not flat, it is helpful to put a radius on the tip of the screwdriver being used to hold the stud more securely.

When the stud shank is housed with an interference fit, installation force should be applied only to the center portion of the flanged end of the stud, preferably with an arbor press.

When the loads are high, the yoke type track rollers should be mounted on a high strength bolt or shaft with the tight transition fit listed in the tabular data. The bearing should be clamped between flat and parallel faces at right angles to the axis to prevent the retaining washers from coming off under load. If the bearing cannot be clamped, a close axial fit in the yoke is required.

When the applied loads are light to moderate, the inner ring of a yoke type track roller may be mounted on an unhardened shaft or bolt with the loose transition fit listed in the tabular data. Again, the retaining washers should be backed up axially to prevent their coming off under load.

C





### LUBRICATION

All inch series stud type track rollers with a screwdriver slot in the flanged end of the stud have provisions for lubrication through the flanged end of the stud. The 12 and larger sizes of inch series stud type track rollers with screwdriver slots have provisions for relubrication through either end of the stud and through a cross-drilled hole in the shank. The ends of the axial holes are counterbored to accept drive type grease lubrication fittings. Hole diameters for these grease fittings are listed in the tables of dimensions.

Sizes 8 through 10-1 of the inch series stud type track rollers with a hexagonal socket in the flanged end of the stud cannot be relubricated. Size 12 and up have relubrication provisions in the threaded end of the stud and a cross-drilled hole in the shank. At the threaded end of the stud, the axial hole is counterbored to receive a drive type grease fitting. Sizes 12 through 22 and 48 through 64 of inch series stud type track rollers with hexagonal sockets also have provisions for relubrication through the hex socket in the flanged end of the stud. Sizes 48 through 64 are supplied with lubrication fittings which may be installed in the axial hole in the bottom of the hexagonal slot in the head end of the stud, at a depth which allows the hexagonal wrench to be inserted in the wrench socket without damaging the grease fitting.

Plugs are furnished with stud type track rollers to close off unused holes. If the cross-drilled hole in the stud shank is not used, it will be covered when the track roller is installed properly.

Most inch series yoke type track rollers are produced with lubrication holes and grooves in the inner ring bores so they can be relubricated through axially and radially drilled holes in the supporting shaft or bolt.

Oil is the preferred lubricant for all types. Use continuous oil lubrication or frequent grease lubrication for steady rotating conditions. Applications involving slow, intermittent oscillation are not as critical, and longer intervals between relubrication are permissible. Both stud and yoke type track rollers are normally supplied with medium temperature grease lubrication.

### SPECIAL TRACK ROLLERS/ CAM FOLLOWERS

Track rollers can be obtained with dimensions different from those in the tabular data, if the quantities permit economical production. For these and other modifications please consult your Timken representative.

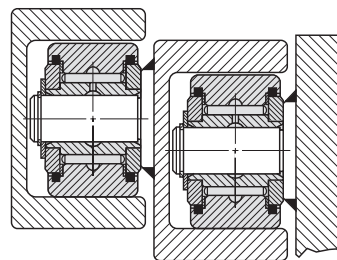
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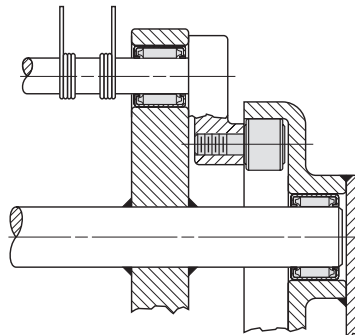
### FORKLIFT TRUCK

Yoke type sealed units serve as high capacity and rugged guide rollers for lift trucks. Their design permits them to be mounted on studs welded to the structure. The seals exclude foreign matter and extend the time between relubrication periods.



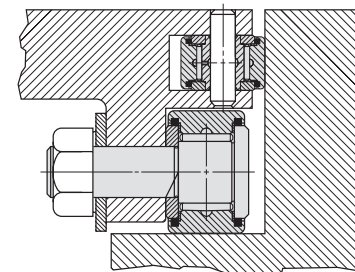
### HAY BALER

Stud types are important components on many different types of farm equipment because of their required long service life under punishing loads and severe operating conditions. Needle bearings provide dependable and economical operation in the windrow pickup of hay balers.



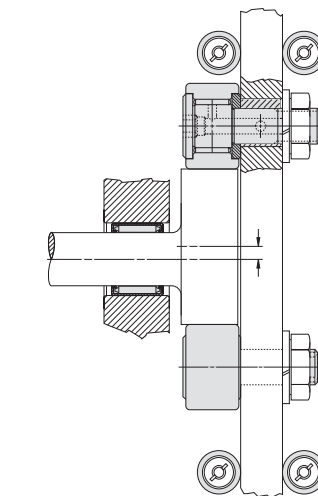
### MACHINE WAY

Heavily loaded machine tool tables must travel freely and accurately. Stud and yoke type sealed units, in combination, support and guide such tables under the most severe conditions. The high capacity and the very low wear rate permit heavy loads to be carried without impairing the accuracy of the table's travel. The seals exclude dirt and chips and make the need for relubrication infrequent.



### RECIPROCATING SLIDE

Stud types find wide application in feeding and advancing mechanisms on metalworking presses. The rotary motion of an eccentric cam rotating between two cam followers mounted on a slide imparts reciprocating linear motion to the slide. Dwell periods as well as accuracy in both rapid and slow linear actuation of the slide are made possible.



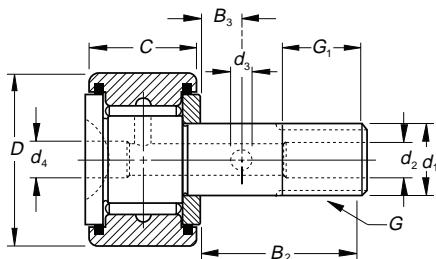


## STUD TYPE TRACK ROLLERS CR, CRS SERIES

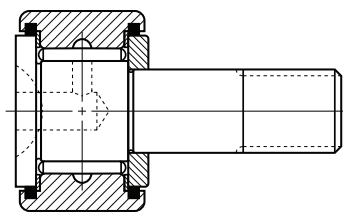
### INCH SERIES

- Screwdriver slot in head facilitates mounting.
- Nonseparable, sealed unit with outer ring, full complement of needle rollers, stud seals, self-lubricating resin internal thrust washers, and stud-fastened retaining washer.
- Seals help retain lubricant and exclude foreign matter (CRS Series).
- Relubrication via axially drilled hole through stud with cross-drilled holes in stud raceway and shank.
- Recessed axial hole accepts standard nominal inch drive-type grease lubrication fitting.
- Lubrication fitting plugs furnished to close off unused holes.
- Tolerance limits for outside diameters of stud and outer ring refer to "single mean diameter" (see engineering section).
- A close fit between stud and hole required for mounting.
- Bore dimensions given below result in varying fit (0.0010 in. tight to 0.0005 in. loose).
- Retaining washer should be firmly backed up by flat housing shoulder (perpendicular to the stud axis).
- Shoulder diameter should be at least same size as minimum clamping diameter listed.
- May be mounted with two thin lock nuts or nut and lock washer.

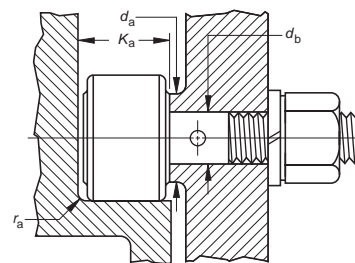
Outside Diameter	Dimensions mm/in.									Track Roller Designation	
	+0.25 -0 +0.0010 -0.0000	+0 -0.025 +0.000 -0.001	+0 -0.13 +0.000 -0.005	(nom.)	Min.				UNF	Without Seals	With Seals And Internal Thrust Washers
	in.	d <sub>1</sub>	D	C	B <sub>2</sub>	B <sub>3</sub>	G <sub>1</sub>	d <sub>4</sub> , d <sub>2</sub>	d <sub>3</sub>	G	
1/2	4.826 0.1900	12.70 0.500	8.74 0.344	12.70 0.500	—	6.35 0.250	3.18 .125*	—	10-32	CR-8	CRS-8
	4.826 0.1900	12.70 0.500	9.53 0.375	15.88 0.625	—	6.35 0.250	3.18 .125*	—	10-32	CR-8-1	CRS-8-1
5/8	6.350 0.2500	15.88 0.625	10.31 0.406	15.88 0.625	—	7.92 0.312	3.18 .125*	—	1/4-28	CR-10	CRS-10
	6.350 0.2500	15.88 0.625	11.13 0.438	19.05 0.750	—	7.92 0.312	3.18 .125*	—	1/4-28	CR-10-1	CRS-10-1
3/4	9.525 0.3750	19.05 0.750	12.70 0.500	22.23 0.875	6.35 0.250	9.53 0.375	3.18 0.188	0.094	3/8-24	CR-12	CRS-12
7/8	9.525 0.3750	22.23 0.875	12.70 0.500	22.23 0.875	6.35 0.250	9.53 0.375	3.18 0.188	2.39 0.094	3/8-24	CR-14	CRS-14
1	11.113 0.4375	25.40 1.000	15.88 0.625	25.40 1.000	6.35 0.250	12.70 0.500	3.18 0.188	3.18 0.125	7/16-20	CR-16	CRS-16
1 1/8	11.113 0.4375	28.58 1.125	15.88 0.625	25.40 1.000	6.35 0.250	12.70 0.500	3.18 0.188	3.18 0.125	7/16-20	CR-18	CRS-18
1 1/4	12.700 0.5000	31.75 1.250	19.05 0.750	31.75 1.250	7.92 0.312	15.88 0.625	3.18 0.188	3.18 0.125	1/2-20	CR-20	CRS-20
1 3/8	12.700 0.5000	34.93 1.375	19.05 0.750	31.75 1.250	7.92 0.312	15.88 0.625	3.18 0.188	3.18 0.125	1/2-20	CR-22	CRS-22
1 1/2	15.875 0.6250	38.10 1.500	22.23 0.875	38.10 1.500	9.53 0.375	19.05 0.750	3.18 0.188	2.39 0.094	5/8-18	CR-24	CRS-24
1 5/8	15.875 0.6250	41.28 1.625	22.23 0.875	38.10 1.500	9.53 0.375	19.05 0.750	3.18 0.188	2.39 0.094	5/8-18	CR-26	CRS-26
1 3/4	19.050 0.7500	44.45 1.750	25.40 1.000	44.45 1.750	11.13 0.438	22.23 0.875	3.18 0.188	2.39 0.094	3/4-16	CR-28	CRS-28
1 7/8	19.050 0.7500	47.63 1.875	25.40 1.000	44.45 1.750	11.13 0.438	22.23 0.875	3.18 0.188	2.39 0.094	3/4-16	CR-30	CRS-30
2	22.225 0.8750	50.80 2.000	31.75 1.250	50.80 2.000	12.70 0.500	25.40 1.000	3.18 0.188	3.18 0.125	7/8-14	CR-32	CRS-32
2 1/4	22.225 0.8750	57.15 2.250	31.75 1.250	50.80 2.000	12.70 0.500	25.40 1.000	3.18 0.188	3.18 0.125	7/8-14	CR-36	CRS-36



CR and CRS -12 to -64



CR and CRS -8 to -10-1



Note: Clamping torque is based on lubricated threads. If threads are dry, the torque values listed below may be doubled.

As a Bearing		Load Rating kN/lbf.			Limiting Speed	Mounting Dimensions mm/in.				Clamping Torque N*m/lbf. • in.	Wt. kg/lbs. Approx.
Dynamic	Static	As a Track Roller		Grease		Bore Dia. for Stud +0.013 +0.0005 -0 -0.0000	Max.	Min.	Min.		
C	C0	Cw	F <sub>T perm</sub>	F <sub>0r perm</sub>	RPM	db	ras max	Ka	da		
4.44 999	4.94 1110	3.01 677	1.04 233	2.49 560	7000	4.826 0.1900	0.25 0.010	10.41 0.41	7.52 0.296	0.90 8	0.010 0.022
4.98 1120	5.69 1280	3.38 759	1.21 272	2.90 652	7000	4.826 0.1900	0.25 0.010	11.18 0.44	7.52 0.296	0.90 8	0.010 0.023
6.05 1360	7.87 1770	4.37 982	2.26 508	5.43 1220	5500	6.350 0.2500	0.38 0.015	11.94 0.47	9.12 0.359	2.26 20	0.019 0.041
6.58 1480	8.76 1970	4.76 1070	2.53 569	6.09 1370	5500	6.350 0.2500	0.38 0.015	12.70 0.50	9.12 0.359	2.26 20	0.020 0.045
10.4 2330	15.2 3410	6.45 1450	2.88 647	6.89 1550	3900	9.525 0.3750	0.38 0.015	14.22 0.56	12.70 0.500	6.21 55	0.034 0.076
10.4 2330	15.2 3410	7.56 1700	4.80 1080	11.5 2590	3900	9.525 0.3750	0.38 0.015	14.22 0.56	12.70 0.500	6.21 55	0.044 0.097
13.3 2980	22.3 5010	8.94 2010	6.05 1360	14.5 3260	3000	11.113 0.4375	0.76 0.030	17.53 0.69	15.09 0.594	16.95 150	0.073 0.161
13.3 2980	22.3 5010	9.88 2220	8.67 1950	18.3 4120	3000	11.113 0.4375	0.76 0.030	17.53 0.69	15.09 0.594	16.95 150	0.089 0.197
21.5 4840	33.18 7460	15.1 3400	9.30 2090	24.3 5470	2600	12.700 0.5000	0.76 0.030	20.57 0.81	19.05 0.750	23.16 205	0.137 0.301
21.5 4840	33.2 7460	16.4 3680	12.6 2840	28.6 6420	2600	12.700 0.5000	0.76 0.030	20.57 0.81	19.05 0.750	23.16 205	0.161 0.354
28.4 6380	40.8 9160	20.1 4520	10.8 2440	26.0 5850	2300	15.875 0.6250	0.76 0.030	23.88 0.94	22.63 0.891	44.06 390	0.239 0.528
28.4 6380	40.8 9160	21.5 4840	14.1 3170	33.8 7610	2300	15.875 0.6250	0.76 0.030	23.88 0.94	22.63 0.891	44.06 390	0.274 0.605
35.8 8040	56.9 12800	25.9 5830	17.7 3980	42.5 9560	1900	19.050 0.7500	1.02 0.040	26.92 1.06	26.59 1.047	84.74 750	0.385 0.848
35.8 8040	56.9 12800	27.4 6150	22.0 4940	49.4 11100	1900	19.050 0.7500	1.02 0.040	26.92 1.06	26.59 1.047	84.74 750	0.430 0.947
43.5 9770	76.1 17100	31.8 7160	26.0 5850	60.5 13600	1700	22.225 0.8750	1.27 0.050	33.78 1.33	30.56 1.203	101.69 900	0.621 1.37
43.5 9770	76.1 17100	34.6 7770	36.7 8250	71.2 16000	1700	22.225 0.8750	1.27 0.050	33.78 1.33	30.56 1.203	101.69 900	0.757 1.67

\* No lubrication hole in threaded end.  
§ UNS instead of UNF threads.

Continued on next page.



**STUD TYPE TRACK ROLLERS**  
**CR, CRS SERIES** – *continued*

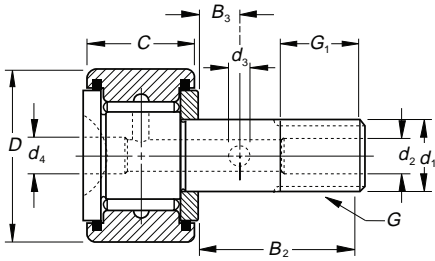
**INCH SERIES**

- Screwdriver slot in head facilitates mounting.
- Nonseparable, sealed unit with outer ring, full complement of needle rollers, stud seals, self-lubricating resin internal thrust washers, and stud-fastened retaining washer.
- Seals help retain lubricant and exclude foreign matter (CRS Series).
- Relubrication via axially drilled hole through stud with cross-drilled holes in stud raceway and shank.
- Recessed axial hole accepts standard nominal inch drive-type grease lubrication fitting.
- Lubrication fitting plugs furnished to close off unused holes.
- Tolerance limits for outside diameters of stud and outer ring refer to “single mean diameter” (see engineering section).
- A close fit between stud and hole required for mounting.
- Bore dimensions given below result in varying fit (0.0010 in. tight to 0.0005 in. loose).
- Retaining washer should be firmly backed up by flat housing shoulder (perpendicular to the stud axis).
- Shoulder diameter should be at least same size as minimum clamping diameter listed.
- May be mounted with two thin lock nuts or nut and lock washer.

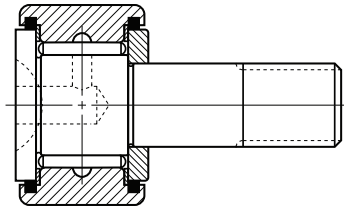
C

Outside Diameter	Dimensions mm/in.									Track Roller Designation		
	+0.25 -0 +0.0010 -0.0000	+0 -0.025 +0.000 -0.001	+0 -0.13 +0.000 -0.005	(nom.)	Min.					UNF	Without Seals	With Seals And Internal Thrust Washers
in.	d <sub>1</sub>	D	C	B <sub>2</sub>	B <sub>3</sub>	G <sub>1</sub>	d <sub>4</sub> , d <sub>2</sub>	d <sub>3</sub>	G			
2 1/2	25.400 1.0000	63.50 2.500	38.10 1.500	57.15 2.250	14.27 0.562	28.58 1.125	3.18 0.188	3.18 0.125	1-14§		CR-40	CRS-40
2 3/4	25.400 1.0000	69.85 2.750	38.10 1.500	57.15 2.250	14.27 0.562	28.58 1.125	3.18 0.188	3.18 0.125	1-14§		CR-44	CRS-44
3	31.750 1.2500	76.20 3.000	44.45 1.750	63.50 2.500	15.88 0.625	31.75 1.250	3.18 0.250	3.18 0.125	1 1/4-12		CR-48	CRS-48
3 1/4	31.750 1.2500	82.55 3.250	44.45 1.750	63.50 2.500	15.88 0.625	31.75 1.250	3.18 0.250	3.18 0.125	1 1/4-12		CR-52	CRS-52
3 1/2	34.925 1.3750	88.90 3.500	50.80 2.000	69.85 2.750	17.48 0.688	34.93 1.375	3.18 0.250	3.18 0.125	1 3/8-12		CR-56	CRS-56
4	38.100 1.5000	101.60 4.000	57.15 2.250	88.90 3.500	19.05 0.750	38.10 1.500	3.18 0.250	3.18 0.125	1 1/2-12		CR-64	CRS-64

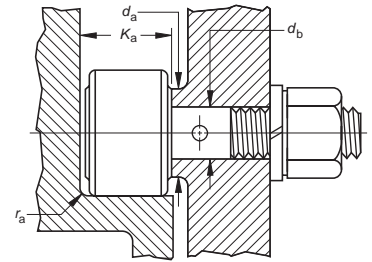
§ UNS instead of UNF threads.



CR and CRS -12 to -64



CR and CRS -8 to -10-1



Note: Clamping torque is based on lubricated threads. If threads are dry, the torque values listed below may be doubled.

C

As a Bearing		As a Track Roller			Limiting Speed Grease RPM	Mounting Dimensions mm/in.				Clamping Torque N*m/lbf. • in.	Wt. kg/lbs. Approx.
Dynamic C	Static C <sub>0</sub>	Dynamic C <sub>w</sub>	Static F <sub>r perm</sub>	Static F <sub>0r perm</sub>		Bore Dia. for Stud +0.013 +0.0005 -0 -0.0000	Max. r <sub>as max</sub>	Min. K <sub>a</sub>	Min. d <sub>a</sub>		
58.7 13200	118 26600	44.5 10000	51.6 11600	101 22700	1400	25.400 1.0000	2.29 0.090	40.13 1.58	34.93 1.375	152.53 1 350	1.134 2.50
58.7 13200	118 26600	47.2 10600	66.7 15000	113 25500	1400	25.400 1.0000	2.29 0.090	40.13 1.58	34.93 1.375	152.53 1 350	1.329 2.93
74.7 16800	179 40200	51.6 11600	64.0 14400	127 28600	990	31.750 1.2500	2.29 0.090	46.48 1.83	44.45 1.750	231.62 2 050	1.905 4.20
74.7 16800	179 40200	54.7 12300	80.1 18000	143 32100	990	31.750 1.2500	2.29 0.090	46.48 1.83	44.45 1.750	231.62 2 050	2.182 4.81
111 24900	227 51000	82.3 18500	89.8 20200	187 42000	950	34.925 1.3750	2.29 0.090	52.83 2.08	48.82 1.922	282.46 2 500	2.912 6.42
138 31100	321 72200	99.2 22300	121 27200	245 55000	780	38.100 1.5000	2.29 0.090	59.18 2.33	57.94 2.281	338.95 3 000	4.291 9.46





## STUD TYPE TRACK ROLLERS CRSB SERIES

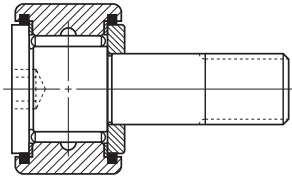
### INCH SERIES

- Nonseparable, sealed unit with outer ring, full complement of needle rollers, stud seals, self-lubricating resin internal thrust washers, and stud-fastened retaining washer.
- Seals help retain lubricant and exclude foreign matter (CRS Series).
- Hexagonal wrench socket in stud head for mounting
- Relubrication via axially drilled hole through stud with cross-drilled holes in stud raceway and shank.
- Recessed axial hole accepts standard nominal inch drive-type grease lubrication fitting.
- Lubrication fitting plugs furnished to close off unused holes.
- Tolerance limits for outside diameters of stud and outer ring refer to "single mean diameter" (see engineering section).
- A close fit between stud and hole required for mounting.
- Bore dimensions given below result in varying fit (0.0010 in. tight to 0.0005 in. loose).
- Retaining washer should be firmly backed up by flat housing shoulder (perpendicular to the stud axis).
- Shoulder diameter should be at least same size as minimum clamping diameter listed.
- May be mounted with two thin lock nuts or nut and lock washer.

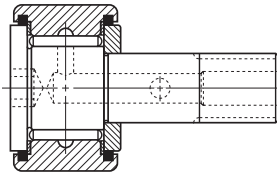
Outside Diameter	Dimensions mm/in.										Bearing Designation
	+0.25 -0 +0.0010 -0.0000	+0 -0.025 +0.000 -0.001	+0 -0.13 +0.000 -0.005	(nom.)	Min.	UNF					
in.	d <sub>1</sub>	D	C	B <sub>2</sub>	B <sub>3</sub>	G <sub>1</sub>	d <sub>4</sub>	d <sub>2</sub>	d <sub>3</sub>	G	
1/2	4.826 0.1900	12.70 0.500	8.74 0.344	12.70 0.500	—	6.35 0.250	—	—	—	10-32	CRSB-8
	4.826 0.1900	12.70 0.500	9.53 0.375	15.88 0.625	—	6.35 0.250	—	—	—	10-32	CRSB-8-1
5/8	6.350 0.2500	15.88 0.625	10.31 0.406	15.88 0.625	—	7.92 0.312	—	—	—	1/4-28	CRSB-10
	6.350 0.2500	15.88 0.625	11.13 0.438	19.05 0.750	—	7.92 0.312	—	—	—	1/4-28	CRSB-10-1
3/4	9.525 0.3750	19.05 0.750	12.70 0.500	22.23 0.875	6.35 0.250	9.53 0.375	4.78 0.188	4.78 0.188	2.39 0.094	3/8-24	CRSB-12
7/8	9.525 0.3750	22.23 0.875	12.70 0.500	22.23 0.875	6.35 0.250	9.53 0.375	4.78 0.188	4.78 0.188	2.39 0.094	3/8-24	CRSB-14
1	11.113 0.4375	25.40 1.000	15.88 0.625	25.40 1.000	6.35 0.250	12.70 0.500	6.35 0.250	4.78 0.188	3.18 0.125	7/16-20	CRSB-16
1 1/8	11.113 0.4375	28.58 1.125	15.88 0.625	25.40 1.000	6.35 0.250	12.70 0.500	6.35 0.250	4.78 0.188	3.18 0.125	7/16-20	CRSB-18
1 1/4	12.700 0.5000	31.75 1.250	19.05 0.750	31.75 1.250	7.92 0.312	15.88 0.625	6.35 0.250	4.78 0.188	3.18 0.125	1/2-20	CRSB-20
1 3/8	12.700 0.5000	34.93 1.375	19.05 0.750	31.75 1.250	7.92 0.312	15.88 0.625	6.35 0.250	4.78 0.188	3.18 0.125	1/2-20	CRSB-22
1 1/2	15.875 0.6250	38.10 1.500	22.23 0.875	38.10 1.500	9.53 0.375	19.05 0.750	—	4.78 0.188	2.39 0.094	5/8-18	CRSB-24
1 5/8	15.875 0.6250	41.28 1.625	22.23 0.875	38.10 1.500	9.53 0.375	19.05 0.750	—	4.78 0.188	2.39 0.094	5/8-18	CRSB-26
1 3/4	19.050 0.7500	44.45 1.750	25.40 1.000	44.45 1.750	11.13 0.438	22.23 0.875	—	4.78 0.188	2.39 0.094	3/4-16	CRSB-28
1 7/8	19.050 0.7500	47.63 1.875	25.40 1.000	44.45 1.750	11.13 0.438	22.23 0.875	—	4.78 0.188	2.39 0.094	3/4-16	CRSB-30
2	22.225 0.8750	50.80 2.000	31.75 1.250	50.80 2.000	12.70 0.500	25.40 1.000	—	4.78 0.188	3.18 0.125	7/8-14	CRSB-32
2 1/4	22.225 0.8750	57.15 2.250	31.75 1.250	50.80 2.000	12.70 0.500	25.40 1.000	—	4.78 0.188	3.18 0.125	7/8-14	CRSB-36
2 1/2	25.400 1.0000	63.50 2.500	38.10 1.500	63.50 2.500	14.27 0.562	28.58 1.125	—	4.78 0.188	3.18 0.125	1-14§	CRSB-40

§ UNS instead of UNF threads.

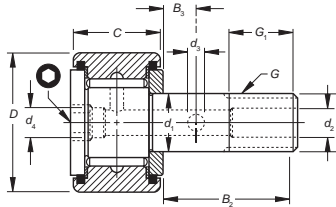
For hexagonal wrench sizes, see page C210.



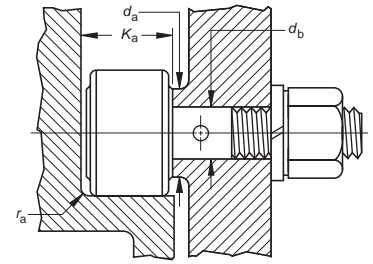
CRSB -8 to -10-1



CRSB -24 to -44



CRSB -12 to -22  
CRSB -48 to -64



Note: Clamping torque is based on lubricated threads. If threads are dry, the torque values listed below may be doubled.

Load Rating kN/bf.					Limiting Speed Grease RPM	Mounting Dimensions mm/in.				Clamping Torque N*m/bf. • in.	Wt. kg/lbs. Approx.
As a Bearing		As a Track Roller				Bore Dia. for Stud +0.013 +0.0005 -0 -0.0000	Max.	Min.	Min.		
Dynamic C	Static C0	Dynamic Cw	Static Fr perm	Static F0r perm							
					db	ras max	Ka	da			
4.44 999	4.94 1110	3.01 677	1.04 233	2.49 560	7000	4.826 0.1900	0.25 0.010	10.4 0.41	7.54 0.297	0.90 8.00	0.010 0.022
4.98 1120	5.69 1280	3.38 759	1.21 272	2.90 652	7000	4.826 0.1900	0.25 0.010	11.2 0.44	7.54 0.297	0.90 8.00	0.010 0.023
6.05 1360	7.87 1770	4.37 982	2.26 508	5.43 1220	5500	6.350 0.2500	0.38 0.015	11.9 0.47	9.12 0.359	2.26 20.0	0.019 0.041
6.58 1480	8.76 1970	4.76 1070	2.53 569	6.09 1370	5500	6.350 0.2500	0.38 0.015	12.7 0.50	9.12 0.359	2.26 20.0	0.020 0.045
10.4 2330	15.2 3410	6.45 1450	2.88 647	6.89 1550	3900	9.525 0.3750	0.38 0.015	14.2 0.56	12.70 0.500	6.21 55.0	0.034 0.076
10.4 2330	15.2 3410	7.56 1700	4.80 1080	11.5 2590	3900	9.525 0.3750	0.38 0.015	17.5 0.69	12.70 0.500	6.21 55.0	0.044 0.097
13.3 2980	22.3 5010	8.94 2010	6.05 1360	14.5 3260	3000	11.113 0.4375	0.76 0.030	17.5 0.69	15.09 0.594	16.95 150	0.073 0.161
13.3 2980	22.3 5010	9.88 2220	8.67 1950	18.3 4120	3000	11.113 0.4375	0.76 0.030	20.6 0.81	15.09 0.594	16.95 150	0.089 0.197
21.5 4840	33.2 7460	15.1 3400	9.30 2090	24.3 5470	2600	12.700 0.5000	0.76 0.030	20.6 0.81	19.05 0.750	23.16 205	0.137 0.301
21.5 4840	33.2 7460	16.4 3680	12.6 2840	28.6 6420	2600	12.700 0.5000	0.76 0.030	23.9 0.94	19.05 0.750	23.16 205	0.161 0.354
4 840 6380	7 460 9160	3 680 4520	2 840 2440	6 420 5850		0.5000 0.6250	0.030 0.030	0.94 0.94	0.750 0.891	205 390	0.354 0.528
28.4 6380	40.8 9160	21.5 4840	14.1 3170	33.8 7610	2300	15.875 0.6250	0.76 0.030	26.9 1.06	22.63 0.891	44.06 390	0.274 0.605
35.8 8040	56.94 12800	25.9 5830	17.7 3980	42.5 9560	1900	19.050 0.7500	1.02 0.040	26.9 1.06	26.59 1.047	84.74 750	0.385 0.848
35.8 8040	56.94 12800	27.4 6150	22.0 4940	49.4 11100	1900	19.050 0.7500	1.02 0.040	33.8 1.33	26.59 1.047	84.74 750	0.430 0.947
43.5 9770	76.06 17100	31.8 7160	26.0 5850	60.5 13600	1700	22.225 0.8750	1.27 0.050	33.8 1.33	30.56 1.203	101.69 900	0.621 1.370
43.5 9770	76.06 17100	34.6 7770	36.7 8250	71.2 16000	1700	22.225 0.8750	1.27 0.050	40.1 1.58	30.56 1.203	101.69 900	0.757 1.670
58.7 13200	118.32 26600	44.5 10000	51.6 11600	101 22700	1400	25.400 1.0000	2.29 0.090	40.1 1.58	34.93 1.375	152.53 1350	1.134 2.500

Continued on next page.



## STUD TYPE TRACK ROLLERS CRSB SERIES – *continued*

### INCH SERIES

- Nonseparable, sealed unit with outer ring, full complement of needle rollers, stud seals, self-lubricating resin internal thrust washers, and stud-fastened retaining washer.
- Seals help retain lubricant and exclude foreign matter (CRS Series).
- Hexagonal wrench socket in stud head for mounting
- Relubrication via axially drilled hole through stud with cross-drilled holes in stud raceway and shank.
- Recessed axial hole accepts standard nominal inch drive-type grease lubrication fitting.
- Lubrication fitting plugs furnished to close off unused holes.
- Tolerance limits for outside diameters of stud and outer ring refer to “single mean diameter” (see engineering section).
- A close fit between stud and hole required for mounting.
- Bore dimensions given below result in varying fit (0.0010 in. tight to 0.0005 in. loose).
- Retaining washer should be firmly backed up by flat housing shoulder (perpendicular to the stud axis).
- Shoulder diameter should be at least same size as minimum clamping diameter listed.
- May be mounted with two thin lock nuts or nut and lock washer.

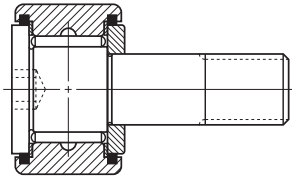
C

Outside Diameter	Dimensions mm/in.										Bearing Designation
	+0.25 -0 +0.0010 -0.0000	+0 -0.025 +0.000 -0.001	+0 -0.13 +0.000 -0.005	(nom.)	Min.						
in.	d <sub>1</sub>	D	C	B <sub>2</sub>	B <sub>3</sub>	G <sub>1</sub>	d <sub>4</sub>	d <sub>2</sub>	d <sub>3</sub>	G	
2 3/4	25.400 1.0000	69.85 2.750	38.10 1.500	63.50 2.500	14.27 0.562	28.58 1.125	—	4.78 0.188	3.18 0.125	1-14§	CRSB-44
3	31.750 1.2500	76.20 3.000	44.45 1.750	63.50 2.500	15.88 0.625	31.75 1.250	6.35 0.250	6.35 0.250	3.18 0.125	1 1/4-12	CRSB-48
3 1/4	31.750 1.2500	82.55 3.250	44.45 1.750	63.50 2.500	15.88 0.625	31.75 1.250	6.35 0.250	6.35 0.250	3.18 0.125	1 1/4-12	CRSB-52
3 1/2	34.925 1.3750	88.90 3.500	50.80 2.000	69.85 2.75	17.48 0.688	34.93 1.375	6.35 0.250	6.35 0.250	3.18 0.125	1 3/8-12	CRSB-56
4	38.100 1.5000	101.60 4.000	57.15 2.250	88.90 3.500	19.05 0.750	38.10 1.500	6.35 0.250	6.35 0.250	3.18 0.125	1 1/2-12	CRSB-64

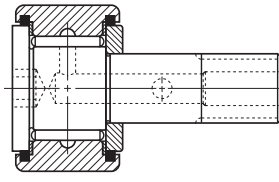
§ UNS instead of UNF threads.



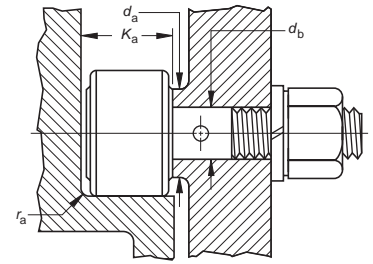
For hexagonal wrench sizes, see page C208.



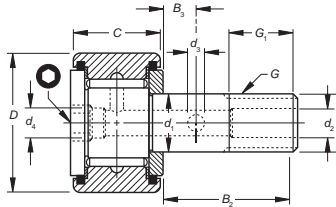
**CRSB -8 to -10-1**



**CRSB -24 to -44**



Note: Clamping torque is based on lubricated threads. If threads are dry, the torque values listed below may be doubled.



**CRSB -12 to -22**  
**CRSB -48 to -64**

Load Rating kN/lbf.					Limiting Speed Grease RPM	Mounting Dimensions mm/in.				Clamping Torque N*m/lbf. • in.	Wt. kg/lbs. Approx.
As a Bearing		As a Track Roller				Bore Dia. for Stud +0.013 +0.0005 -0 -0.0000	Max.	Min.	Min.		
Dynamic C	Static C <sub>0</sub>	Dynamic C <sub>w</sub>	Static F <sub>r perm</sub>	Static F <sub>or perm</sub>							
<b>58.7</b> 13200	<b>118.32</b> 26600	<b>47.2</b> 10600	<b>66.7</b> 15000	<b>113</b> 25500	<b>1400</b>	<b>25.400</b> 1.0000	<b>2.29</b> 0.090	<b>44.5</b> 1.75	<b>34.93</b> 1.375	<b>152.53</b> 1 350	<b>1.329</b> 2.930
<b>74.7</b> 16800	<b>178.82</b> 40200	<b>51.6</b> 11600	<b>64.0</b> 14400	<b>127</b> 28600	<b>990</b>	<b>31.750</b> 1.2500	<b>2.29</b> 0.090	<b>46.5</b> 1.83	<b>44.45</b> 1.750	<b>231.62</b> 2 050	<b>1.905</b> 4.200
<b>74.7</b> 16800	<b>178.82</b> 40200	<b>54.7</b> 12300	<b>80.1</b> 18000	<b>143</b> 32100	<b>990</b>	<b>31.750</b> 1.2500	<b>2.29</b> 0.090	<b>46.5</b> 1.83	<b>44.45</b> 1.750	<b>231.62</b> 2 050	<b>2.182</b> 4.810
<b>110.8</b> 24900	<b>226.86</b> 51000	<b>82.3</b> 18500	<b>89.8</b> 20200	<b>187</b> 42000	<b>950</b>	<b>34.925</b> 1.3750	<b>2.29</b> 0.090	<b>52.8</b> 2.08	<b>48.82</b> 1.922	<b>282.46</b> 2 500	<b>2.912</b> 6.420
<b>138.3</b> 31100	<b>321.16</b> 72200	<b>99.2</b> 22300	<b>121</b> 27200	<b>245</b> 55000	<b>780</b>	<b>38.100</b> 1.5000	<b>2.29</b> 0.090	<b>59.2</b> 2.33	<b>57.94</b> 2.281	<b>338.95</b> 3 000	<b>4.291</b> 9.460

C



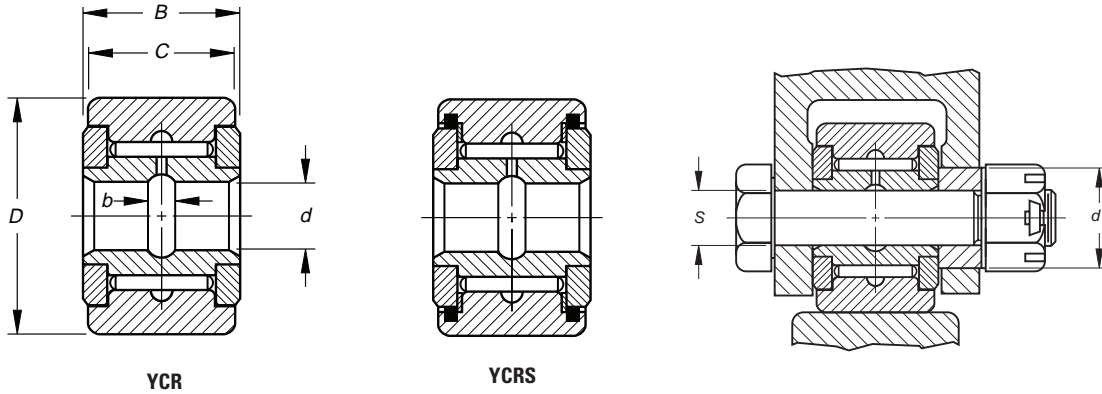


## YOKE TYPE TRACK ROLLERS YCR, YCRS SERIES

### INCH SERIES

- Non-separable unit with outer ring, a full complement of needle rollers, inner ring, self-lubricating resin internal thrust washers, and two retaining washers securely fastened to the inner ring.
- Seals in counterbores of outer ring seal against the retaining washers; retain lubricant and exclude foreign matter (YCRS Series).
- Dimensions shown are for unplated finished unit.
- Tolerance limits for outside diameters of stud and outer ring refer to "single mean diameter" (see engineering section).
- A close fit between stud and hole required for mounting bore dimensions given below result in varying fit (0.0010" tight to 0.0005" loose).
- Machine element must be sufficiently rigid in area of mounting bolt holes to resist local crushing under the applied load and resist bending causing uneven loading of rollers.
- Unit should be clamped endwise between parallel faces (perpendicular to axis) to prevent retaining washers from coming off under load.
- If the unit cannot be clamped, yoke requires a close axial fit.

Outside Diameter	Dimensions mm/in.						Track Roller Designation	
	+0 +0.000 -0.03 -0.001	Max.	Min.	+ .130 +0.0050 -0.250 -0.0100	+0 +0.000 -.13 -0.005	(nom.)	Without Seals	With Seals and Internal Thrust Washers
in.	D	d	B	C	b			
3/4	19.05 0.75	6.355 0.2502	6.34 0.2496	14.288 0.5625	12.7 0.5	3.18 0.125	YCR-12	YCRS-12
7/8	22.23 0.875	6.355 0.2502	6.34 0.2496	14.288 0.5625	12.7 0.5	3.18 0.125	YCR-14	YCRS-14
1	25.4 1	7.943 0.3127	7.927 0.3121	17.463 0.6875	15.88 0.625	3.18 0.125	YCR-16	YCRS-16
1 1/8	28.58 1.125	7.943 0.3127	7.927 0.3121	17.463 0.6875	15.88 0.625	3.18 0.125	YCR-18	YCRS-18
1 1/4	31.75 1.25	9.53 0.3752	9.515 0.3746	20.638 0.8125	19.05 0.75	4.78 0.188	YCR-20	YCRS-20
1 3/8	34.93 1.375	9.53 0.3752	9.515 0.3746	20.638 0.8125	19.05 0.75	4.78 0.188	YCR-22	YCRS-22
1 1/2	38.1 1.5	11.118 0.4377	11.102 0.4371	23.813 0.9375	22.23 0.875	3.18 0.125	YCR-24	YCRS-24
1 5/8	41.28 1.625	11.118 0.4377	11.102 0.4371	23.813 0.9375	22.23 0.875	3.18 0.125	YCR-26	YCRS-26
1 3/4	44.45 1.75	12.705 0.5002	12.69 0.4996	26.988 1.0625	25.4 1	3.18 0.125	YCR-28	YCRS-28
1 7/8	47.63 1.875	12.705 0.5002	12.69 0.4996	26.988 1.0625	25.4 1	3.18 0.125	YCR-30	YCRS-30
2	50.8 2	15.88 0.6252	15.865 0.6246	33.338 1.3125	31.75 1.25	3.18 0.125	YCR-32	YCRS-32
2 1/4	57.15 2.25	15.88 0.6252	15.865 0.6246	33.338 1.3125	31.75 1.25	3.18 0.125	YCR-36	YCRS-36
2 1/2	63.5 2.5	19.055 0.7502	19.04 0.7496	39.688 1.5625	38.1 1.5	3.68 0.145	YCR-40	YCRS-40
2 3/4	69.85 2.75	19.055 0.7502	19.04 0.7496	39.688 1.5625	38.1 1.5	3.68 0.145	YCR-44	YCRS-44
3	76.2 3	25.403 1.0001	25.387 0.9995	46.038 1.8125	44.45 1.75	3.68 0.145	YCR-48	YCRS-48
3 1/4	82.55 3.25	25.403 1.0001	25.387 0.9995	46.038 1.8125	44.45 1.75	3.68 0.145	YCR-52	YCRS-52
3 1/2	88.9 3.5	28.578 1.1251	28.562 1.1245	52.388 2.0625	50.8 2	3.68 0.145	YCR-56	YCRS-56
4	101.6 4	31.753 1.2501	31.737 1.2495	58.738 2.3125	57.15 2.25	3.68 0.145	YCR-64	YCRS-64



YCR

YCRS

Load Ratings kN/bf.					Limiting Speed Grease RPM	Mounting Dimensions mm/in.				Clamping Diameter $d_a$	Wt. Approx. kg/lbs.
As a Bearing		As a Track Roller				Shaft Bolt diameter Loose Fit (f7)		Tight Fit (h6)			
Dynamic C	Static C <sub>0</sub>	Dynamic C <sub>w</sub>	Static F <sub>R perm</sub>	Static F <sub>O perm</sub>		Max.	Min.	Max.	Min.		
10.4 2330	15.2 3410	6.45 1450	2.88 647	6.89 1550	3900	6.342 0.2497	6.332 0.2493	6.363 0.2505	6.353 0.2501	0.06 0.5	0.027 0.06
10.4 2330	15.2 3410	7.56 1700	4.8 1080	11.5 2590	3900	6.342 0.2497	6.332 0.2493	6.363 0.2505	6.353 0.2501	0.06 0.5	0.036 0.08
13.3 2980	22.3 5010	8.94 2010	6.05 1360	14.5 3260	3000	7.93 0.3122	7.92 0.3118	7.95 0.313	7.94 0.3126	0.07 0.594	0.068 0.15
13.3 2980	22.3 5010	9.88 2220	8.67 1950	18.3 4120	3000	7.93 0.3122	7.92 0.3118	7.95 0.313	7.94 0.3126	0.07 0.594	0.077 0.17
21.5 4840	33.2 7460	15.1 3400	9.3 2090	24.3 5470	2600	9.517 0.3747	9.507 0.3743	9.538 0.3755	9.528 0.3751	0.08 0.75	0.109 0.24
21.5 4840	33.2 7460	16.4 3680	12.6 2840	28.6 6420	2600	9.517 0.3747	9.507 0.3743	9.538 0.3755	9.528 0.3751	0.08 0.75	0.136 0.3
28.4 6380	40.7 9160	20.1 4520	10.8 2440	26 5850	2300	11.105 0.4372	11.095 0.4368	11.125 0.438	11.115 0.4376	0.1 0.891	0.186 0.41
28.4 6380	40.7 9160	21.5 4840	14.1 3170	33.8 7610	2300	11.105 0.4372	11.095 0.4368	11.125 0.438	11.115 0.4376	0.1 0.891	0.227 0.5
35.8 8040	56.9 12800	25.9 5830	17.7 3980	42.5 9560	1900	12.692 0.4997	12.682 0.4993	12.718 0.5007	12.708 0.5003	0.12 1.047	0.29 0.64
35.8 8040	56.9 12800	27.4 6150	22 4940	49.4 11100	1900	12.692 0.4997	12.682 0.4993	12.718 0.5007	12.708 0.5003	0.12 1.047	0.363 0.8
43.5 9770	76.1 17100	31.8 7160	26 5850	60.5 13600	1700	15.867 0.6247	15.857 0.6243	15.893 0.6257	15.883 0.6253	0.14 1.203	0.476 1.05
43.5 9770	76.1 17100	34.6 7770	36.7 8250	71.2 16000	1700	15.867 0.6247	15.857 0.6243	15.893 0.6257	15.883 0.6253	0.14 1.203	0.599 1.32
58.7 13200	118 26600	44.5 10000	51.6 11600	100 22700	1400	19.042 0.7497	19.032 0.7493	19.068 0.7507	19.058 0.7503	0.16 1.375	0.816 1.8
58.7 13200	118 26600	47.2 10600	66.7 15000	113 25500	1400	19.042 0.7497	19.032 0.7493	19.068 0.7507	19.058 0.7503	0.16 1.375	1.021 2.25
74.7 16800	179 40200	51.6 11600	64 14400	127 28600	990	25.39 0.9996	25.377 0.9991	25.42 1.0008	25.408 1.0003	0.2 1.75	1.406 3.1
74.7 16800	179 40200	54.7 12300	80.1 18000	143 32100	990	25.39 0.9996	25.377 0.9991	25.42 1.0008	25.408 1.0003	0.2 1.75	1.642 3.62
111 24900	227 51000	82.3 18500	89.8 20200	187 42000	950	28.565 1.1246	28.552 1.1241	28.595 1.1258	28.583 1.1253	0.22 1.922	2.245 4.95
138 31100	321 72200	99.2 22300	121 27200	245 55000	780	31.74 1.2496	31.727 1.2491	31.77 1.2508	31.758 1.2503	0.26 2.281	3.198 7.05

C





# NEEDLE ROLLER BEARINGS



## NOTES

C



## THRUST BEARINGS, ASSEMBLIES, WASHERS

**Overview:** Needle roller and cage thrust assemblies are complements of small diameter needle rollers arranged in a spoke-like configuration. Needle rollers are equally spaced by means of a cage whose web section separates the rollers and provides guidance to keep them tracking in an orbital path. The purpose of these assemblies is to transmit a thrust load between two relatively rotating objects while greatly reducing friction.

Needle roller and cage thrust assemblies can also be unitized with lipped washers which service as raceway surfaces for the needle rollers. Washers can be supplied separately or can be mechanically unitized to the needle roller thrust assemblies for ease of handling.

- **Sizes:** 6 mm - 140 mm (0.2362 in. - 5.5118 in.).
- **Markets:** Automotive automatic and manual transmissions, automotive accessories (compressors, steering gears, etc.) agricultural and construction equipment.
- **Features:** One-way fool-proof assembly features, anti-rotation locking features and lubrication flow enhancements.
- **Benefits:** High-speed performance and application flexibility.



## Needle Roller Thrust Bearings – Metric Nominal Dimensions

### Prefix

- AXK** needle roller and cage thrust assembly with two washers retained with a steel ring
- FNT** needle roller and cage thrust assembly (two piece cage design)
- AX** needle roller and cage thrust assembly with one unitized thin or thick washer
- AR** cylindrical roller and cage thrust assembly with one unitized light and heavy series washers
- AXZ** needle roller and cage thrust assembly with two washers retained with a ring
- ARZ** cylindrical roller and cage thrust assembly with two washers retained with a steel ring

**Width** (for X or AR bearings) over 3 mm  
3.5 = 3.5 mm

**Bore\***  
60 = 60 mm  
\* thick AX series and heavy AR(Z) series has same bore but larger O.D. dimension

**Outer Diameter**  
85 = 85 mm

**AXZ**

**3.5**

**60**

**85**

### Prefix

- K.811** cylindrical roller thrust bearing
- K.812** cylindrical roller thrust bearing

**Bore Diameter**  
02 = 15 mm  
03 = 17 mm  
(for bore ≥ 20 mm): bore code x 5 = bore diameter  
04 = 4 x 5 = 20 mm

**K.811**

**04**

**TVP**

### Suffix

- TVP** molded, reinforced polymer window-type cage
- LPB** machined, light metal window-type cage

## Thrust Washers – Metric Nominal Dimensions

### Prefix

- AS** thin thrust washer
- LS** heavy thrust washer
- CP** thin and thick series thrust washer for AX and AR series
- CPR** heavy series thrust washer for AR series
- CPN** precision series thrust washer for AX series

**Width** (for CP and CPR washers over 1 mm thick)  
8 = 8 mm

**Bore**  
40 = 40 mm

**Outer Diameter**  
60 = 60 mm

**LS**

**8**

**40**

**60**

### Prefix

- GS.811, GS.812** housing washer
- WS.812, WS.812** shaft washer

### Bore Diameter

**for WS.811, WS.812:**  
02 = 15 mm  
03 = 17 mm  
(for bore ≥ 20 mm):  
bore code x 5 = bore diameter  
04 = 4 x 5 = 20 mm

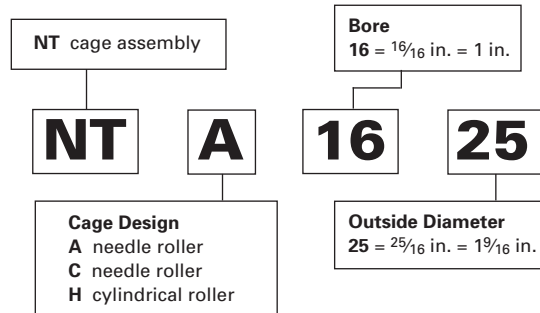
**for GS.811:**  
02 = 16 mm  
03 = 18 mm  
04 = 21 mm  
05 = 26 mm  
(for bore ≥ 30 mm):  
[bore code x 5]+2 = bore diameter  
06 = [6 x 5]+2 = 32 mm

**for GS.812:**  
02 = 16 mm  
03 = 17 mm  
04 = 21 mm  
05 = 26 mm  
(for bore ≥ 30 mm):  
[bore code x 5]+2 = bore diameter  
06 = [6 x 5]+2 = 32 mm  
(for bore > 85 mm):  
[bore code x 5]+3 = bore diameter  
17 = [17 x 5]+3 = 88 mm

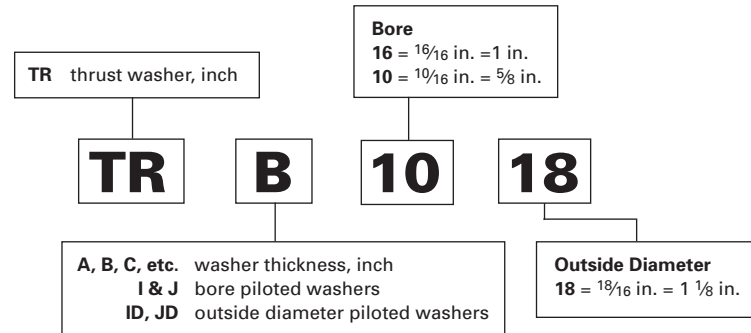
**GS.811**

**04**

## Thrust Bearings – Inch Nominal Dimensions



## Thrust Washers – Inch Nominal Dimensions



C





# Thrust Bearings, Assemblies and Washers

C

<i>NEEDLE ROLLER AND CAGE THRUST ASSEMBLIES AND THRUST WASHERS – METRIC SERIES</i>	<i>Page</i>
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Unitized Thrust Bearing Type FNTK . . . . .	C239
Unitized Thrust Bearing Assemblies . . . . .	C240
Unitized Thrust Bearings . . . . .	C242
 <i>CYLINDRICAL ROLLER THRUST BEARINGS</i>	
Introduction . . . . .	C250
Cylindrical Roller Thrust Bearings Cylindrical Roller and Cage Thrust Assemblies Metric Series . . . . .	C254
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## NEEDLE ROLLER AND CAGE THRUST ASSEMBLIES AND THRUST WASHERS –

### METRIC SERIES

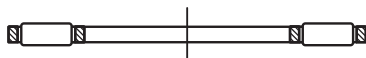
Needle roller and cage thrust assemblies are available in a variety of sizes. They all have very small cross-sections. This catalog includes the most popular, standardized and non-standard designs. If back up surface cannot be used as a raceway, hardened washers are available.

### REFERENCE STANDARDS ARE:

- **ISO 3031** – Rolling bearings – Needle roller and cage thrust assemblies, thrust washers – Dimensions and tolerances
- **DIN 5405 Part 2** – Rolling bearings – Needle bearings – Thrust needle roller and cage assemblies.
- **DIN 5405 Part 3** – Rolling bearings – Needle bearings – Thrust washers
- **ANSI/ABMA Std. 21.1-1988** – Thrust needle roller and cage assemblies and thrust washers – Metric design.

Before selecting specific needle roller and cage thrust assemblies, the engineering section of this catalog should be reviewed.

### TYPES OF METRIC SERIES NEEDLE ROLLER AND CAGE THRUST ASSEMBLIES AND THRUST WASHERS



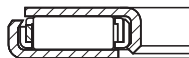
**AXK, FNT**  
Needle roller & cage thrust assembly



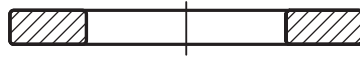
**LS**  
Heavy thrust washer



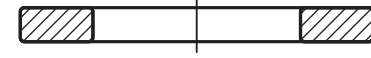
**AS**  
Thin thrust washer



**FNTKF (FNTK, FNTF)**  
Unitized thrust bearing assembly



**WS.811**  
Shaft piloted washer



**GS.811**  
Housing piloted washer

## CONSTRUCTION

### NEEDLE ROLLER AND CAGE THRUST ASSEMBLIES

The needle roller and cage thrust assembly (Series FNT) has a two piece steel cage and through hardened needle rollers which are precision finished to close tolerances for optimum load distribution. The cage is comprised of two mating pieces that are securely fastened together.

Series AXK needle roller and cage thrust assembly, which can be used interchangeably with the FNT assembly, has a one piece cage. The cage is similar in design to the successful profiled radial steel cages.

These cage assemblies have a very thin section and when they must run directly against the back up surface raceways their section may be 2 to 5 mm (0.08 to 0.20 in.) which is equivalent to the diameter of the needle rollers used.

When the back up surfaces cannot be hardened and ground, hardened washers of different thicknesses are available.

### UNITIZED THRUST BEARING ASSEMBLIES

Thrust bearing assemblies of the FNTK, FNTF and FNTKF Series have been specially designed for use in applications where a unitized assembly allows for ease of installation and eliminates the need for heat treatment and precision finishing of one or both thrust bearing backup surfaces.

Each FNTK, FNTF or FNTKF assembly consists of a FNT needle roller and cage thrust assembly with one or two special lipped washers that snap over the cage to produce a unitized thrust bearing assembly. The FNTK and FNTF assembly has one such washer, the FNTKF assembly has a washer on each side of the bearing.

The backup surfaces for these unitized thrust bearing assemblies should meet the limits of permissible out-of-squareness and coning or dishing as shown in figures 1 and 2 on C232. Oil is the preferred lubricant for these assemblies, however they are also available pregreased for applications that do not allow for oil lubrication.





**DIMENSIONAL ACCURACY**

**TOLERANCES FOR NEEDLE ROLLER AND CAGE THRUST ASSEMBLIES**

Pages C234 to C237 list the nominal outside diameter, bore diameter and needle roller diameter for the FNT and AXK Series of needle roller and cage thrust assemblies and also the nominal outside diameter and bore diameter of the series AS, LS, WS and GS thrust washers. Thickness tolerances for the AS and LS thrust washers are also included.

Tolerances for the outside and bore diameters of series FNT and AXK needle roller and cage thrust assemblies are given in Table 1. The needle rollers in any one assembly have a group tolerance of 2 µm (80 µin.).

**TABLE 1 – TOLERANCES FOR OUTSIDE DIAMETER (D<sub>c</sub>) AND BORE DIAMETER (D<sub>c1</sub>) OF SERIES FNT AND AXK NEEDLE ROLLER AND CAGE THRUST ASSEMBLIES**

D <sub>c</sub> mm		Deviations of max. outside dia. (c12) µm		D <sub>c1</sub> mm		Deviations of min. bore dia. (E11) µm	
>	≤	high	low	>	≤	low	high
18	30	-110	-320	3	6	+20	+95
30	40	-120	-370	6	10	+25	+115
40	50	-130	-380	10	18	+32	+142
50	65	-140	-440	18	30	+40	+170
65	80	-150	-450	30	50	+50	+210
80	100	-170	-520	50	80	+60	+250
100	120	-180	-530	80	120	+72	+292
120	140	-200	-600				

**BORE INSPECTION PROCEDURE FOR ASSEMBLY**

If an inspection of the bore diameter is desired, the bore diameter (D<sub>c1</sub>) of the assembly should be checked with “go” and “no go” plug gages. The “go” plug gage size is the minimum bore diameter of the assembly. The “no go” plug gage size is the maximum bore diameter of the assembly.

The assembly, under its own weight, must fall freely from the “go” plug gage. The “no go” plug gage must not enter the bore. Where the “no go” plug gage can be forced through the bore, the assembly must not fall from the gage under its own weight.

**TOLERANCES FOR THRUST WASHERS**

Tolerances for the bore diameters of series WS, shaft piloted thrust washers are given in the engineering section. Tolerances for the outside diameters of Series GS, housing piloted thrust washers are given in the engineering section.

Tolerances for the outside and bore diameters of Series AS thrust washers are given in Table 2. Thickness tolerance for Series AS thrust washers is ±0.05 mm (±0.002 in.).

**BORE INSPECTION PROCEDURE FOR SERIES AS AND LS THRUST WASHERS**

If an inspection of the thrust washer bore diameter (d) is desired, it should be checked with “go” and “no go” plug gages. The “go” plug gage size is the minimum bore diameter of the thrust washer. The “no go” plug gage size is the maximum bore diameter of the thrust washer.

The thrust washer, under its own weight, must fall freely from the “go” plug gage. The “no go” plug gage must not enter the bore. Where the “no go” plug gage can be forced through the bore, the thrust washer must not fall from the gage under its own weight.

**TABLE 1B - AX SERIES THICKNESS AND AXIAL RUN-OUT TOLERANCES**

	Bore D <sub>c1</sub> mm	Thickness Tolerance µm	Axial run-out µm	
			HP	HSP
Needle thrust bearings (thin)	≤ 60	+30 / -40 <sup>(1)</sup>	20	
	60 < D <sub>c1</sub> ≤ 90	+50 / -60 <sup>(2)</sup>	25	
	90 < D <sub>c1</sub> ≤ 120	+50 / -60 <sup>(2)</sup>	30	
Needle thrust bearings (thick)	D <sub>c1</sub> ≤ 60	+30 / -30 <sup>(1)</sup>	20	Quality
	60 < D <sub>c1</sub> ≤ 90	+50 / -50 <sup>(2)</sup>	25	HP   HSP
	90 < D <sub>c1</sub> ≤ 120	+50 / -50 <sup>(2)</sup>	30	2   1
Thrust washers (thin) [thick]	D <sub>c1</sub> ≤ 120	+50 / -60[-50]	5*	3   1.5
	120 < D <sub>c1</sub> ≤ 180	+50 / -110[-100]	7*	4   2
	180 < D <sub>c1</sub> ≤ 250	+30 / -160[-150]	10*	

\*HP Quality

<sup>(1)</sup> Under min. load of 150 N

<sup>(2)</sup> Under min. load of 250 N

**TABLE 2 – TOLERANCES FOR OUTSIDE DIAMETER (d<sub>1</sub>) AND BORE DIAMETER (d) OF SERIES AS THRUST WASHERS.**

d <sub>1</sub> mm		Deviations of max. outside dia. (e13) µm		d mm		Deviations of min. bore dia. (E12) µm	
>	≤	high	low	>	≤	low	high
18	30	-40	-370	3	6	+20	+140
30	50	-50	-440	6	10	+25	+175
50	80	-60	-520	10	18	+32	+212
80	120	-72	-612	18	30	+40	+250
120	180	-85	-715	30	50	+50	+300
180	250	-100	-820	50	80	+60	+360
				80	120	+72	+422
				120	180	+85	+485

Tolerances for the outside and bore diameters of series LS heavy thrust washers are given in Table 3. Thickness tolerances for series LS heavy thrust washers are given in tabular pages.

**TABLE 3 – TOLERANCES FOR OUTSIDE DIAMETER (d<sub>1</sub>) AND BORE DIAMETER (d) OF SERIES LS HEAVY THRUST WASHERS.**

d <sub>1</sub> mm		Deviations of max. outside dia. (a12) µm		d mm		Deviations of min. bore dia. (E12) µm	
>	≤	high	low	>	≤	low	high
18	30	-300	-510	3	6	+20	+140
30	40	-310	-560	6	10	+25	+175
40	50	-320	-570	10	18	+32	+212
50	65	-340	-640	18	30	+40	+250
65	80	-360	-660	30	50	+50	+300
80	100	-380	-730	50	80	+60	+360
100	120	-410	-760	80	120	+72	+422
120	140	-460	-860	120	180	+85	+485
140	160	-520	-920				
160	180	-580	-980				
180	200	-660	-1120				

**TABLE 4 – MOUNTING TOLERANCES FOR SHAFTS AND HOUSINGS FOR METRIC SERIES COMPONENTS.**

Bearing Components	Shaft Tolerance (shaft piloting)	Housing Tolerance (housing piloting)	Piloting Member
Cylindrical roller & needle roller cage thrust assembly Types: AXK, FNT, K.811 and K.812	h8	H10	shaft
Cylindrical roller & needle roller cage thrust assembly Types: AX, AR, AXZ, and ARZ	h10	H10	shaft
Thin thrust washer Type: AS	h10	H11	shaft
Heavy thrust washer Type: LS	h10	H11	shaft
Shaft piloted thrust washer Type: WS.811	h6 (j6)	clearance	shaft
Housing piloted thrust washer Type: GS.811	Clearance	H7 (K7)	housing
Thick, thin and heavy series thrust washers Types: CP and CPR	h10	H10	as required

## MOUNTING TOLERANCES

### NEEDLE ROLLER AND CAGE THRUST ASSEMBLIES – METRIC SERIES

On FNT and AXK Series needle roller and cage thrust assemblies, the cage bore has a closer tolerance than the outside diameter, therefore bore piloting is preferred for these assemblies. To reduce wear it is suggested that the piloting surface for the cage be hardened to an equivalent of at least 55 HRC. Where design requirements prevent bore piloting, the FNT or AXK Series needle roller and cage thrust assemblies may be piloted on the outside diameters. For such cases, suitable O.D. piloting dimensions should be determined. Mounting tolerances are given in Table 4.

### THRUST WASHERS

The mounting tolerances for series AS, LS, WS and GS thrust washers for use with needle roller and cage thrust assemblies are given in Table 4.

As for the FNT and AXK Series thrust assemblies, to reduce wear, the piloting surface for the thrust washers should also be hardened to an equivalent of at least 55 HRC.

### BACK UP SURFACES

In some applications, it is desirable to use the back up surfaces as raceways for the needle rollers of the needle roller and cage thrust assemblies. In such designs these surfaces should be parallel and must be hardened to at least 58 HRC. If this hardness cannot be achieved, and thrust washers cannot be used, the load ratings must be reduced, as explained in the engineering section.

Thrust raceway surfaces must be ground to a surface finish of  $0.2 \mu\text{m } R_a$  ( $79 \mu\text{in } R_a$ ). When this requirement cannot be met, thrust washers must be used.

The raceways against which the needle rollers operate, or the surface against which the thrust washers bear must be square with the axis of the shaft. Equally important, the raceway, or surface backing the thrust washer, must not be dished or coned. The permissible limits of out-of-squareness and dishing or coning are shown in Figures 1 and 2.

Raceway contact dimensions  $E_a$  and  $E_b$  are given in the tabular pages. For the thin series AS thrust washers, full back up between the dimensions  $E_a$  and  $E_b$  should be provided.

For AX Series thrust bearings, the maximum out of square must be of no more than 0.0005 mm (maximum angle no more than 1 min. 43 sec.), see Figure 1.

Thin series needle thrust bearings and thin thrust washers must be supported on a flat, rigid, and continuous face throughout the area of circulation of the needles bounded by dimensions  $E_b$  and  $E_a$ .

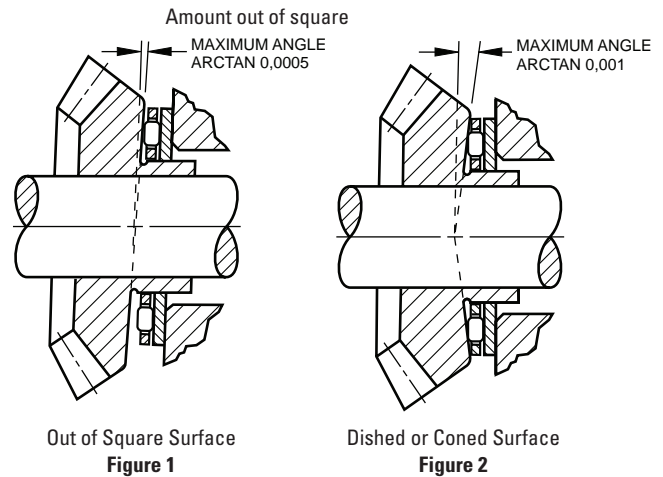
Thick series needle thrust bearings and thick thrust washers can be supported on a more restricted or discontinuous shoulder, provided that the deflection of the washer under load does not impede the smooth operation of the thrust bearing or the required axial run-out.

When an application does not involve the use of a thrust washer, the surface forming the second raceway must:

- extend at least across the whole area of circulation of the rolling elements between dimensions  $E_b$  and  $E_a$ , and,
- possess a suitable surface finish ( $\leq 0.2 \mu\text{m } R_a$  or  $\leq 79 \mu\text{in } R_a$ ) and sufficient hardness in relation to the load to be supported. A hardness of 58 HRC (min.) enables thrust bearings to carry their full load capacity. Lower hardness values reduce the capacities shown in the tables of dimensions (see tabulated sizes).

### TOLERANCES FOR PILOTING SURFACES (AX SERIES)

- Piloting on the shaft : h10 on dimensions  $D_{c1}$  for thrust bearings or dimension  $d$  for thrust washers.
- Piloting in the housing : H10 on dimensions  $D$  for thrust bearings or dimension  $d_1$  for thrust washers.



## LOAD RATINGS

### MINIMUM AXIAL LOAD

Slippage can occur if the applied axial load is too light and the operating speed of the needle roller and cage thrust assembly is high, particularly if accompanied by inadequate lubrication. For satisfactory operation, a certain minimum load must be applied to a needle roller and cage thrust assembly which can be calculated from:

$$F_{a \text{ min}} = C_0/2200 \text{ [kN]}$$

where

$C_0$  - static load rating [kN]  
 $F_{a \text{ min}}$  - minimum axial load [kN]

### COEFFICIENT OF FRICTION

In general, the coefficient of friction of a thrust bearing (consisting of a needle roller and cage thrust assembly and thrust washers) is defined as the friction torque divided by the product of the applied load and the bearing pitch radius. This coefficient of friction is not a constant value but will vary considerably with load, speed and lubricant. Generally the coefficient of friction becomes smaller as the load is increased and larger as the speed is increased. It is suggested that a value of 0.003 to 0.004 be used for needle thrust bearings and 0.004 to 0.005 be used for roller thrust bearings as a conservative estimate.

### LUBRICATION

Oil is the preferred lubricant for needle roller and cage thrust assemblies and an ample oil flow is absolutely necessary for high speeds, or for moderate speeds when the load is relatively high.

When the application must utilize grease lubrication the needle roller and cage thrust assembly should be ordered pregreased. When the speeds are low, and rotation is not continuous, the initial charge of grease may be suitable for the life of the application. When the speeds are moderate, however, the designer must provide for frequent regreasing. Since the needle rollers tend to expel the lubricant radially outward, relubrication passages should be directed to the bore of the cage whether oil or grease is used as the lubricant.

### SPECIAL DESIGNS

Needle roller and cage thrust assemblies and thrust washers are also made to special dimensions and configurations, as well as from special materials, when quantities permit economical manufacture.

Needle roller and cage thrust assemblies are particularly adaptable to low cost integral combination with special thrust washers. When the use of such special designs is considered, the following pages should be reviewed for evaluation of proposed arrangements.

### TYPE AXJ BEARINGS

Needle thrust bearings type AXJ have been developed by Timken to run at very high rotational speed. They comprise two rows of needles retained and guided in hardened steel cages. These assemblies are retained on either side of a common washer by inserted retaining caps which serve to center them with adequate clearance in relation to the washer.

The special feature of these thrust bearings is the self-piloting action to which each rotating ring of needles is submitted. This self-piloting is transmitted to the washer which is "floating" in relation to the shaft. For this reason, the relative speed of each ring of needles relative to its raceway and the speed of the washer relative to the rotating shaft are reduced by about half.

With a well-designed oil circulation, type AXJ thrust bearings permit speeds approximately twice that achieved with normal thrust bearings.

To ensure the axial position of a shaft in both directions, two AXJ thrust bearings should be mounted on either side of an intermediate washer with oil hole (type PMH), piloted in the housing. Please consult your Timken representative for applications involving the use of these special thrust bearings.

C

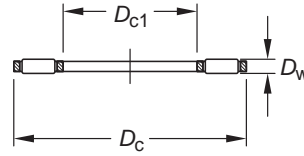




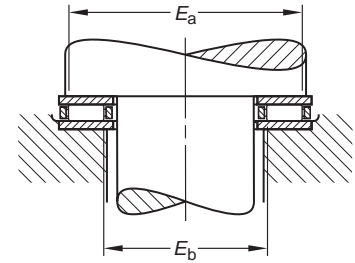
**NEEDLE ROLLER AND CAGE THRUST ASSEMBLIES, THRUST WASHERS**

**METRIC SERIES**

- Dimensions for bore and O.D. of thrust assemblies and washers are nominal.
- See page C232 for details on piloting and backup surfaces.
- Thrust washers burnished at least one-quarter of bore area (remainder is rough breakaway finish).
- O.D. finish of washers will be as blanked.
- Thinner washers may be out of flat due to distortion in hardening in the free state (expected to flatten out under load).



FNT, AXK

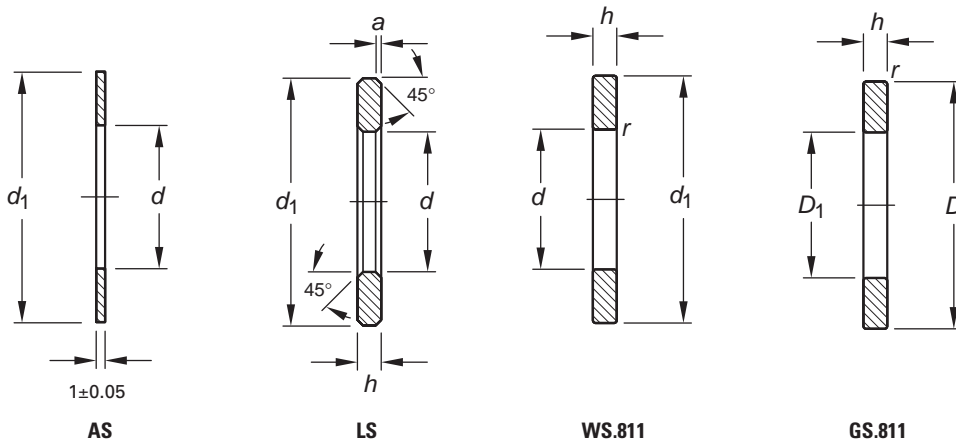


Raceway contact dimensions

Shaft Diameter	Dimensions mm/in.						Assembly Designation	Wt. kg/lbs.	Load Ratings kN/lbf.		Limiting Speed Oil RPM
	mm	d <sub>c1</sub>	D <sub>c</sub>	D <sub>w</sub>	E <sub>b</sub>	E <sub>a</sub>			r <sub>as max</sub>	C	
8	8	21	2	9.6	18.6	0.3	AXK0821TN	0.001 0.002	8.34 1870	21.1 4740	20000
10	10	24	2	11.0	22.5	0.3	AXK1024	0.003 0.007	9.32 2100	25.9 5820	17000
12	12	26	2	13.0	24.5	0.3	AXK1226	0.004 0.009	10.8 2430	32.3 7260	15000
15	15	28	2	17.0	27.0	0.3	AXK1528	0.004 0.009	11.1 2500	35.2 7910	15000
17	17	30	2	22.0	34.0	0.3	AXK1730TN	0.004 0.009	11.7 2630	38.7 8700	14000
20	20	35	2	22.0	34.0	0.3	AXK2035	0.001 0.001	12.8 2880	45.4 10200	12000
25	25	42	2	29.0	41.0	0.6	AXK2542	0.007 0.015	14.3 3210	56.8 12800	10000
30	30	47	2	35.0	46.0	0.6	AXK3047	0.009 0.020	16.0 3600	68.1 15300	9000
35	35	52	2	40.0	51.0	0.6	AXK3552	0.010 0.022	17.4 3910	79.5 17900	8100
40	40	60	3	45.0	58.0	0.6	AXK4060	0.016 0.035	27.1 6090	110.0 24700	7000
45	45	65	3	50.0	63.0	0.6	AXK4565	0.020 0.044	29.0 6520	124.0 27900	6500
50	50	70	3	55.0	68.0	0.6	AXK5070	0.020 0.044	30.8 6920	137.0 30800	6000
55	55	78	3	60.0	76.0	0.6	AXK5578	0.026 0.057	39.4 8860	195.0 43800	5300
60	60	85	3	65.0	83.0	0.6	AXK6085	0.035 0.077	44.5 10000	234.0 52600	4900
65	65	90	3	70.0	88.0	0.6	AXK6590	0.036 0.079	46.7 10500	254 57100	4600



# Needle Roller Thrust Bearings, Assemblies, Washers



Dimensions mm/in.				Washer Designation	Wt. kg/lbs.	Washer Designation	mm/in. Chamfer	Wt. kg/lbs.	Washer Designation Shaft Piloted	Washer Designation Housing Piloted	Radius mm/in.	Wt. kg/lbs.
d	D, d <sub>1</sub>	D <sub>1</sub>	h	Thin		Heavy	a				r <sub>s</sub> min	
<b>8</b> 0.3150	<b>21</b> 0.8268		<b>2.75</b> 0.108	<b>AS0821</b>	<b>0.002</b> 0.004	<b>LS0821</b>	<b>0.30</b> 0.012	<b>0.004</b> 0.009				
<b>10</b> 0.3937	<b>24</b> 0.9449		<b>2.75</b> 0.108	<b>AS1024</b>	<b>0.003</b> 0.007	<b>LS1024</b>	<b>0.50</b> 0.020	<b>0.008</b> 0.018				
<b>12</b> 0.4724	<b>26</b> 1.0236		<b>2.75</b> 0.108	<b>AS1226</b>	<b>0.003</b> 0.007	<b>LS1226</b>	<b>0.50</b> 0.020	<b>0.009</b> 0.020				
<b>15</b> 0.5906	<b>28</b> 1.1024	<b>16</b> 0.6299	<b>2.75</b> 0.108	<b>AS1528</b>	<b>0.003</b> 0.007	<b>LS1528</b>	<b>0.50</b> 0.020	<b>0.010</b> 0.022	<b>WS.81102</b>	<b>GS.81102</b>	<b>0.30</b> 0.012	<b>0.010</b> 0.022
<b>17</b> 0.6693	<b>30</b> 1.1811	<b>18</b> 0.7087	<b>2.75</b> 0.108	<b>AS1730</b>	<b>0.003</b> 0.007	<b>LS1730</b>	<b>0.50</b> 0.020	<b>0.011</b> 0.024	<b>WS.81103</b>	<b>GS.81103</b>	<b>0.30</b> 0.012	<b>0.011</b> 0.024
<b>20</b> 0.7874	<b>35</b> 1.3780	<b>21</b> 0.8268	<b>2.75</b> 0.108	<b>AS2035</b>	<b>0.005</b> 0.011	<b>LS2035</b>	<b>0.50</b> 0.020	<b>0.014</b> 0.031	<b>WS.81104</b>	<b>GS.81104</b>	<b>0.30</b> 0.012	<b>0.014</b> 0.031
<b>25</b> 0.9843	<b>42</b> 1.6535	<b>26</b> 1.0236	<b>3.00</b> 0.118	<b>AS2542</b>	<b>0.007</b> 0.015	<b>LS2542</b>	<b>1.00</b> 0.039	<b>0.021</b> 0.046	<b>WS.81105</b>	<b>GS.81105</b>	<b>0.60</b> 0.024	<b>0.021</b> 0.046
<b>30</b> 1.1811	<b>47</b> 1.8504	<b>32</b> 1.2598	<b>3.00</b> 0.118	<b>AS3047</b>	<b>0.008</b> 0.018	<b>LS3047</b>	<b>1.00</b> 0.039	<b>0.023</b> 0.051	<b>WS.81106</b>	<b>GS.81106</b>	<b>0.60</b> 0.024	<b>0.023</b> 0.051
<b>35</b> 1.3780	<b>52</b> 2.0472	<b>37</b> 1.4567	<b>3.50</b> 0.138	<b>AS3552</b>	<b>0.009</b> 0.020	<b>LS3552</b>	<b>1.00</b> 0.039	<b>0.030</b> 0.066	<b>WS.81107</b>	<b>GS.81107</b>	<b>0.60</b> 0.024	<b>0.032</b> 0.071
<b>40</b> 1.5748	<b>60</b> 2.3622	<b>42</b> 1.6535	<b>3.50</b> 0.138	<b>AS4060</b>	<b>0.012</b> 0.026	<b>LS4060</b>	<b>1.00</b> 0.039	<b>0.041</b> 0.090	<b>WS.81108</b>	<b>GS.81108</b>	<b>0.60</b> 0.024	<b>0.043</b> 0.095
<b>45</b> 1.7717	<b>65</b> 2.5591	<b>47</b> 1.8504	<b>4.00</b> 0.157	<b>AS4565</b>	<b>0.013</b> 0.029	<b>LS4565</b>	<b>1.00</b> 0.039	<b>0.052</b> 0.115	<b>WS.81109</b>	<b>GS.81109</b>	<b>0.60</b> 0.024	<b>0.054</b> 0.119
<b>50</b> 1.9685	<b>70</b> 2.7559	<b>52</b> 2.0472	<b>4.00</b> 0.157	<b>AS5070</b>	<b>0.014</b> 0.031	<b>LS5070</b>	<b>1.00</b> 0.039	<b>0.056</b> 0.123	<b>WS.81110</b>	<b>GS.81110</b>	<b>0.60</b> 0.024	<b>0.059</b> 0.130
<b>55</b> 2.1654	<b>78</b> 3.0709	<b>57</b> 2.2441	<b>5.00</b> 0.197	<b>AS5578</b>	<b>0.018</b> 0.040	<b>LS5578</b>	<b>1.00</b> 0.039	<b>0.091</b> 0.201	<b>WS.81111</b>	<b>GS.81111</b>	<b>0.60</b> 0.024	<b>0.094</b> 0.207
<b>60</b> 2.3622	<b>85</b> 3.3465	<b>62</b> 2.4409	<b>4.75</b> 0.187	<b>AS6085</b>	<b>0.022</b> 0.049	<b>LS6085</b>	<b>1.50</b> 0.059	<b>0.102</b> 0.225	<b>WS.81112</b>	<b>GS.81112</b>	<b>1.00</b> 0.039	<b>0.106</b> 0.234
<b>65</b> 2.5591	<b>90</b> 3.5433	<b>67</b> 2.6378	<b>5.25</b> 0.207	<b>AS6590</b>	<b>0.023</b> 0.051	<b>LS6590</b>	<b>1.50</b> 0.059	<b>0.121</b> 0.267	<b>WS.81113</b>	<b>GS.81113</b>	<b>1.00</b> 0.039	<b>0.125</b> 0.276

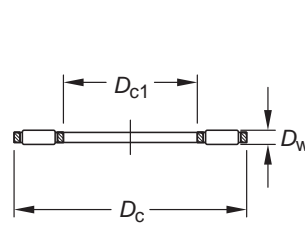
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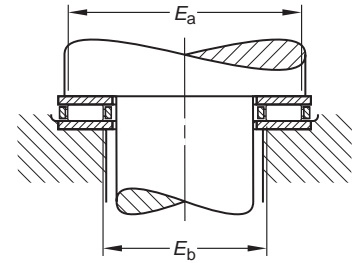
**NEEDLE ROLLER AND CAGE THRUST ASSEMBLIES, THRUST WASHERS - continued**

**METRIC SERIES**

- Dimensions for bore and O.D. of thrust assemblies and washers are nominal.
- See page C232 for details on piloting and backup surfaces.
- Thrust washers burnished at least one-quarter of bore area (remainder is rough breakaway finish).
- O.D. finish of washers will be as blanked.
- Thinner washers may be out of flat due to distortion in hardening in the free state (expected to flatten out under load).



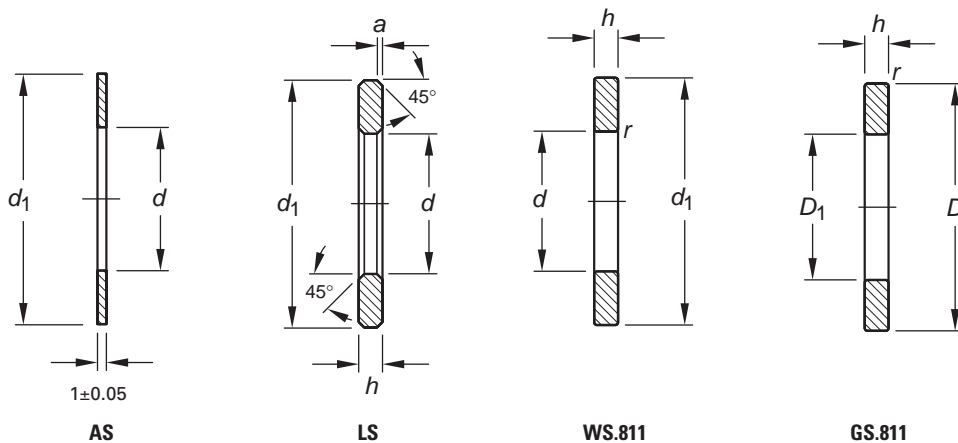
FNT, AXK



Raceway contact dimensions

Shaft Diameter	Dimensions mm/in.						Assembly Designation	Wt. kg/lbs.	Load Ratings kN/lbf.		Limiting Speed Oil RPM
	mm	$d_{c1}$	$D_c$	$D_w$	$E_b$	$E_a$			$r_{as\ max}$	C	
70	70	95	4	74.0	93.0	0.6	AXK7095	0.055	53.8	253	4400
	2.7559	3.7402	0.1575	2.913	3.661	0.024		0.121	12100	56900	
75	75	100	4	79.0	98.0	0.6	AXK75100	0.058	55.1	266	4200
	2.9528	3.9370	0.1575	3.110	3.858	0.024		0.128	12400	59800	
80	80	105	4	84.0	103.0	0.6	AXK80105	0.092	56.4	279	4000
	3.1496	4.1339	0.1575	3.307	4.055	0.024		0.203	12700	62700	
85	85	110	4	89.0	108.0	0.6	AXK85110	0.063	57.6	291	3800
	3.3465	4.3307	0.1575	3.504	4.252	0.024		0.139	12900	65400	
90	90	120	4	94.0	118.0	0.6	AXK90120	0.081	72.9	405	3500
	3.5433	4.7244	0.1575	3.701	4.646	0.024		0.179	16400	91000	
100	100	135	4	105.0	133.0	0.6	AXK100135	0.106	90.2	552	3100
	3.9370	5.3150	0.1575	4.134	5.236	0.024		0.234	20300	124000	
110	110	145	4	115.0	143.0	0.6	AXK110145	0.117	93.2	591	2800
	4.3307	5.7087	0.1575	4.528	5.630	0.024		0.258	21000	133000	
120	120	155	4	125.0	153.0	0.6	AXK120155	0.126	98.5	650	2700
	4.7244	6.1024	0.1575	4.921	6.024	0.024		0.278	22100	146000	
130	130	170	5	136.0	167.0	0.6	AXK130170	0.198	132	829	2400
	5.1181	6.6929	0.1969	5.354	6.575	0.024		0.437	29700	186000	
140	140	180	5	146.0	177.0	0.6	AXK140180	0.221	136	887	2300
	5.5118	7.0866	0.1969	5.748	6.969	0.024		0.487	30600	199000	
150	150	190	5	156.0	187.0	0.6	AXK150190	0.225	141	944	2200
	5.9055	7.4803	0.1969	6.142	7.362	0.024		0.496	31700	212000	
160	160	200	5	166.0	197.0	0.6	AXK160200	0.249	146	1000	2100
	6.2992	7.8740	0.1969	6.535	7.756	0.024		0.549	32800	225000	

# Needle Roller Thrust Bearings, Assemblies, Washers



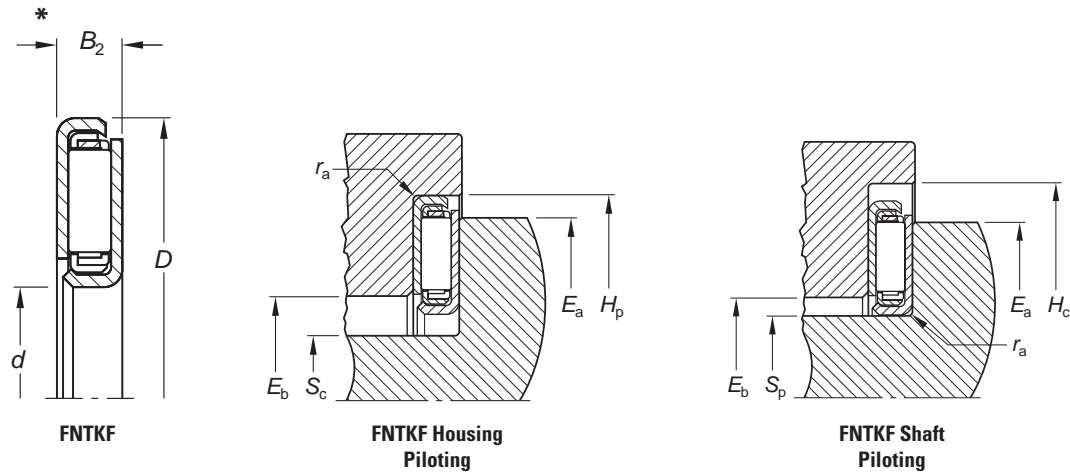
Dimensions mm/in.				Washer Designation	Wt. kg/lbs.	Washer Designation	mm/in. Chamfer	Wt. kg/lbs.	Washer Designation Shaft Piloted	Housing Piloted	Radius mm/in.	Wt. kg/lbs.
d	D, d <sub>1</sub>	D <sub>1</sub>	h	Thin		Heavy	a				r <sub>s min</sub>	
<b>70</b> 2.7559	<b>95</b> 3.7402	<b>72</b> 2.8346	<b>5.25</b> 0.207	<b>AS7095</b>	<b>0.025</b> 0.055	<b>LS7095</b>	<b>1.50</b> 0.059	<b>0.128</b> 0.282	<b>WS.81114</b>	<b>GS.81114</b>	<b>1.00</b> 0.039	<b>0.133</b> 0.293
<b>75</b> 2.9528	<b>100</b> 3.9370	<b>77</b> 3.0315	<b>5.75</b> 0.226	<b>AS75100</b>	<b>0.027</b> 0.060	<b>LS75100</b>	<b>1.50</b> 0.059	<b>0.150</b> 0.331	<b>WS.81115</b>	<b>GS.81115</b>	<b>1.00</b> 0.039	<b>0.155</b> 0.342
<b>80</b> 3.1496	<b>105</b> 4.1339	<b>82</b> 3.2283	<b>5.75</b> 0.226	<b>AS80105</b>	<b>0.028</b> 0.062	<b>LS80105</b>	<b>1.50</b> 0.059	<b>0.158</b> 0.348	<b>WS.81116</b>	<b>GS.81116</b>	<b>1.00</b> 0.039	<b>0.165</b> 0.364
<b>85</b> 3.3465	<b>110</b> 4.3307	<b>87</b> 3.4252	<b>5.75</b> 0.226	<b>AS85110</b>	<b>0.028</b> 0.062	<b>LS85110</b>	<b>1.50</b> 0.059	<b>0.166</b> 0.366	<b>WS.81117</b>	<b>GS.81117</b>	<b>1.00</b> 0.039	<b>0.173</b> 0.381
<b>90</b> 3.5433	<b>120</b> 4.7244	<b>92</b> 3.6220	<b>6.50</b> 0.256	<b>AS90120</b>	<b>0.038</b> 0.084	<b>LS90120</b>	<b>1.50</b> 0.059	<b>0.245</b> 0.540	<b>WS.81118</b>	<b>GS.81118</b>	<b>1.00</b> 0.039	<b>0.253</b> 0.558
<b>100</b> 3.9370	<b>135</b> 5.3150			<b>AS100135</b>	<b>0.050</b> 0.110							
<b>110</b> 4.3307	<b>145</b> 5.7087		<b>7.00</b> 0.276	<b>AS110145</b>	<b>0.055</b> 0.121	<b>LS110145</b>	<b>1.50</b> 0.059	<b>0.373</b> 0.822				
<b>120</b> 4.7244	<b>155</b> 6.1024			<b>AS120155</b>	<b>0.059</b> 0.130							
<b>130</b> 5.1181	<b>170</b> 6.6929		<b>9.00</b> 0.354	<b>AS130170</b>	<b>0.074</b> 0.163	<b>LS130170</b>	<b>1.50</b> 0.059	<b>0.065</b> 0.143				
<b>140</b> 5.5118	<b>180</b> 7.0866			<b>AS140180</b>	<b>0.078</b> 0.172							
<b>150</b> 5.9055	<b>190</b> 7.4803			<b>AS150190</b>	<b>0.083</b> 0.183							
<b>160</b> 6.2992	<b>200</b> 7.8740			<b>AS160200</b>	<b>0.089</b> 0.196							



**UNITIZED THRUST BEARING TYPE FNTKF**

**METRIC SERIES**

- Combines low friction and thin cross-section with the convenience of complete packaged assembly.
- Used where both thrust backup surfaces are not suitably hardened or ground.
- Backup surfaces should meet limits of permissible out-of-squareness, dishing or coning (see Figures 1 and 2 on page C232).
- Assembly can be either shaft or housing piloted, but not both (see mounting dimensions shown on the opposite page).
- Many special sizes available – contact your Timken representative.
- Call for availability.



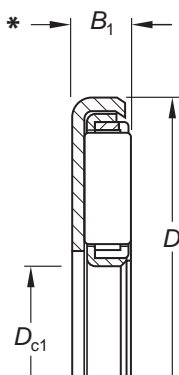
Shaft Diameter	Dimensions mm/in.			Assembly Designation	Load Ratings kN/lbf.		Limiting Speed Oil RPM	Mounting Dimensions mm/in.				Nominal	
	E13	e13	-0.2, -.002		Dynamic	Static		Housing Piloting H10	Max. Sc	Shaft Piloting h10	Min. Sp	Hc	Ea
mm	d	D	B2*		C	Co		H	Sc	Sp	Hc	Ea	Eb
10	10 0.3937	28 1.1024	3.7 0.146	FNTKF-1028	9.88 2220	29.0 6520	16000	28 1.102	8 0.31496	10 0.394	30 1.181	25 0.984	14 0.551
13	13 0.5118	30 1.1811	3.7 0.146	FNTKF-1330	10.1 2270	31.3 7040	15000	30 1.181	11 0.433	13 0.512	32 1.260	27 1.063	17 0.669
15	15 0.5906	32 1.2598	3.7 0.146	FNTKF-1532	10.8 2430	34.8 7820	14000	32 1.260	13 0.512	15 0.591	34 1.339	29 1.142	19 0.748
18	18 0.7087	37 1.4567	3.7 0.146	FNTKF-1837	13.8 3100	50.3 11300	12000	37 1.457	16 0.630	18 0.709	39 1.535	34 1.339	22 0.866
23	23 0.9055	44 1.7323	3.7 0.146	FNTKF-2344	18.0 4050	75.3 16900	9700	44 1.732	21 0.827	23 0.906	46 1.811	41 1.614	27 1.063
28	28 1.1024	49 1.9291	3.7 0.146	FNTKF-2849	18.6 4180	82.4 18500	8900	49 1.929	26 1.024	28 1.102	51 2.008	46 1.811	32 1.260
33	33 1.2992	54 2.126	3.7 0.146	FNTKF-3354	21.6 4860	104 23400	7900	54 2.126	31 1.220	33 1.299	56 2.205	51 2.008	37 1.457
38	38 1.4961	62 2.4409	4.7 0.185	FNTKF-3862	31.4 7060	132 29700	7100	62 2.441	36 1.417	38 1.496	64 2.520	57 2.244	43 1.693
43	43 1.6929	67 2.6378	4.7 0.185	FNTKF-4367	37.8 8500	173 38900	6400	67 2.638	41 1.614	43 1.693	69 2.717	63 2.480	47 1.850
48	48 1.890	72 2.8346	4.7 0.185	FNTKF-4872	37.9 8520	179 40200	5900	72 2.835	46 1.811	48 1.890	74 2.913	68 2.677	52 2.047
53	53 2.0866	80 3.150	4.7 0.185	FNTKF-5380	48.5 10900	254 57100	5300	80 3.150	51 2.008	53 2.087	82 3.228	76 2.992	57 2.244

\* To be measured under a 1.5 kN (0.34 lb.) load.

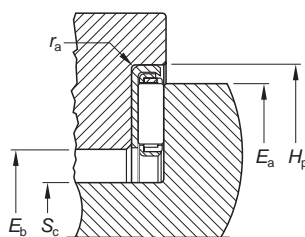
## UNITIZED THRUST BEARING TYPE FNTK

### METRIC SERIES

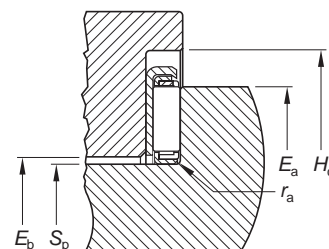
- Combine low friction and thin cross-section with the convenience of complete packaged assembly.
- Integral washer allows use where one thrust backup surfaces is not suitably hardened or ground.
- Backup surface should meet limits of permissible out-of-squareness, dishing or coning (see Figures 1 and 2 on page C232).
- Backup surface finish of 0.2  $\mu\text{m}$   $R_a$  (min.) or 8.0  $\mu\text{in}$   $R_a$  (min.) required.
- Assembly can be either shaft or housing piloted, but not both (see mounting dimensions shown on the opposite page).
- Many special sizes available – contact your Timken representative.
- Call for availability.



FNTK



FNTK Housing Piloting



FNTK Shaft Piloting

Shaft Diameter	Dimensions mm/in.			Assembly Designation	Load Ratings kN/lbf.		Limiting Speed Oil RPM	Mounting Dimensions mm/in.				Nominal	
	E13	e13	-0.2, -.002		Dynamic	Static		Housing Piloting H10	Shaft Piloting h10	Max.	Min.		
mm	d	D	B <sub>2</sub>		C	C <sub>0</sub>		H	S <sub>c</sub>	S <sub>p</sub>	H <sub>c</sub>	E <sub>a</sub>	E <sub>b</sub>
12	12 0.4724	28 1.1024	2.85 0.1122	FNTK-1228	9.88 2220	29.0 6520	16000	28 1.102	10.5 0.413	12 0.4724	29.5 1.161	25 0.9843	14 0.5512
15	15 0.5906	30 1.1811	2.85 0.1122	FNTK-1530	10.1 2270	31.3 7040	15000	30 1.181	13.5 0.531	15 0.5906	31.5 1.240	27 1.063	17 0.6693
17	17 0.6693	32 1.260	2.85 0.1122	FNTK-1732	10.8 2430	34.8 7820	14000	32 1.260	15.5 0.610	17 0.6693	33.5 1.319	29 1.1417	19 0.748
20	20 0.7874	37 1.4567	2.85 0.1122	FNTK-2037	13.8 3100	50.3 11300	12000	37 1.457	18.5 0.728	20 0.7874	38.5 1.516	34 1.3386	22 0.8661
25	25 0.9843	44 1.7323	2.85 0.1122	FNTK-2544	18.0 4050	75.3 16900	9700	44 1.732	23.5 0.925	25 0.9843	45.5 1.791	41 1.6142	27 1.063
30	30 1.1811	49 1.9291	2.85 0.1122	FNTK-3049	18.6 4180	82.4 18500	8900	49 1.929	28.5 1.122	30 1.1811	50.5 1.988	46 1.811	32 1.260
35	35 1.378	54 2.126	2.85 0.1122	FNTK-3554	21.6 4860	104 23400	7900	54 2.126	33.5 1.319	35 1.378	55.5 2.185	51 2.0079	37 1.4567
40	40 1.5748	62 2.4409	3.85 0.1516	FNTK-4062	31.4 7060	132 29700	7100	62 2.441	38.5 1.516	40 1.5748	63.5 2.500	57 2.2441	43 1.6929
45	45 1.7717	67 2.6378	3.85 0.1516	FNTK-4567	37.8 8500	173 38900	6400	67 2.638	43.5 1.713	45 1.7717	68.5 2.697	63 2.480	47 1.850
50	50 1.9685	72 2.8346	3.85 0.1516	FNTK-5072	37.9 8520	179 40200	5900	72 2.835	48.5 1.909	50 1.9685	73.5 2.894	68 2.6772	52 2.0472
55	55 2.1654	80 3.150	3.85 0.1516	FNTK-5580	48.5 10900	254 57100	5300	80 3.150	53.5 2.106	55 2.1654	81.5 3.209	76 2.9921	57 2.2441

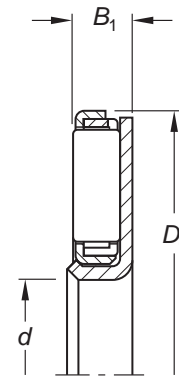
\* To be measured under a 1.5 kN (0.34 lb.) load.



**UNITIZED THRUST BEARING ASSEMBLIES**

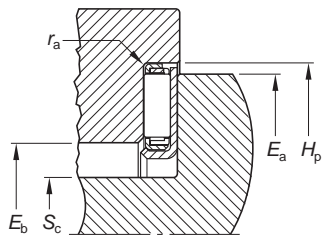
**METRIC SERIES**

- Combine low friction and thin cross-section with the convenience of complete packaged assembly.
- Integral washer allows use where one thrust backup surfaces is not suitably hardened or ground.
- Backup surface should meet limits of permissible out-of-squareness, dishing or coning (see Figures 1 and 2 on page C232).
- Backup surface finish of 0.2  $\mu\text{m}$   $R_a$  (min.) or 8.0  $\mu\text{in}$   $R_a$  (min.) required.
- Assembly can be either shaft or housing piloted, but not both (see mounting dimensions shown on the opposite page).
- Many special sizes available – contact your Timken representative.

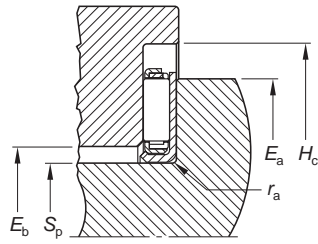


Shaft Diameter	Dimensions mm/in.			Assembly Designation	Load Ratings kN/lbf		Limiting Speed Oil
	(E13)	(C12)	(-0.1)		Dynamic	Static	
	mm	$d$	$D_c$		$B_1^*$	C	
10	10 0.394	26 1.024	2.85 0.112	FNTF-1026	9.88 2220	29.0 6520	16000
13	13 0.512	28 1.102	2.85 0.112	FNTF-1328	10.1 2270	31.3 7040	15000
15	15 0.591	30 1.181	2.85 0.112	FNTF-1530	10.8 2430	34.8 7820	14000
18	18 0.709	35 1.378	2.85 0.112	FNTF-1835	13.8 3100	50.3 11300	12000
23	23 0.906	42 1.654	2.85 0.112	FNTF-2342	18.0 4050	75.3 16900	9700
28	28 1.102	47 1.850	2.85 0.112	FNTF-2847	18.6 4180	82.4 18500	8900
33	33 1.299	52 2.047	2.85 0.112	FNTF-3352	21.6 4860	104 23400	7900
38	38 1.496	60 2.362	3.85 0.152	FNTF-3860	31.4 7060	132 29700	7100
43	43 1.693	65 2.559	3.85 0.152	FNTF-4365	37.8 8500	173 38900	6400
48	48 1.890	70 2.756	3.85 0.152	FNTF-4870	37.9 8520	179 40200	5900
53	53 2.087	78 3.071	3.85 0.152	FNTF-5378	48.5 10900	254 57100	5300

\* To be measured under a 1.5 kN (0.34 lb.) load.  
 Timken manufactures many special sizes of Unitized Needle Roller Thrust Bearing Assemblies.  
 Please contact your Timken representative for availability.



FNTF Housing Piloting



FNTF Shaft Piloting

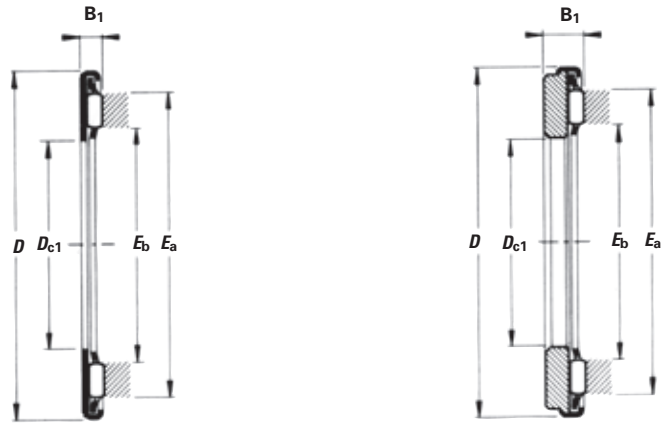
Housing Piloting		Mounting Dimensions mm/in.			
(H10)	(Max.)	Shaft Piloting		(Nom.)	(Nom.)
H <sub>p</sub>	S <sub>c</sub>	S <sub>p</sub>	H <sub>c</sub>	E <sub>a</sub>	E <sub>b</sub>
26 1.024	8.5 0.335	10 0.394	27.5 1.083	25 0.984	14 0.551
28 1.102	11.5 0.453	13 0.512	29.5 1.161	27 1.063	17 0.669
30 1.181	13.5 0.531	15 0.591	31.5 1.240	29 1.142	19 0.748
35 1.378	16.5 0.650	18 0.709	36.5 1.437	34 1.339	22 0.866
42 1.654	21.5 0.846	23 0.906	43.5 1.713	41 1.614	27 1.063
47 1.850	26.5 1.043	28 1.102	48.5 1.909	46 1.811	32 1.260
52 2.047	31.5 1.240	33 1.299	53.5 2.106	51 2.008	37 1.457
60 2.362	36.5 1.437	38 1.496	61.5 2.421	57 2.244	43 1.693
65 2.559	41.5 1.634	43 1.693	66.5 2.618	63 2.480	47 1.850
70 2.756	46.5 1.831	48 1.890	71.5 2.815	68 2.677	52 2.047
78 3.071	51.5 2.028	53 2.087	79.5 3.130	76 2.992	57 2.244

r<sub>as</sub> = 1.0 mm max. (0.039 in. max.)



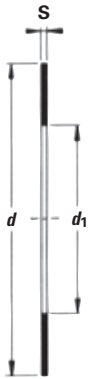
## UNITIZED THRUST BEARINGS

### METRIC SERIES



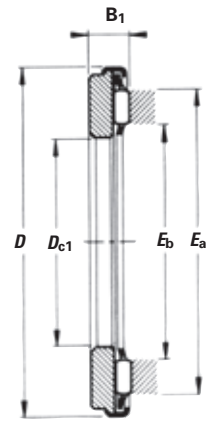
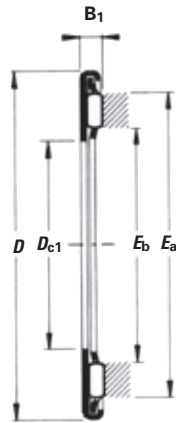
Shaft Diameter	Dimensions mm/in.					Bearing Designation		Wt. kg/lbs.	Load Ratings kN/lbf.		Limiting Speed Oil RPM
	D <sub>c1</sub>	D	E <sub>a</sub>	E <sub>b</sub>	B <sub>1</sub>	Thin Series	Thick Series		Dynamic C	Static C <sub>0</sub>	
5	5 0.205	13 0.513	10.9 0.43	6.3 0.25	2.3 0.090	AX 5 13		1.3 0.003	3.00 670	5.70 1280	25000
5	13 0.205	10.9 0.513	6.3 0.43	3.5 0.25	0.138	AX 3,5 5 13		2.3 0.005	3.00 670	5.70 1280	25000
6	6 0.244	14 0.553	11.9 0.47	7.3 0.29	2.3 0.090	AX 6 14		1.4 0.003	3.15 710	6.35 1430	22000
	6 0.243	14 0.553	11.9 0.47	7.3 0.29	3.5 0.138		AX 3,5 6 14	2.4 0.005	3.15 710	6.35 1430	22000
7	7 0.283	15 0.592	12.9 0.51	8.3 0.33	2.3 0.090	AX 7 15		1.7 0.004	3.55 800	7.60 1710	22000
	7 0.282	15 0.592	12.9 0.51	8.3 0.33	3.5 0.138		AX 3,5 7 15	2.9 0.006	3.55 800	7.60 1710	22000
8	8 0.323	16 0.631	13.9 0.55	9.3 0.37	2.3 0.090	AX 8 16		1.7 0.004	3.70 830	8.30 1870	22000
	8 0.321	16 0.631	13.9 0.55	9.3 0.37	3.5 0.138		AX 3,5 8 16	3 0.007	3.70 830	8.30 1870	22000
9	9 0.362	17 0.671	14.9 0.59	10.3 0.41	2.3 0.090	AX 9 17		2.1 0.005	4.05 910	9.50 2140	19000
	9 0.361	17 0.671	14.9 0.59	10.3 0.41	3.5 0.138		AX 3,5 9 17	3.6 0.008	4.05 910	9.50 2140	19000
10	10 0.400	22 0.868	18.6 0.73	12.0 0.47	4.0 0.157		AX 4 10 22	6.6 0.015	5.00 1120	10.90 2450	15500
12	12 0.481	26 1.025	22.6 0.89	15.0 0.59	2.8 0.110	AX 12 26		6 0.013	6.90 1550	17.70 3980	13000
	12 0.479	26 1.025	22.6 0.89	15.0 0.59	4.0 0.157		AX 4 12 26	10 0.022	6.90 1550	17.70 3980	13000
13	13 0.521	26 1.025	22.6 0.89	15.0 0.59	2.8 0.110	AX 13 26		6 0.013	6.90 1550	17.70 3980	13000
	13 0.519	26 1.025	22.6 0.89	15.0 0.59	4.0 0.157		AX 4 13 26	9.8 0.022	6.90 1550	17.70 3980	13000
14											
15	15 0.600	28 1.104	24.6 0.97	17.0 0.67	2.8 0.110	AX 15 28		6.9 0.015	7.40 1660	20.00 4500	11500
	15 0.598	28 1.104	24.6 0.97	17.0 0.67	4.0 0.157		AX 4 15 28	9 0.020	7.40 1660	20.00 4500	11500



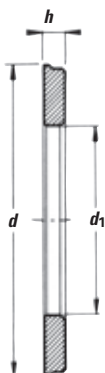
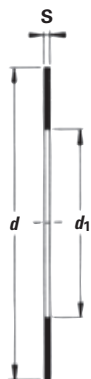


Dimensions mm/in.			Thin Wt. kg/lbs.	Washer Designation		Thick Wt. kg/lbs.	Washer Designation Precision	mm/in.	Precision Wt. kg/lbs.	Shaft mm	
d	d <sub>1</sub>	s		Thin	Thick						mm/in.
<b>5</b> 0.201	<b>12.4</b> 0.488	<b>0.8</b> 0.031	<b>0.001</b> 0.001	<b>CP 5 13</b>						<b>5</b>	
					<b>CP 2 5 13</b>	<b>2.0</b> 0.079	<b>0.002</b> 0.004				
<b>6</b> 0.240	<b>13.4</b> 0.528	<b>0.8</b> 0.031	<b>0.001</b> 0.002	<b>CP 6 14</b>						<b>6</b>	
					<b>CP 2 6 14</b>	<b>2.0</b> 0.079	<b>0.002</b> 0.004				
<b>7</b> 0.280	<b>14.4</b> 0.567	<b>0.8</b> 0.031	<b>0.001</b> 0.002	<b>CP 7 15</b>						<b>7</b>	
					<b>CP 2 7 15</b>	<b>2.0</b> 0.079	<b>0.002</b> 0.004				
<b>8</b> 0.319	<b>15.4</b> 0.606	<b>0.8</b> 0.031	<b>0.001</b> 0.002	<b>CP 8 16</b>						<b>8</b>	
					<b>CP 2 8 16</b>	<b>2.0</b> 0.079	<b>0.002</b> 0.005				
<b>9</b> 0.358	<b>16.4</b> 0.646	<b>0.8</b> 0.031	<b>0.001</b> 0.002	<b>CP 9 17</b>						<b>9</b>	
					<b>CP 2 9 17</b>	<b>2.0</b> 0.079	<b>0.002</b> 0.005				
<b>10</b> 0.396	<b>21.2</b> 0.836			<b>CP 2 10 22</b>		<b>2.0</b> 0.079	<b>0.002</b> 0.004			<b>10</b>	
<b>12</b> 0.474	<b>25.5</b> 1.003	<b>0.8</b> 0.031	<b>0.003</b> 0.006	<b>CP 12 26</b>				<b>CPN 2 12 26</b>	<b>2.0</b> 0.079	<b>0.006</b> 0.013	<b>12</b>
					<b>CP 2 12 26</b>	<b>2.0</b> 0.079	<b>0.006</b> 0.014				
<b>13</b> 0.514	<b>25.5</b> 1.003	<b>0.8</b> 0.031	<b>0.002</b> 0.005	<b>CP 13 26</b>						<b>13</b>	
					<b>CP 2 13 26</b>	<b>2.0</b> 0.079	<b>0.006</b> 0.013				
<b>14</b> 0.553	<b>25.5</b> 1.003	<b>0.8</b> 0.031	<b>0.002</b> 0.005	<b>CP 14 26</b>							
					<b>CP 2 14 26</b>	<b>2.0</b> 0.079	<b>0.006</b> 0.012				
<b>15</b> 0.593	<b>27.5</b> 1.081	<b>0.8</b> 0.031	<b>0.003</b> 0.006	<b>CP 15 28</b>				<b>CPN 2 15 28</b>	<b>2.0</b> 0.079	<b>0.006</b> 0.013	<b>15</b>
					<b>CP 2 15 28</b>	<b>2.0</b> 0.079	<b>0.006</b> 0.013				

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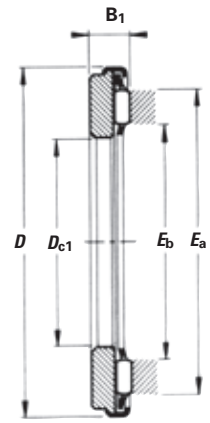
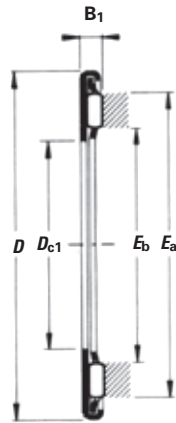
**UNITIZED THRUST BEARINGS — continued**
**METRIC SERIES**


Shaft Diameter	Dimensions mm/in.					Bearing Designation		Wt. kg/lbs.	Load Ratings kN/lbf.		Limiting Speed Oil RPM
	D <sub>c1</sub>	D	E <sub>a</sub>	E <sub>b</sub>	B <sub>1</sub>	Thin Series	Thick Series		Dynamic C	Static C <sub>0</sub>	
17	17	30	26.6	19.0	2.8	AX 17 30		7.6	7.80	22.00	10500
	0.678	1.183	1.05	0.75	0.110			0.017	1750	4950	
	17	30	26.6	19.0	4.0		AX 4 17 30	10	7.80	22.00	10500
	0.677	1.183	1.05	0.75	0.157			0.022	1750	4950	
18											
19	19	32	28.6	21.0	2.8	AX 19 32		8.6	8.00	23.30	10000
	0.757	1.261	1.13	0.83	0.110			0.019	1800	5240	
	19	32	28.6	21.0	4.0		AX 4 19 32	13	8.00	23.30	10000
	0.756	1.261	1.13	0.83	0.157			0.029	1800	5240	
20	20	35	31.6	22.0	5.0		AX 5 20 35	18	11.80	39.00	9000
	0.795	1.379	1.24	0.87	0.197			0.040	2650	8770	
25	25	42	37.4	27.7	2.8	AX 25 42		11.5	13.30	49.00	7500
	0.994	1.655	1.47	1.09	0.110			0.025	2990	11000	
	25	42	37.4	27.7	5.0		AX 5 25 42	25	13.30	49.00	7500
	0.992	1.655	1.47	1.09	0.197			0.055	2990	11000	
27											
27	27	44	39.6	30.0	2.8	AX 27 44		12.1	13.70	52.00	7200
	1.073	1.734	1.56	1.18	0.110			0.027	3080	11690	
30	30	47	42.4	32.7	2.8	AX 30 47		13.7	14.50	57.00	6500
	1.193	1.852	1.67	1.29	0.110			0.030	3260	12800	
	30	47	42.4	32.7	5.0		AX 5 30 47	29	14.50	57.00	6500
	1.189	1.852	1.67	1.29	0.197			0.064	3260	12800	
31	35	52	49.0	37.2	2.8	AX 35 52		18.5	18.90	84.00	5500
	1.385	2.048	1.93	1.46	0.110			0.041	4250	18900	
35	35	52	49.0	37.2	5.0		AX 5 35 52	35	18.90	84.00	5500
	1.386	2.048	1.93	1.46	0.197			0.077	4250	18900	
	35	53	49.0	37.2	2.8	AX 35 53		19.3	18.90	84.00	5500
	1.390	2.088	1.93	1.46	0.110			0.043	4250	18900	
	35	53	49.0	37.2	5.0		AX 5 35 53	36	18.90	84.00	5500
	1.386	2.088	1.93	1.46	0.197			0.079	4250	18900	
40	40	60	54.9	43.0	2.8	AX 40 60		23.9	20.40	96.00	5000
	1.587	2.363	2.16	1.69	0.110			0.053	4590	21600	
	40	60	54.9	43.0	5.0		AX 5 40 60	46	20.40	96.00	5000
	1.583	2.363	2.16	1.69	0.197			0.101	4590	21600	

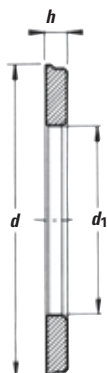
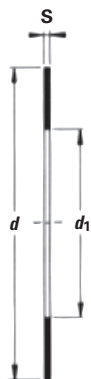


Dimensions mm/in.			Thin Wt. kg/lbs.	Washer Designation		Thick Wt. kg/lbs.	Washer Designation Precision	Precision Wt. kg/lbs.	Shaft		
d	d <sub>1</sub>	s		Thin	Thick					mm/in.	mm/in.
<b>17</b> 0.671	<b>29.5</b> 1.160	<b>0.8</b> 0.031	<b>0.003</b> 0.006	<b>CP 17 30</b>			<b>CPN 7 17 30</b>	<b>7.0</b> 0.276	<b>0.025</b> 0.055	<b>17</b>	
					<b>CP 2 17 30</b>	<b>2.0</b> 0.079	<b>0.007</b> 0.015				
<b>18</b> 0.711	<b>29.5</b> 1.160	<b>0.8</b> 0.031	<b>0.003</b> 0.006	<b>CP 18 30</b>							
					<b>CP 2 18 30</b>	<b>2.0</b> 0.079	<b>0.007</b> 0.015				
<b>19</b> 0.750	<b>31.5</b> 1.239	<b>0.8</b> 0.031	<b>0.004</b> 0.008	<b>CP 19 32</b>						<b>19</b>	
					<b>CP 2 19 32</b>	<b>2.0</b> 0.079	<b>0.009</b> 0.020				
<b>20</b> 0.789	<b>34.5</b> 1.357				<b>CP 3 20 35</b>	<b>3.0</b> 0.118	<b>0.013</b> 0.029	<b>CPN 3 20 35</b>	<b>3.0</b> 0.118	<b>0.013</b> 0.029	<b>20</b>
<b>25</b> 0.988	<b>41.5</b> 1.634	<b>0.8</b> 0.031	<b>0.005</b> 0.012	<b>CP 25 42</b>				<b>CPN 3 25 42</b>	<b>3.0</b> 0.118	<b>0.019</b> 0.042	<b>25</b>
					<b>CP 3 25 42</b>	<b>3.0</b> 0.118	<b>0.019</b> 0.042				
<b>27</b> 1.065	<b>43.7</b> 1.719	<b>0.8</b> 0.031	<b>0.006</b> 0.013	<b>CP 27 44</b>						<b>27</b>	
<b>30</b> 1.183	<b>46.5</b> 1.830	<b>0.8</b> 0.031	<b>0.006</b> 0.013	<b>CP 30 47</b>				<b>CPN 5 30 47</b>	<b>5.0</b> 0.197	<b>0.037</b> 0.082	<b>30</b>
					<b>CP 3 30 47</b>	<b>3.0</b> 0.118	<b>0.022</b> 0.049				
<b>35</b> 1.380	<b>51.5</b> 2.026	<b>0.8</b> 0.031	<b>0.007</b> 0.015	<b>CP 35 52</b>				<b>CPN 3 35 52</b>	<b>3.0</b> 0.118	<b>0.027</b> 0.060	<b>31</b>
					<b>CP 3 35 52</b>	<b>3.0</b> 0.118	<b>0.026</b> 0.057				
		<b>0.8</b> 0.031	<b>0.007</b> 0.016	<b>CP 35 53</b>							
					<b>CP 3 35 53</b>	<b>3.0</b> 0.118	<b>0.027</b> 0.060				
<b>40</b> 1.577	<b>59.5</b> 2.341	<b>0.8</b> 0.031	<b>0.009</b> 0.021	<b>CP 40 60</b>				<b>CPN 3 40 60</b>	<b>3.0</b> 0.118	<b>0.034</b> 0.075	<b>40</b>

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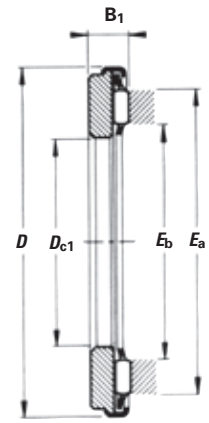
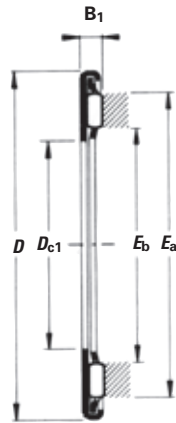
**UNITIZED THRUST BEARINGS — *continued***
**METRIC SERIES**


Shaft Diameter	Dimensions mm/in.					Bearing Designation		Wt. kg/lbs.	Load Ratings kN/lbf.		Limiting Speed Oil RPM
	D <sub>c1</sub>	D	E <sub>a</sub>	E <sub>b</sub>	B <sub>1</sub>	Thin Series	Thick Series		Dynamic C	Static C <sub>0</sub>	
45	45	65	59.9	48.0	2.8	AX 45 65		24.7	21.80	109	4500
	1.783	2.560	2.36	1.89	0.110			0.054	4900	24500	
45	45	65	59.9	48.0	5.0		AX 5 45 65	50	21.80	109	4500
	1.780	2.560	2.36	1.89	0.197			0.110	4900	24500	
50	50	70	65.7	53.3	2.8	AX 50 70		25.5	22.50	118	4000
	1.982	2.757	2.59	2.10	0.110			0.056	5060	26500	
50	50	70	65.7	53.3	5.0		AX 5 50 70	55	22.50	118	4000
	1.976	2.757	2.59	2.10	0.197			0.121	5060	26500	
55	55	78	72.5	58.4	2.8	AX 55 78		34	28.50	164	3800
	2.179	3.072	2.85	2.30	0.110			0.075	6410	36900	
55	55	78	72.5	58.4	6.0		AX 6 55 78	89	28.50	164	3800
	2.174	3.072	2.85	2.30	0.236			0.196	6410	36900	
60	60	85	79.2	63.5	6.0		AX 6 60 85	106	31.50	193	3500
	2.371	3.347	3.12	2.50	0.236			0.234	7080	43400	
65	65	90	84.2	68.5	3.5	AX 3,5 65 90		59	33.50	210	3200
	2.573	3.544	3.31	2.70	0.138			0.130	7530	47200	
65	65	90	84.2	68.5	6.0		AX 6 65 90	114	33.50	210	3200
	2.568	3.544	3.31	2.70	0.236			0.251	7530	47200	
70	70	95	89.2	73.5	3.5	AX 3,5 70 95		61	34.50	223	3000
	2.770	3.741	3.51	2.89	0.138			0.134	7760	50100	
70	70	95	89.2	73.5	6.0		AX 6 70 95	120	34.50	223	3000
	2.765	3.741	3.51	2.89	0.236			0.265	7760	50100	
75	75	100	94.2	78.5	3.5	AX 3,5 75 100		65	36.00	240	2900
	2.967	3.938	3.71	3.09	0.138			0.143	8090	54000	
75	75	100	94.2	78.5	6.0		AX 6 75 100	127	36.00	240	2900
	2.961	3.938	3.71	3.09	0.236			0.280	8090	54000	
80	80	105	99.2	83.5	3.5	AX 3,5 80 105		69	36.50	253	2700
	3.165	4.135	3.91	3.29	0.138			0.152	8210	56900	
80	80	105	99.2	83.5	6.0		AX 6 80 105	134	36.50	253	2700
	3.158	4.135	3.91	3.29	0.236			0.295	8210	56900	
85	85	110	104.2	88.5	3.5	AX 3,5 85 110		78	38.00	270	2600
	3.362	4.332	4.10	3.48	0.138			0.172	8540	60700	
85	85	110	104.2	88.5	6.0		AX 6 85 110	142	38.00	270	2600
	3.356	4.332	4.10	3.48	0.236			0.313	8540	60700	
90	90	120	112.9	94.2	4.5	AX 4,5 90 120		117	59.00	360	2400
	3.559	4.725	4.44	3.71	0.177			0.258	13300	80900	
90	90	120	112.9	94.2	8.0		AX 8 90 120	238	59.00	360	2400
	3.553	4.725	4.44	3.71	0.315			0.525	13300	80900	

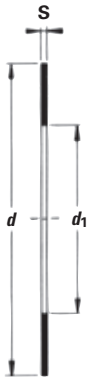


Dimensions mm/in.			Thin Wt. kg/lbs.	Washer Designation		Thick Wt. kg/lbs.	Washer Designation Precision	Precision Wt. kg/lbs.	Shaft	
d	d <sub>1</sub>	s		Thin	Thick					mm/in.
					<b>CP 3 40 60</b>	<b>3.0</b> 0.118	<b>0.034</b> 0.075			
<b>45</b> 1.774	<b>64.3</b> 2.533	<b>0.8</b> 0.031	<b>0.010</b> 0.022	<b>CP 45 65</b>			<b>CPN 3 45 65</b>	<b>3.0</b> 0.118	<b>0.037</b> 0.082	<b>45</b>
				<b>CP 3 45 65</b>	<b>3.0</b>	<b>0.037</b> 0.118	<b>0.082</b>			
<b>50</b> 1.970	<b>69.4</b> 2.731	<b>0.8</b> 0.031	<b>0.011</b> 0.024	<b>CP 50 70</b>					<b>50</b>	
				<b>CP 3 50 70</b>	<b>3.0</b>	<b>0.040</b> 0.118	<b>0.088</b>			
<b>55</b> 2.167	<b>77.4</b> 3.046	<b>0.8</b> 0.031	<b>0.014</b> 0.031	<b>CP 55 78</b>					<b>55</b>	
				<b>CP 4 55 78</b>		<b>4.0</b> 0.157	<b>0.069</b> 0.152			
<b>60</b> 2.366	<b>84.3</b> 3.318			<b>CP 4 60 85</b>	<b>4.0</b>	<b>0.083</b> 0.157		<b>60</b>		
<b>65</b> 2.563	<b>89.3</b> 3.515	<b>1.5</b> 0.059	<b>0.033</b> 0.073	<b>CP 1,5 65 90</b>					<b>65</b>	
				<b>CP 4 65 90</b>		<b>4.0</b> 0.157	<b>0.088</b> 0.194			
<b>70</b> 2.760	<b>94.3</b> 3.711	<b>1.5</b> 0.059	<b>0.034</b> 0.076	<b>CP 1,5 70 95</b>			<b>CPN 4 70 95</b>	<b>4.0</b> 0.157	<b>0.093</b> 0.205	<b>70</b>
				<b>CP 4 70 95</b>		<b>4.0</b> 0.157	<b>0.093</b> 0.205			
<b>75</b> 2.961	<b>99</b> 3.901	<b>1.5</b> 0.059	<b>0.037</b> 0.082	<b>CP 1,5 75 100</b>					<b>75</b>	
				<b>CP 4 75 100</b>		<b>4.0</b> 0.157	<b>0.099</b> 0.218			
<b>80</b> 3.157	<b>104</b> 4.098	<b>1.5</b> 0.059	<b>0.039</b> 0.086	<b>CP 1,5 80 105</b>					<b>80</b>	
				<b>CP 4 80 105</b>		<b>4.0</b> 0.157	<b>0.104</b> 0.229			
<b>85</b> 3.350	<b>109</b> 4.302	<b>1.5</b> 0.059	<b>0.047</b> 0.103	<b>CP 1,5 85 110</b>					<b>85</b>	
				<b>CP 4 85 110</b>		<b>4.0</b> 0.157	<b>0.111</b> 0.245			
<b>90</b> 3.544	<b>119</b> 4.676	<b>1.5</b> 0.059	<b>0.052</b> 0.115	<b>CP 1,5 90 120</b>					<b>90</b>	

Continued on next page.

**UNITIZED THRUST BEARINGS — continued**
**METRIC SERIES**


Shaft Diameter	Dimensions mm/in.					Bearing Designation		Wt. kg/lbs.	Load Ratings kN/lbf.		Limiting Speed Oil RPM
	D <sub>c1</sub>	D	E <sub>a</sub>	E <sub>b</sub>	B <sub>1</sub>	Thin Series	Thick Series		Dynamic C	Static C <sub>0</sub>	
<b>100</b>	<b>100</b>	<b>135</b>	<b>127.3</b>	<b>104.2</b>	<b>9.0</b>		<b>AX 9 100 135</b>	<b>364</b>	<b>73.00</b>	<b>490</b>	<b>2100</b>
	3.947	5.316	5.01	4.10	0.354			0.802	16400	110000	
<b>110</b>	<b>110</b>	<b>145</b>	<b>137.3</b>	<b>114.2</b>	<b>4.5</b>		<b>AX 4,5 110 145</b>	<b>168</b>	<b>77.00</b>	<b>550</b>	<b>2000</b>
	4.346	5.709	5.41	4.50	0.177			0.370	17300	124000	
	<b>110</b>	<b>145</b>	<b>137.3</b>	<b>114.2</b>	<b>9.0</b>		<b>AX 9 110 145</b>	<b>393</b>	<b>77.00</b>	<b>550</b>	<b>2000</b>
	4.341	5.709	5.41	4.50	0.354			0.866	17300	124000	
<b>120</b>	<b>120</b>	<b>155</b>	<b>147.3</b>	<b>124.2</b>	<b>4.5</b>		<b>AX 4,5 120 155</b>	<b>182</b>	<b>80.00</b>	<b>590</b>	<b>1800</b>
	4.740	6.103	5.80	4.89	0.177			0.401	18000	133000	
	<b>120</b>	<b>155</b>	<b>147.3</b>	<b>124.2</b>	<b>9.0</b>		<b>AX 9 120 155</b>	<b>424</b>	<b>80.00</b>	<b>590</b>	<b>1800</b>
	4.734	6.103	5.80	4.89	0.354			0.935	18000	133000	
<b>130</b>	<b>130</b>	<b>170</b>	<b>161.0</b>	<b>135.0</b>	<b>11.0</b>		<b>AX 11 130 170</b>	<b>660</b>	<b>106</b>	<b>710</b>	<b>1700</b>
	5.129	6.694	6.34	5.31	0.432			1.455	23800	160000	
<b>140</b>	<b>140</b>	<b>180</b>	<b>171.0</b>	<b>145.0</b>	<b>9.0</b>		<b>AX 11 140 180</b>	<b>670</b>	<b>111</b>	<b>770</b>	<b>1600</b>
	5.522	7.087	6.73	5.71	0.353			1.477	25000	173000	
<b>150</b>	<b>150</b>	<b>190</b>	<b>181.0</b>	<b>155.0</b>	<b>9.0</b>		<b>AX 11 150 190</b>	<b>710</b>	<b>115</b>	<b>830</b>	<b>1500</b>
	5.916	7.481	7.13	6.10	0.353			1.565	25900	187000	
<b>160</b>	<b>160</b>	<b>200</b>	<b>191.0</b>	<b>165.0</b>	<b>9.0</b>		<b>AX 11 160 200</b>	<b>760</b>	<b>118</b>	<b>870</b>	<b>1400</b>
	6.310	7.874	7.52	6.50	0.353			1.676	26500	196000	
<b>170</b>	<b>170</b>	<b>215</b>	<b>207.0</b>	<b>175.0</b>	<b>12.0</b>		<b>AX 12 170 215</b>	<b>1000</b>	<b>165</b>	<b>1160</b>	<b>1300</b>
	6.704	8.465	8.15	6.89	0.471			2.205	37100	261000	
<b>180</b>	<b>180</b>	<b>225</b>	<b>217.0</b>	<b>185.0</b>	<b>12.0</b>		<b>AX 12 180 225</b>	<b>1050</b>	<b>173</b>	<b>1250</b>	<b>1200</b>
	7.097	8.859	8.54	7.28	0.471			2.315	38900	281000	
<b>190</b>	<b>190</b>	<b>240</b>	<b>232.0</b>	<b>196.0</b>	<b>13.9</b>		<b>AX 14 190 240</b>	<b>1400</b>	<b>230</b>	<b>1650</b>	<b>1200</b>
	7.493	9.449	9.13	7.72	0.549			3.086	51700	371000	
<b>200</b>	<b>200</b>	<b>250</b>	<b>242.0</b>	<b>206.0</b>	<b>13.9</b>		<b>AX 14 200 250</b>	<b>1500</b>	<b>239</b>	<b>1730</b>	<b>1100</b>
	7.886	9.843	9.53	8.11	0.549			3.307	53700	389000	
<b>220</b>	<b>220</b>	<b>270</b>	<b>262.0</b>	<b>226.0</b>	<b>13.9</b>		<b>AX 14 220 270</b>	<b>1600</b>	<b>248</b>	<b>1850</b>	<b>1000</b>
	8.674	10.630	10.31	8.90	0.549			3.527	55800	416000	
<b>240</b>	<b>240</b>	<b>300</b>	<b>286.0</b>	<b>246.0</b>	<b>14.9</b>		<b>AX 15 240 300</b>	<b>2300</b>	<b>280</b>	<b>2240</b>	<b>900</b>
	9.461	11.811	11.26	9.69	0.588			5.071	62900	504000	



Dimensions mm/in.			Thin Wt. kg/lbs.	Washer Designation		Thick Wt. kg/lbs.	Washer Designation Precision	mm/in.	Precision Wt. kg/lbs.	Shaft mm
$d$	$d_1$	$s$		Thin	Thick					
					CP 5 90 120	5.0 0.197	0.173 0.381			
100 3.938	133.8 5.266				CP 6 100 135	6.0 0.236	0.277 0.611			100
110 4.333	143.8 5.660	1.5 0.059	0.075 0.165		CP 1,5 110 145					110
					CP 6 110 145	6.0 0.236	0.300 0.661			
120 4.726	153.8 6.054	1.5 0.059	0.081 0.179		CP 1,5 120 155					120
					CP 6 120 155	6.0 0.236	0.323 0.712			
130 5.122	168.7 6.640				CP 7 130 170	7.0 0.276	0.480 1.058			130
140 5.516	178.7 7.034				CP 7 140 180	7.0 0.276	0.500 1.102			140
150 5.909	188.7 7.428				CP 7 150 190	7.0 0.276	0.530 1.168			150
160 6.303	198.7 7.821				CP 7 160 200	7.0 0.276	0.560 1.235			160
170 6.697	213.5 8.404				CP 7 170 215	7.0 0.276	0.700 1.543			170
180 7.091	223.5 8.798				CP 7 180 225	7.0 0.276	0.735 1.620			180
190 7.484	238.3 9.380				CP 8 190 240	8.0 0.315	0.950 2.094			190
200 7.878	248.3 9.774				CP 8 200 250	8.0 0.315	1.000 2.205			200
220 8.665	268.3 10.563				CP 8 220 270	8.0 0.315	1.100 2.425			220



## CYLINDRICAL ROLLER THRUST BEARINGS AND THEIR COMPONENTS

### METRIC SERIES

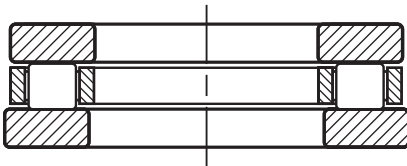
Cylindrical roller thrust bearings provide rolling bearing arrangements which can accommodate high dynamic axial loads as well as shock loads. The simple geometry of the bearing components allows the use of many design arrangements. As an example, for less demanding applications it is possible to combine metric series cylindrical roller and cage thrust assemblies with the metric series heavy thrust washers (LS,CPR) and even metric series thin thrust washers (AS, CP). These two thrust washer types are more commonly used with needle roller and cage thrust assemblies. Cylindrical roller and cage thrust assemblies can also be used without bearing thrust washers if the adjacent machine components can be prepared to serve as suitable raceways.

Cylindrical roller thrust bearings may be used where the load carrying capability of needle roller and cage thrust assemblies is insufficient. Also the bearings can accommodate high dynamic and static axial loads in one direction but they are not suitable to transmit radial loads.

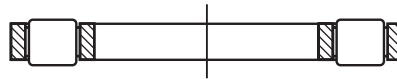
### REFERENCE STANDARDS ARE:

- **ISO 104** – Rolling bearings – Thrust Bearings – Boundary dimensions, general plan.
- **ISO 199** – Rolling bearings – Thrust ball bearings – Tolerances.
- **DIN 616** – Rolling bearings – General Plans of Boundary Dimensions
- **DIN 722** – Single direction thrust cylindrical roller bearings

### TYPES OF METRIC SERIES CYLINDRICAL ROLLER THRUST BEARINGS AND THEIR COMPONENTS.



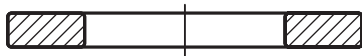
**811, 812 Series**  
Cylindrical roller thrust bearings



**K.811, K.812**  
Cylindrical roller and cage thrust assemblies



**ARZ Series**  
Unitized cylindrical roller thrust bearing



**WS.811, WS.812**  
Shaft washers



**GS.811, GS.812**  
Housing washers

#### Suffixes

<b>LPB</b>	machined light metal window type cage.
<b>TVP</b>	molded window type cage of glass reinforced nylon.







## DIMENSIONAL ACCURACY

The tolerances for the metric series cylindrical roller thrust bearing bore and outside diameter shown in the engineering section apply to shaft piloted washers of series WS.811 and WS.812 as well as housing piloted washers of series GS.811 and GS.812. Tolerances for the bore diameter of series K.811 and K.812 thrust assemblies are given on tabular page C254.

The tolerances for the bore and outside diameter of series AS thrust washers are shown in Table 2 below. The tolerances for the bore and outside diameter of series LS thrust washers are given in Table 3. Bore inspection procedures for thin thrust washers (AS) and heavy thrust washers (LS) are given on page C230.

**TABLE 2 – TOLERANCES FOR OUTSIDE DIAMETER (d<sub>1</sub>) AND BORE DIAMETER (d) OF SERIES AS THRUST WASHERS.**

d <sub>1</sub>		Deviations of max. outside dia. (e13)		d		Deviations of min. bore dia. (E12)	
mm		µm		mm		µm	
>	≤	high	low	>	≤	low	high
18	30	-40	-370	3	6	+20	+140
30	50	-50	-440	6	10	+25	+175
50	80	-60	-520	10	18	+32	+212
80	120	-72	-612	18	30	+40	+250
120	180	-85	-715	30	50	+50	+300
180	250	-100	-820	50	80	+60	+360
				80	120	+72	+422
				120	180	+85	+485

Tolerances for the outside and bore diameters of series LS heavy thrust washers are given in Table 3. Thickness tolerances for series LS heavy thrust washers are given in tabular pages.

**TABLE 3 – TOLERANCES FOR OUTSIDE DIAMETER (d<sub>1</sub>) AND BORE DIAMETER (d) OF SERIES LS HEAVY THRUST WASHERS.**

d <sub>1</sub>		Deviations of max. outside dia. (a12)		d		Deviations of min. bore dia. (E12)	
mm		µm		mm		µm	
>	≤	high	low	>	≤	low	high
18	30	-300	-510	3	6	+20	+140
30	40	-310	-560	6	10	+25	+175
40	50	-320	-570	10	18	+32	+212
50	65	-340	-640	18	30	+40	+250
65	80	-360	-660	30	50	+50	+300
80	100	-380	-730	50	80	+60	+360
100	120	-410	-760	80	120	+72	+422
120	140	-460	-860	120	180	+85	+485
140	160	-520	-920				
160	180	-580	-980				
180	200	-660	-1120				

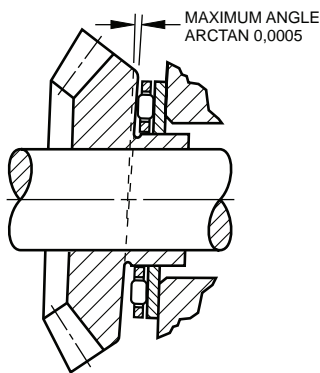
## MOUNTING TOLERANCES

Shaft and housing tolerances for mounting metric series cylindrical roller and cage thrust assemblies are given in Table 4 shown below. If the cylindrical rollers of the cylindrical roller and cage thrust assemblies are to run directly on the adjacent support surfaces, these must be hardened to at least 58 HRC. Raceway contact dimensions  $E_a$  and  $E_b$  must be observed.

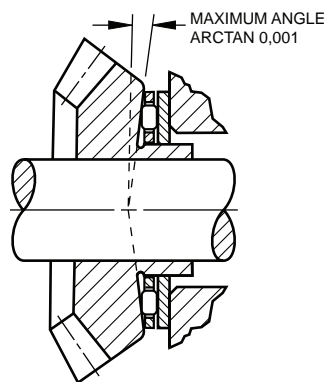
**TABLE 4 – MOUNTING TOLERANCES FOR SHAFTS AND HOUSINGS FOR METRIC SERIES COMPONENTS.**

Bearing Components	Shaft Tolerance (shaft piloting)	Housing Tolerance (housing piloting)	Piloting Member
Cylindrical roller & needle roller cage thrust assembly Types: AXK, FNT, K.811 and K.812	h8	H10	shaft
Cylindrical roller & needle roller cage thrust assembly Types: AX, AR, AXZ, and ARZ	h10	H10	shaft
Thin thrust washer Type: AS	h10	H11	shaft
Heavy thrust washer Type: LS	h10	H11	shaft
Shaft piloted thrust washer Type: WS.811	h6 (j6)	clearance	shaft
Housing piloted thrust washer Type: GS.811	Clearance	H7 (K7)	housing
Thick, thin and heavy series thrust washers Types: CP and CPR	h10	H10	as required

The backup surfaces for the shaft washers WS.811 and WS.812 as well as the housing washers GS.811 and GS.812 of cylindrical roller thrust bearings must be square with the axis of the shaft. Equally important, the raceway or the surface backing the thrust washer, must not be dished or coned. The permissible limits of the squareness and dishing or coning are shown in figures 1 and 2. When using the thin (AS) thrust washers the cylindrical rollers of the thrust cage assembly must be supported over their entire length.



Out of Square Surface  
**Figure 1**



Dished or Coned Surface  
**Figure 2**

Bearing thrust washers should make close contact with the shaft or housing shoulder and must not touch the fillet radius. Therefore the maximum fillet radius  $r_{as\ max}$  must be no greater than the minimum chamfer  $r_{s\ min}$  of the shaft washer (WS) and the housing washer (GS). See tabular page C255.

Since roller thrust bearings generally run under considerable loads, their incorporated washer (and thrust washer) should be supported on a shoulder covering the whole area of circulation of the rollers bounded by dimensions  $E_b$  and  $E_a$ .

## LOAD RATINGS

### MINIMUM AXIAL LOAD

To prevent slippage a cylindrical roller thrust bearing must always be axially loaded. For satisfactory operation a certain minimum load must be applied between the cylindrical rollers and their raceways. This can be calculated from:

$$F_{a\ min} = 0.1 \cdot C_0 / 2200 \text{ (kN)}$$

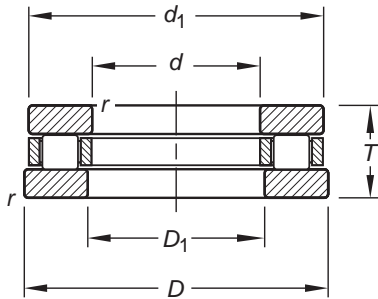
where

$C_0$  – static load rating (kN)

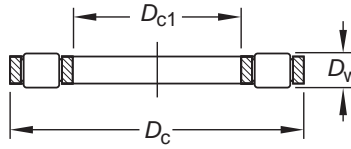
$F_{a\ min}$  – minimum axial load (kN)

**CYLINDRICAL ROLLER THRUST BEARINGS  
CYLINDRICAL ROLLER AND CAGE THRUST ASSEMBLIES**

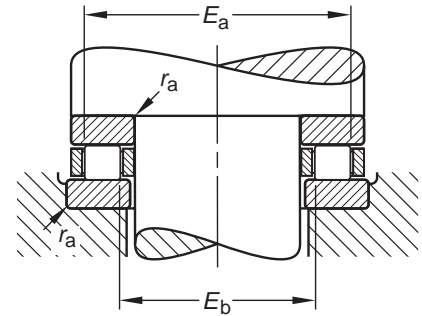
**METRIC SERIES**



811, 812

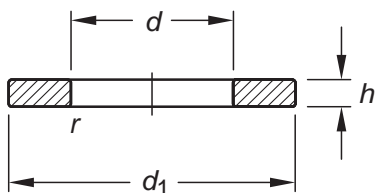


K811, K812

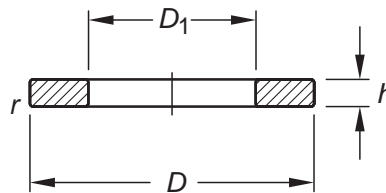


Raceway contact dimensions

Shaft Diameter	Dimensions mm/in.						Assembly Designation	Load Ratings kN/bf.		Limiting Speed Oil RPM	Wt. kg/lbs.
	E11	a13						Dynamic C	Static Co		
mm	Dc1	Dc	Dw	Eb	Ea	ras max					
15	15	28	3.5	18	25	0.3	K.81102LPB	12.8	28.6	12000	0.006
	0.5906	1.1024	0.1378	0.709	0.984	0.012		2880	6430		
15	15	28	3.5	18	25	0.3	K.81102TVP	12.8	28.6	12000	0.006
	0.5906	1.1024	0.1378	0.709	0.984	0.012		2880	6430		
17	17	30	3.5	20	27	0.3	K.81103LPB	14.2	33.4	11000	0.008
	0.6693	1.1811	0.1378	0.787	1.063	0.012		3190	7510		
17	17	30	3.5	20	27	0.3	K.81103TVP	14.2	33.4	11000	0.008
	0.6693	1.1811	0.1378	0.787	1.063	0.012		3190	7510		
20	20	35	4.5	23	32	0.3	K.81104TVP	23.6	56.8	9500	0.009
	0.7874	1.3780	0.1772	0.906	1.260	0.012		5310	12800		
25	25	42	5.0	28	39	0.6	K.81105TVP	31.2	81.0	8000	0.014
	0.9843	1.6535	0.1969	1.102	1.535	0.024		7010	18200		
30	30	47	5.0	33	44	0.6	K.81106LPB	33.0	91.1	6700	0.026
	1.1811	1.8504	0.1969	1.299	1.732	0.024		7420	20500		
30	30	47	5.0	33	44	0.6	K.81106TVP	33.0	91.1	6700	0.016
	1.1811	1.8504	0.1969	1.299	1.732	0.024		7420	20500		
30	30	52	7.5	33	49	0.6	K.81206LPB	56.9	141	6300	0.052
	1.1811	2.0472	0.2953	1.299	1.929	0.024		12800	31700		
30	30	52	7.5	33	49	0.6	K.81206TVP	56.9	141	6300	0.034
	1.1811	2.0472	0.2953	1.299	1.929	0.024		12800	31700		
35	35	52	5.0	38	49	0.6	K.81107LPB	34.8	101	6000	0.025
	1.3780	2.0472	0.1969	1.496	1.929	0.024		7820	22700		
35	35	52	5.0	38	49	0.6	K.81107TVP	34.8	101	6000	0.020
	1.3780	2.0472	0.1969	1.496	1.929	0.024		7820	22700		
35	35	62	7.5	41	56	1.0	K.81207LPB	61.6	164	5300	0.073
	1.3780	2.4409	0.2953	1.614	2.205	0.039		13800	36900		
35	35	62	7.5	41	56	1.0	K.81207TVP	61.6	164	5300	0.055
	1.3780	2.4409	0.2953	1.614	2.205	0.039		13800	36900		
40	40	60	6.0	44	56	0.6	K.81108LPB	49.8	148	5300	0.044
	1.5748	2.3622	0.2362	1.732	2.205	0.024		11200	33300		
40	40	60	6.0	44	56	0.6	K.81108TVP	49.8	148	5300	0.031
	1.5748	2.3622	0.2362	1.732	2.205	0.024		11200	33300		
40	40	68	9.0	45	63	1.0	K.81208TVP	86.8	233	4800	0.076
	1.5748	2.6772	0.3543	1.772	2.480	0.039		19500	52400		
45	45	65	6.0	49	61	0.6	K.81109LPB	52.3	163	4800	0.035
	1.7717	2.5591	0.2362	1.929	2.402	0.024		11800	36600		
45	45	65	6.0	49	61	0.6	K.81109TVP	52.3	163	4800	0.035
	1.7717	2.5591	0.2362	1.929	2.402	0.024		11800	36600		
45	45	73	9.0	50	68	1.0	K.81209TVP	94.2	266	4500	0.083
	1.7717	2.8740	0.3543	1.969	2.677	0.039		21200	59800		



WS.811, WS.812



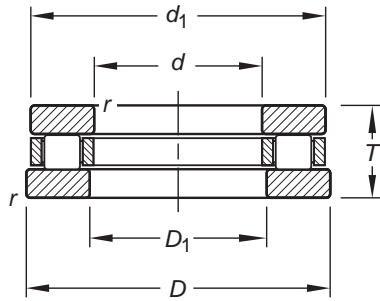
GS.811, GS.812

Dimensions mm/in.			Max.	Min.		Assembly Designation		Wt. kg/lbs.	Shaft Diameter mm
d	D <sub>1</sub>	D <sub>1</sub> d <sub>1</sub>	h		r <sub>s min</sub>				
15 0.591	16 0.630	28 1.102	2.75 0.108	2.64 0.104	0.3 0.012	WS.81102	GS.81102	0.010 0.022	15
15 0.591	16 0.630	28 1.102	2.75 0.108	2.64 0.104	0.3 0.012	WS.81102	GS.81102	0.010 0.022	
17 0.669	18 0.709	30 1.181	2.75 0.108	2.64 0.104	0.3 0.012	WS.81103	GS.81103	0.011 0.024	17
17 0.669	18 0.709	30 1.181	2.75 0.108	2.64 0.104	0.3 0.012	WS.81103	GS.81103	0.011 0.024	
20 0.787	21 0.827	35 1.378	2.75 0.108	2.62 0.103	0.3 0.012	WS.81104	GS.81104	0.014 0.031	20
25 0.984	26 1.024	42 1.654	3.00 0.118	2.87 0.113	0.6 0.024	WS.81105	GS.81105	0.021 0.046	25
30 1.181	32 1.260	47 1.850	3.00 0.118	2.87 0.113	0.6 0.024	WS.81106	GS.81106	0.023 0.051	30
30 1.181	32 1.260	47 1.850	3.00 0.118	2.87 0.113	0.6 0.024	WS.81106	GS.81106	0.023 0.051	
30 1.181	32 1.260	52 2.047	4.25 0.167	4.12 0.162	0.6 0.024	WS.81206	GS.81206	0.047 0.104	
30 1.181	32 1.260	52 2.047	4.25 0.167	4.12 0.162	0.6 0.024	WS.81206	GS.81206	0.047 0.104	
35 1.378	37 1.457	52 2.047	3.50 0.138	3.34 0.131	0.6 0.024	WS.81107	GS.81107	0.032 0.071	35
35 1.378	37 1.457	52 2.047	3.50 0.138	3.34 0.131	0.6 0.024	WS.81107	GS.81107	0.032 0.071	
35 1.378	37 1.457	62 2.441	5.25 0.207	5.09 0.200	1.0 0.039	WS.81207	GS.81207	0.085 0.187	
35 1.378	37 1.457	62 2.441	5.25 0.207	5.09 0.200	1.0 0.039	WS.81207	GS.81207	0.085 0.187	
40 1.575	42 1.654	60 2.362	3.50 0.138	3.34 0.131	0.6 0.024	WS.81108	GS.81108	0.043 0.095	40
40 1.575	42 1.654	60 2.362	3.50 0.138	3.34 0.131	0.6 0.024	WS.81108	GS.81108	0.043 0.095	
40 1.575	42 1.654	68 2.677	5.00 0.197	4.84 0.191	1.0 0.039	WS.81208	GS.81208	0.093 0.205	
45 1.772	47 1.850	65 2.559	4.00 0.157	3.84 0.151	0.6 0.024	WS.81109	GS.81109	0.054 0.119	45
45 1.772	47 1.850	65 2.559	4.00 0.157	3.84 0.151	0.6 0.024	WS.81109	GS.81109	0.054 0.119	
45 1.772	47 1.850	73 2.874	5.50 0.217	5.34 0.210	1.0 0.039	WS.81209	GS.81209	0.112 0.247	

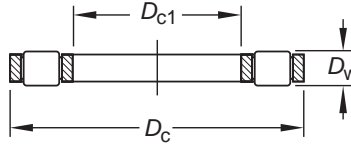
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# CYLINDRICAL ROLLER THRUST BEARINGS CYLINDRICAL ROLLER AND CAGE THRUST ASSEMBLIES – *continued*

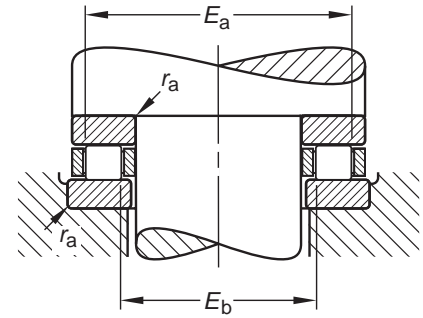
## METRIC SERIES



811, 812

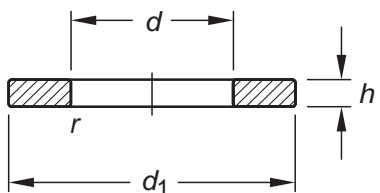


K811, K812

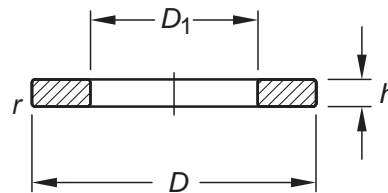


Raceway contact dimensions

Shaft Diameter	Dimensions mm/in.						Assembly Designation	Load Ratings kN/bf.		Limiting Speed Oil RPM	Wt. kg/lbs.
	E11	a13	D <sub>w</sub>	E <sub>b</sub>	E <sub>a</sub>	r <sub>as max</sub>		Dynamic	Static		
	mm	D <sub>c1</sub>						D <sub>c</sub>	C		
50	50	70	6.0	54	66	0.6	K.81110LPB	54.8	177	4300	0.052
	1.9685	2.7559	0.2362	2.126	2.598	0.024		12300	39800		
50	50	70	6.0	54	66	0.6	K.81110TVP	54.8	177	4300	0.042
	1.9685	2.7559	0.2362	2.126	2.598	0.024		12300	39800		
50	50	78	9.0	55	73	1.0	K.81210TVP	101	299	4000	0.089
	1.9685	3.0709	0.3543	2.165	2.874	0.039		22700	67200		
55	55	78	6.0	60	73	0.6	K.81111TVP	60.3	207	4000	0.066
	2.1654	3.0709	0.2362	2.362	2.874	0.024		13600	46500		
55	55	90	11.0	61	84	1.0	K.81211LPB	138	403	3600	0.156
	2.1654	3.5433	0.4331	2.402	3.307	0.039		31000	90600		
55	55	90	11.0	61	84	1.0	K.81211TVP	138	403	3600	0.140
	2.1654	3.5433	0.4331	2.402	3.307	0.039		31000	90600		
60	60	85	7.5	65	80	1.0	K.81112TVP	84.4	281	3600	0.103
	2.3622	3.3465	0.2953	2.559	3.150	0.039		19000	63200		
60	60	95	11.0	66	89	1.0	K.81212LPB	129	378	3400	0.166
	2.3622	3.7402	0.4331	2.598	3.504	0.039		29000	85000		
65	65	90	7.5	70	85	1.0	K.81113TVP	88.3	305	3400	0.109
	2.5591	3.5433	0.2953	2.756	3.346	0.039		19900	68600		
65	65	100	11.0	71	94	1.0	K.81213LPB	134	403	3200	0.176
	2.5591	3.9370	0.4331	2.795	3.701	0.039		30100	90600		
70	70	95	7.5	75	90	1.0	K.81114TVP	92.1	328	3200	0.056
	2.7559	3.7402	0.2953	2.953	3.543	0.039		20700	73700		
70	70	105	11.0	76	99	1.0	K.81214LPB	138	428	3000	0.186
	2.7559	4.1339	0.4331	2.992	3.898	0.039		31000	96200		
75	75	100	7.5	80	95	1.0	K.81115LPB	86.1	305	3000	0.091
	2.9528	3.9370	0.2953	3.150	3.740	0.039		19400	68600		
75	75	110	11.0	81	104	1.0	K.81215LPB	143	453	2800	0.197
	2.9528	4.3307	0.4331	3.189	4.094	0.039		32100	101800		
80	80	105	7.5	85	100	1.0	K.81116LPB	87.5	316	2800	0.103
	3.1496	4.1339	0.2953	3.346	3.937	0.039		19700	71000		
80	80	115	11.0	86	109	1.0	K.81216LPB	147	478	2600	0.208
	3.1496	4.5276	0.4331	3.386	4.291	0.039		33000	107500		
85	85	110	7.5	90	105	1.0	K.81117LPB	88.9	328	2600	0.108
	3.3465	4.3307	0.2953	3.543	4.134	0.039		20000	73700		
85	85	125	12.0	93	117	1.0	K.81217LPB	174	572	2400	0.376
	3.3465	4.9213	0.4724	3.661	4.606	0.039		39100	128600		
90	90	120	9.0	96	114	1.0	K.81118LPB	119	432	2400	0.156
	3.5433	4.7244	0.3543	3.780	4.488	0.039		26800	97100		
90	90	135	14.0	98	127	1.0	K.81218LPB	215	691	2400	0.540
	3.5433	5.3150	0.5512	3.858	5.000	0.039		48300	155300		



WS.811, WS.812

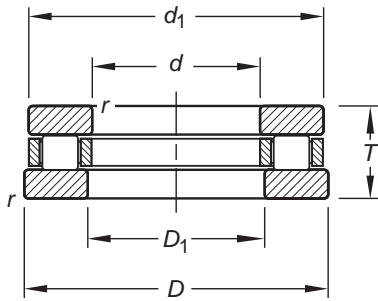
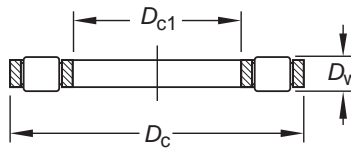
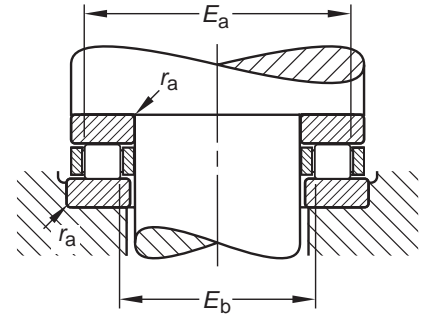


GS.811, GS.812

Dimensions mm/in.			Max.	Min.		Assembly Designation		Wt. kg/lbs.	Shaft Diameter mm
d	D <sub>1</sub>	D <sub>1</sub> d <sub>1</sub>	h		r <sub>s min</sub>				
50 1.969	52 2.047	70 2.756	4.00 0.157	3.84 0.151	0.6 0.024	WS.81110	GS.81110	0.059 0.130	50
50 1.969	52 2.047	70 2.756	4.00 0.157	3.84 0.151	0.6 0.024	WS.81110	GS.81110	0.059 0.130	
50 1.969	52 2.047	78 3.071	6.5 0.256	6.34 0.250	1.0 0.039	WS.81210	GS.81210	0.144 0.317	55
55 2.165	57 2.244	78 3.071	5.00 0.197	4.81 0.189	0.6 0.024	WS.81111	GS.81111	0.094 0.207	
55 2.165	57 2.244	90 3.543	7.00 0.276	6.81 0.268	1.0 0.039	WS.81211	GS.81211	0.219 0.483	
55 2.165	57 2.244	90 3.543	7.00 0.276	6.81 0.268	1.0 0.039	WS.81211	GS.81211	0.219 0.483	
60 2.362	62 2.441	85 3.346	4.75 0.187	4.56 0.180	1.0 0.039	WS.81112	GS.81112	0.106 0.234	60
60 2.362	62 2.441	95 3.740	7.50 0.295	7.31 0.288	1.0 0.039	WS.81212	GS.81212	0.251 0.553	
65 2.559	67 2.638	90 3.543	5.25 0.207	5.06 0.199	1.0 0.039	WS.81113	GS.81113	0.125 0.276	65
65 2.559	67 2.638	100 3.937	8.00 0.315	7.81 0.307	1.0 0.039	WS.81213	GS.81213	0.285 0.628	
70 2.756	72 2.835	95 3.740	5.25 0.207	5.06 0.199	1.0 0.039	WS.81114	GS.81114	0.133 0.293	70
70 2.756	72 2.835	105 4.134	8.00 0.315	7.81 0.307	1.0 0.039	WS.81214	GS.81214	0.302 0.666	
75 2.953	77 3.031	100 3.937	5.75 0.226	5.56 0.219	1.0 0.039	WS.81115	GS.81115	0.155 0.342	75
75 2.953	77 3.031	110 4.331	8.00 0.315	7.81 0.307	1.0 0.039	WS.81215	GS.81215	0.319 0.703	
80 3.150	82 3.228	105 4.134	5.75 0.226	5.56 0.219	1.0 0.039	WS.81116	GS.81116	0.165 0.364	80
80 3.150	82 3.228	115 4.528	8.50 0.335	8.31 0.327	1.0 0.039	WS.81216	GS.81216	0.357 0.787	
85 3.346	87 3.425	110 4.331	5.75 0.226	5.53 0.218	1.0 0.039	WS.81117	GS.81117	0.173 0.381	85
85 3.346	88 3.465	125 4.921	9.50 0.374	9.28 0.365	1.0 0.039	WS.81217	GS.81217	0.492 1.085	
90 3.543	92 3.622	120 4.724	6.50 0.256	6.28 0.247	1.0 0.039	WS.81118	GS.81118	0.253 0.558	90
90 3.543	93 3.661	135 5.315	10.50 0.413	10.28 0.405	1.1 0.043	WS.81218	GS.81218	0.655 1.444	

## CYLINDRICAL ROLLER THRUST BEARINGS CYLINDRICAL ROLLER AND CAGE THRUST ASSEMBLIES

### METRIC SERIES


**811, 812**

**K811, K812**

**Raceway contact dimensions**

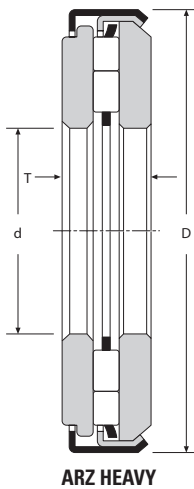
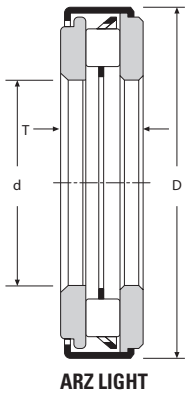
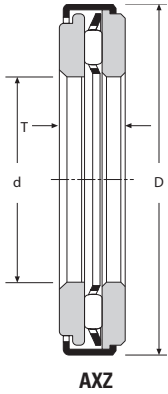
Shaft Diameter	Dimensions mm/in.							Bearing Designation	Load Ratings N/lbf.		Limiting Speed Oil RPM	Wt. kg/lbs.
	mm	d	D	D <sub>w</sub>	T	E <sub>b</sub>	E <sub>a</sub>		r as max	C		
15	15	28	3.5	9	18	25	0.3	81102LPB	12.8	28.6	12000	0.029
	0.5906	1.1024	0.1378	0.354	0.709	0.984	0.012		2880	6430		
17	17	30	3.5	9	18	25	0.3	81102TVP	12.8	28.6	12000	0.022
	0.5906	1.1024	0.1378	0.354	0.709	0.984	0.012		2880	6430		
20	17	30	3.5	9	20	27	0.3	81103TVP	14.2	33.4	11000	0.000
	0.6693	1.1811	0.1378	0.354	0.787	1.063	0.012		3190	7510		
20	20	35	4.5	10	23	32	0.3	81104TVP	23.6	56.8	9500	0.040
	0.7874	1.3780	0.1772	0.394	0.906	1.260	0.012		5310	12800		
25	25	42	5.0	11	28	39	0.6	81105TVP	31.2	81.0	8000	0.070
	0.9843	1.6535	0.1969	0.433	1.102	1.535	0.024		7010	18200		
30	30	47	5.0	11	33	44	0.6	81106TVP	33.0	91.1	6700	0.060
	1.1811	1.8504	0.1969	0.433	1.299	1.732	0.024		7420	20500		
30	30	52	7.5	16	33	49	0.6	81206TVP	56.9	141	6300	0.128
	1.1811	2.0472	0.2953	0.630	1.299	1.929	0.024		12800	31700		
35	35	52	5.0	12	38	49	0.6	81107TVP	34.8	101	6000	0.081
	1.3780	2.0472	0.1969	0.472	1.496	1.929	0.024		7820	22700		
35	35	62	7.5	18	41	56	1.0	81207TVP	61.6	164	5300	0.250
	1.3780	2.4409	0.2953	0.709	1.614	2.205	0.039		13800	36900		
40	40	60	6.0	13	44	56	0.6	81108TVP	49.8	148	5300	0.100
	1.5748	2.3622	0.2362	0.512	1.732	2.205	0.024		11200	33300		
40	40	68	9.0	19	45	63	1.0	81208TVP	86.8	233	4800	0.266
	1.5748	2.6772	0.3543	0.748	1.772	2.480	0.039		19500	52400		
45	45	65	6.0	14	49	61	0.6	81109TVP	52.3	163	4800	0.141
	1.7717	2.5591	0.2362	0.551	1.929	2.402	0.024		11800	36600		
50	50	70	6.0	14	54	66	0.6	81110LPB	54.8	177	4300	0.152
	1.9685	2.7559	0.2362	0.551	2.126	2.598	0.024		12300	39800		
50	50	70	6.0	14	54	66	0.6	81110TVP	54.8	177	4300	0.160
	1.9685	2.7559	0.2362	0.551	2.126	2.598	0.024		12300	39800		
50	50	78	9.0	22	55	73	1.0	81210TVP	101	299	4000	0.437
	1.9685	3.0709	0.3543	0.866	2.165	2.874	0.039		22700	67200		
55	55	78	6.0	16	60	73	0.6	81111TVP	60.3	207	4000	0.233
	2.1654	3.0709	0.2362	0.630	2.362	2.874	0.024		13600	46500		
55	55	90	11.0	25	61	84	1.0	81211TVP	138	403	3600	0.584
	2.1654	3.5433	0.4331	0.984	2.402	3.307	0.039		31000	90600		



Shaft Diameter	Dimensions mm/in.							Bearing Designation	Load Ratings kN/lbf.		Limiting Speed Oil	Wt. kg/lbs.
	mm	d	D	D <sub>w</sub>	T	E <sub>b</sub>	E <sub>a</sub>		r <sub>as max</sub>	C		
60	60	85	7.5	17	65	80	1.0	81112TVP	84.4	281	3600	0.315
	2.3622	3.3465	0.2953	0.669	2.559	3.150	0.039		19000	63200		
60	60	95	11.0	26	66	89	1.0	81212LPB	129	378	3400	0.770
	2.3622	3.7402	0.4331	1.024	2.598	3.504	0.039		29000	85000		
65	65	90	7.5	18	70	85	1.0	81113TVP	88.3	305	3400	0.360
	2.5591	3.5433	0.2953	0.709	2.756	3.346	0.039		19900	68600		
65	65	100	11.0	27	71	94	1.0	81213LPB	134	403	3200	0.805
	2.5591	3.9370	0.4331	1.063	2.795	3.701	0.039		30100	90600		
70	70	95	7.5	18	75	90	1.0	81114TVP	92.1	328	3200	0.352
	2.7559	3.7402	0.2953	0.709	2.953	3.543	0.039		20700	73700		
70	70	105	11.0	27	76	99	1.0	81214LPB	138	428	3000	0.868
	2.7559	4.1339	0.4331	1.063	2.992	3.898	0.039		31000	96200		
75	75	100	7.5	19	80	95	1.0	81115LPB	86.1	305	3000	0.405
	2.9528	3.9370	0.2953	0.748	3.150	3.740	0.039		19400	68600		
75	75	110	11.0	27	81	104	1.0	81215LPB	143	453	2800	0.780
	2.9528	4.3307	0.4331	1.063	3.189	4.094	0.039		32100	102000		
80	80	105	7.5	19	85	100	1.0	81116LPB	87.5	316	2800	0.412
	3.1496	4.1339	0.2953	0.748	3.346	3.937	0.039		19700	71000		
80	80	115	11.0	28	86	109	1.0	81216LPB	147	478	2600	1.080
	3.1496	4.5276	0.4331	1.102	3.386	4.291	0.039		33000	107000		
85	85	110	7.5	19	90	105	1.0	81117LPB	88.9	328	2600	0.480
	3.3465	4.3307	0.2953	0.748	3.543	4.134	0.039		20000	73700		
85	85	125	12.0	31	93	117	1.0	81217LPB	174	572	2400	1.360
	3.3465	4.9213	0.4724	1.220	3.661	4.606	0.039		39100	129000		
90	90	120	9.0	22	96	114	1.0	81118LPB	119	432	2400	0.710
	3.5433	4.7244	0.3543	0.866	3.780	4.488	0.039		26800	97100		
90	90	135	14.0	35	98	127	1.0	81218LPB	215	691	2400	1.850
	3.5433	5.3150	0.5512	1.378	3.858	5.000	0.039		48300	155000		

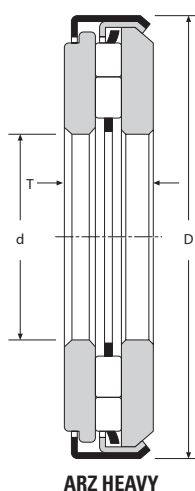
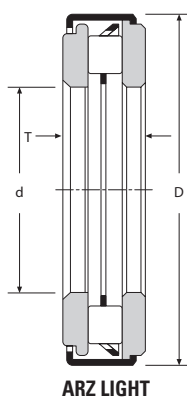
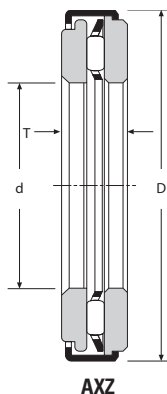
**NEEDLE OR ROLLER THRUST BEARINGS**

**METRIC SERIES**



Shaft Diameter	mm/in.			AXZ	ARZ Light	ARZ Heavy	Load Ratings kN/lbf.		Limiting Speed Oil RPM	Wt. kg/lbs.
	mm	d	D				T	C		
5	5 0.197	13 0.512	5.5 0.217	AXZ 5,5 5 13			3.00 670	5.70 1300	25000	0.004 0.008
6	6 0.236	14 0.551	5.5 0.217	AXZ 5,5 6 14			3.15 710	6.35 1400	22000	0.004 0.009
7	7 0.276	15 0.591	5.5 0.217	AXZ 5,5 7 15			3.55 800	7.60 1700	22000	0.005 0.010
8	8 0.315	16 0.630	5.5 0.217	AXZ 5,5 8 16			3.70 830	8.30 1900	22000	0.005 0.011
9	9 0.354	17 0.669	5.5 0.217	AXZ 5,5 9 17			4.05 910	9.50 2100	19000	0.005 0.012
10	10 0.394	22.4 0.882	6.5 0.256	ARZ 6,5 10 22,4			8.20 1840	17.9 4000	15500	0.012 0.026
				AXZ 6 10 22,4			5.00 1120	10.9 2500	15500	0.011 0.025
12	12 0.472	26.4 1.039	6 0.236	AXZ 6 12 26,4			6.90 1550	17.7 4000	13000	0.017 0.037
				ARZ 7 12 26,4			12.7 2860	29.5 6600	13000	0.017 0.037
15	15 0.591	28.4 1.118	6 0.236	AXZ 6 15 28,4			7.40 1660	20.0 4500	11500	0.016 0.034
				ARZ 7 15 28,4			14.0 3150	34.0 7600	11500	0.019 0.042
17	17 0.669	30 1.197	6 0.236	AXZ 6 17 30,4			7.80 1750	22.0 4900	10500	0.018 0.039
				ARZ 7 17 30,4			15.0 3370	39.0 8800	10500	0.022 0.049
20	20 0.787	35 1.394	8 0.315	AXZ 8 20 35,4			11.80 2650	39.0 8800	9000	0.033 0.072
				ARZ 10 20 35,4			22.0 4950	54.0 12100	9000	0.038 0.084
25	25 0.984	43 1.693	8 0.315	AXZ 8 25 43			13.30 2990	49.0 11000	7500	0.047 0.104
				ARZ 10 25 43			25.5 5730	70.0 15700	7500	0.057 0.126
30	30 1.181	53 2.087	11 0.433	ARZ 11 25 53			32.5 7310	122 27400	6500	0.122 0.269
				AXZ 8 30 48			14.50 3260	57.0 12800	6500	0.054 0.119
35	35 1.378	54 2.126	8 0.315	ARZ 10 30 48			26.5 5960	77.0 17300	6500	0.065 0.143
				ARZ 14 30 61			46.0 10340	162 36400	5600	0.196 0.432
35	35 1.378	54 2.126	11 0.433	AXZ 8 35 54			18.90 4250	84.0 18900	5500	0.066 0.146
				ARZ 11 35 54			33.8 7600	94.0 21100	5500	0.087 0.192
	35 1.378	69 2.717	14 0.551	ARZ 14 35 69			51.0 11470	194.0 43600	4900	0.246 0.542

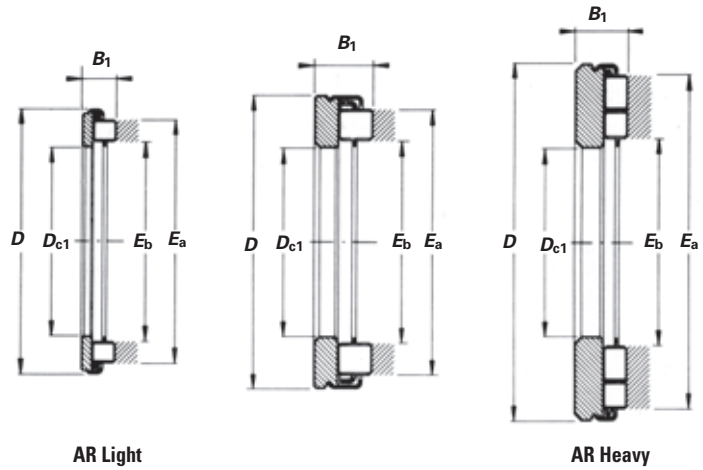
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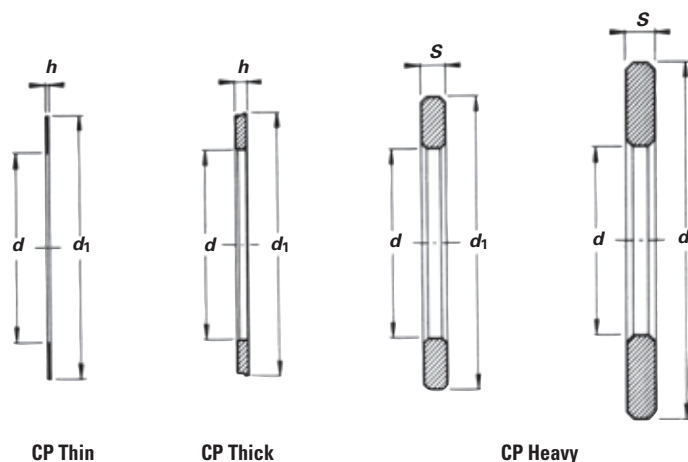
Shaft Diameter	mm/in.			AXZ	ARZ Light	ARZ Heavy	Load Ratings kN/lbf		Limiting Speed Oil RPM	Wt. kg/lbs.
	mm	d	D				T	C		
40	40	61	8	AXZ 8 40 61			20.40	96.0	5000	0.084
	1.575	2.402	0.315				4590	21600		
40	40	61	12		ARZ 12 40 61		46.0	129	5000	0.114
	1.575	2.402	0.472				10340	29000		
40	40	79	17			ARZ 17 40 79	71.0	265	4200	0.387
	1.575	3.110	0.669				15960	59600		
45	45	66	8	AXZ 8 45 66			21.80	109	4500	0.092
	1.772	2.598	0.315				4900	24500		
45	45	66	12		ARZ 12 45 66		49.0	143	4500	0.126
	1.772	2.598	0.472				11000	32100		
45	45	86	22			ARZ 22 45 86	92.0	340	3800	0.595
	1.772	3.386	0.866				20700	76400		
50	50	71	8	AXZ 8 50 71			22.50	118	4000	0.100
	1.969	2.795	0.315				5100	26500		
50	50	71	12		ARZ 12 50 71		51.0	157	4000	0.137
	1.969	2.795	0.472				11500	35300		
50	50	96	22			ARZ 22 50 96	108.0	430	3400	0.756
	1.969	3.780	0.866				24300	96700		
55	55	106	22			ARZ 22 55 106	125.0	530	3100	0.917
	2.165	4.173	0.866				28100	119100		
60	60	86	10	AXZ 10 60 86			31.50	193	3500	0.194
	2.362	3.386	0.394				7100	43400		
60	60	86	14		ARZ 14 60 86		71.0	255	3500	0.246
	2.362	3.386	0.551				16000	57300		
60	60	111	22			ARZ 22 60 111	130.0	580	2900	0.977
	2.362	4.370	0.866				29200	130400		
65	65	116	22			ARZ 22 65 116	135.0	620	2800	1.040
	2.559	4.567	0.866				30300	139400		
70	70	96	10	AXZ 10 70 96			34.50	223	3000	0.220
	2.756	3.780	0.394				7800	50100		
70	70	96	14		ARZ 14 70 96		77.0	295	3000	0.279
	2.756	3.780	0.551				17300	66300		
80	80	106	10	AXZ 10 80 106			36.50	253	2700	0.256
	3.150	4.173	0.394				8200	56900		
80	80	106	14		ARZ 14 80 106		82.0	330	2700	0.312
	3.150	4.173	0.551				18400	74200		

## UNITIZED ROLLER THRUST BEARING ASSEMBLIES

### METRIC SERIES


**AR Light**
**AR Heavy**

Shaft Diameter	mm/in.					Light Series	Heavy Series	Wt. kg/lbs.	Load Ratings kN/lbf.		Limiting Speed Oil RPM
	D <sub>c1</sub>	D	B <sub>1</sub>	E <sub>a</sub>	E <sub>b</sub>				Dynamic C	Static C <sub>0</sub>	
<b>10</b>	<b>10</b> 0.394	<b>22</b> 0.866	<b>4.5</b> 0.177	<b>18.5</b> 0.73	<b>12.2</b> 0.48	<b>AR 4,5 10 22</b>	<b>0.007</b> 0.016	<b>8.2</b> 1840	<b>17.9</b> 4020	<b>15500</b>	
<b>12</b>	<b>12</b> 0.472	<b>26</b> 1.024	<b>5</b> 0.197	<b>22.9</b> 0.90	<b>14.8</b> 0.58	<b>AR 5 12 26</b>	<b>0.011</b> 0.024	<b>12.7</b> 2860	<b>29.5</b> 6630	<b>13000</b>	
<b>15</b>	<b>15</b> 0.591	<b>28</b> 1.103	<b>5</b> 0.197	<b>24.9</b> 0.98	<b>16.8</b> 0.66	<b>AR 5 15 28</b>	<b>0.011</b> 0.024	<b>14.0</b> 3150	<b>34.0</b> 7640	<b>11500</b>	
<b>17</b>	<b>17</b> 0.669	<b>30</b> 1.181	<b>5</b> 0.197	<b>26.9</b> 1.06	<b>18.8</b> 0.74	<b>AR 5 17 30</b>	<b>0.013</b> 0.028	<b>15.0</b> 3370	<b>39.0</b> 8770	<b>10500</b>	
<b>20</b>	<b>20</b> 0.787	<b>35</b> 1.378	<b>7</b> 0.276	<b>31.6</b> 1.24	<b>22.0</b> 0.87	<b>AR 7 20 35</b>	<b>0.022</b> 0.049	<b>22.0</b> 4950	<b>54.0</b> 12100	<b>9000</b>	
<b>25</b>	<b>25</b> 0.984	<b>42</b> 1.654	<b>7</b> 0.276	<b>37.3</b> 1.47	<b>27.7</b> 1.09	<b>AR 7 25 42</b>	<b>0.031</b> 0.068	<b>25.5</b> 5730	<b>70.0</b> 15700	<b>7500</b>	
	<b>25</b> 0.984	<b>52</b> 2.047	<b>7</b> 0.276	<b>47.0</b> 1.85	<b>29.0</b> 1.14	<b>AR 7 25 52</b>	<b>0.070</b> 0.154	<b>32.5</b> 7310	<b>122.0</b> 27400	<b>6500</b>	
<b>30</b>	<b>30</b> 1.181	<b>47</b> 1.851	<b>7</b> 0.276	<b>42.3</b> 1.67	<b>32.7</b> 1.29	<b>AR 7 30 47</b>	<b>0.036</b> 0.079	<b>26.5</b> 5960	<b>77.0</b> 17300	<b>6500</b>	
	<b>30</b> 1.181	<b>60</b> 2.362	<b>9</b> 0.354	<b>53.5</b> 2.11	<b>33.5</b> 1.32	<b>AR 9 30 60</b>	<b>0.113</b> 0.249	<b>46.0</b> 10340	<b>162.0</b> 36400	<b>5600</b>	
<b>35</b>	<b>35</b> 1.378	<b>53</b> 2.103	<b>8</b> 0.315	<b>47.8</b> 1.88	<b>37.8</b> 1.49	<b>AR 8 35 53,4</b>	<b>0.052</b> 0.115	<b>33.8</b> 7600	<b>94.0</b> 21100	<b>5500</b>	
	<b>35</b> 1.378	<b>68</b> 2.677	<b>9</b> 0.354	<b>60.6</b> 2.39	<b>39.0</b> 1.54	<b>AR 9 35 68</b>	<b>0.144</b> 0.317	<b>51.0</b> 11500	<b>194.0</b> 43600	<b>4900</b>	
<b>40</b>	<b>40</b> 1.575	<b>60</b> 2.378	<b>9</b> 0.354	<b>54.8</b> 2.16	<b>42.8</b> 1.69	<b>AR 9 40 60,4</b>	<b>0.070</b> 0.154	<b>46.0</b> 10300	<b>129.0</b> 29000	<b>5000</b>	
	<b>40</b> 1.575	<b>78</b> 3.071	<b>11</b> 0.433	<b>70.0</b> 2.76	<b>44.0</b> 1.73	<b>AR 11 40 78</b>	<b>0.225</b> 0.496	<b>71.0</b> 16000	<b>265.0</b> 59600	<b>4200</b>	
<b>45</b>	<b>45</b> 1.772	<b>65</b> 2.575	<b>9</b> 0.354	<b>59.8</b> 2.35	<b>47.8</b> 1.88	<b>AR 9 45 65,4</b>	<b>0.077</b> 0.170	<b>49.0</b> 11000	<b>143.0</b> 32100	<b>4500</b>	
	<b>45</b> 1.772	<b>85</b> 3.347	<b>14</b> 0.551	<b>77.0</b> 3.03	<b>49.0</b> 1.93	<b>AR 14 45 85</b>	<b>0.350</b> 0.772	<b>92.0</b> 20700	<b>340.0</b> 76400	<b>3800</b>	
<b>50</b>	<b>50</b> 1.968	<b>70</b> 2.772	<b>9</b> 0.354	<b>64.8</b> 2.55	<b>52.8</b> 2.08	<b>AR 9 50 70,4</b>	<b>0.082</b> 0.181	<b>51.0</b> 11500	<b>15 7.0</b> 35300	<b>4000</b>	
	<b>50</b> 1.968	<b>95</b> 3.740	<b>14</b> 0.551	<b>86.0</b> 3.39	<b>54.0</b> 2.13	<b>AR 14 50 95</b>	<b>0.448</b> 0.988	<b>108.0</b> 24300	<b>430.0</b> 96700	<b>3400</b>	
<b>55</b>	<b>55</b> 2.165	<b>78</b> 3.087	<b>10</b> 0.394	<b>72.5</b> 2.85	<b>58.5</b> 2.30	<b>AR 10 55 78,4</b>	<b>0.125</b> 0.276	<b>61.0</b> 13700	<b>203.0</b> 45600	<b>3800</b>	
	<b>55</b> 2.165	<b>105</b> 4.134	<b>14</b> 0.551	<b>96.2</b> 3.79	<b>60.2</b> 2.37	<b>AR 14 55 105</b>	<b>0.537</b> 1.184	<b>125.0</b> 28100	<b>530.0</b> 119100	<b>3100</b>	



mm/in.		Thin Series	mm/in.		Thick Series	mm/in.		Heavy Series	mm/in.		Shaft Diameter
d	d <sub>1</sub>		Wt. kg/lbs.	S <sup>1</sup>		Wt.	h <sup>2</sup>		Wt. kg/lbs.	h <sup>2</sup>	
10 0.396	22 0.846	CP 10 22	0.8 0.031	0.004 0.009	CP 2 10 22	2 0.079	0.002 0.004				10
12 0.474	25 1.003	CP 12 26	0.8 0.031	0.003 0.006	CP 2 12 26	2 0.079	0.006 0.014				12
15 0.593	27 1.081	CP 15 28	0.8 0.031	0.003 0.006	CP 2 15 28	2 0.079	0.006 0.013				15
17 0.671	29 1.160	CP 17 30	0.8 0.031	0.003 0.006	CP 2 17 30	2 0.079	0.007 0.015				17
20 0.789	34 1.357	CP 20 35	0.8 0.031	0.004 0.008	CP 3 20 35	3 0.118	0.013 0.029				20
25 0.988	42 1.634	CP 25 42	0.8 0.031	0.005 0.012	CP 3 25 42	3 0.118	0.019 0.042				25
25 0.992	52 2.045							CPR 4 25 52	4 0.157	0.052 0.115	25
30 1.183	46 1.830	CP 30 47	0.8 0.031	0.006 0.013	CP 3 30 47	3 0.118	0.022 0.049				30
30 1.189	60 2.360							CPR 5 30 60	5 0.197	0.083 0.183	
35 1.380	51 2.026	CP 35 52	0.8 0.031	0.007 0.015	CP 3 35 52	3 0.118	0.026 0.057				35
35 1.386	68 2.675							CPR 5 35 68	5 0.197	0.102 0.225	
40 1.577	59 2.341	CP 40 60	0.8 0.031	0.009 0.021	CP 3 40 60	3 0.118	0.034 0.075				40
40 1.583	78 3.069							CPR 6 40 78	6 0.236	0.162 0.357	
45 1.774	64 2.533	CP 45 65	0.8 0.031	0.010 0.022	CP 3 45 65	3 0.118	0.037 0.082				45
45 1.780	85 3.344							CPR 8 45 85	8 0.315	0.245 0.540	
50 1.970	69 2.731	CP 50 70	0.8 0.031	0.011 0.024	CP 3 50 70	3 0.118	0.040 0.088				50
50 1.970	95 2.731							CPR 8 50 95	8 0.315	0.308 0.679	
55 2.167	77 3.046	CP 55 78	0.8 0.031	0.014 0.031	CP 4 55 78	4 0.157	0.069 0.152				55
55 2.174	105 4.131							CPR 8 55 105	8 0.315	0.380 0.838	

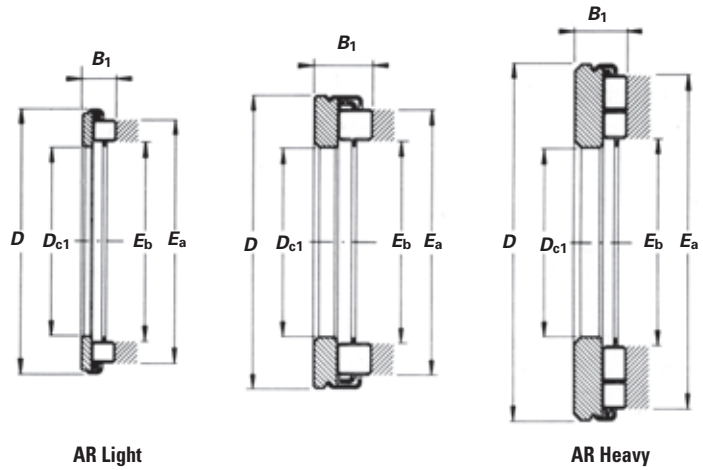
<sup>(1)</sup> ±0.03 mm (±0.0012") under 150 N (34 lbs.) load

<sup>(2)</sup> ±0.05 mm (±0.0020") under 250 N (56 lbs.) load

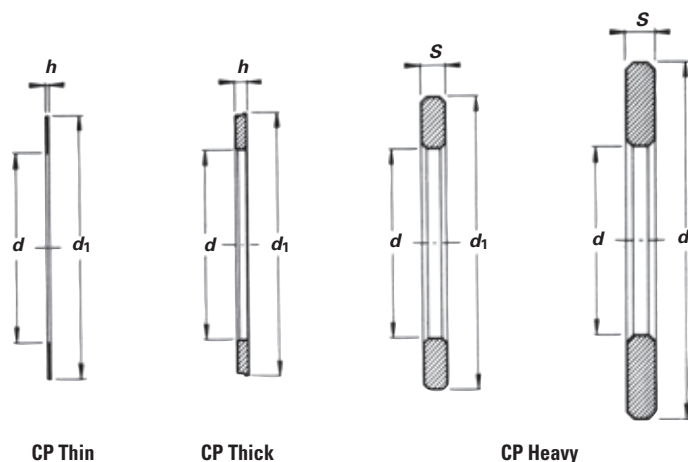
Continued on next page.

## UNITIZED ROLLER THRUST BEARING ASSEMBLIES — *continued*

### METRIC SERIES



Shaft Diameter	mm/in.					Light Series	Heavy Series	Wt. kg/lbs.	Load Ratings kN/lbf.		Limiting Speed Oil RPM
	D <sub>c1</sub>	D	B <sub>1</sub>	E <sub>a</sub>	E <sub>b</sub>				Dynamic C	Static C <sub>0</sub>	
60	60	85	10	79.5	63.5	AR 10 60 85,4		0.150 0.331	71.0	255.0	3500
	2.362	3.362	0.394	3.13	2.50				16000	57300	
60	60	110	14	101.2	65.2	AR 14 60 110		0.572 1.261	130.0	580.0	2900
	2.362	4.331	0.551	3.98	2.57				29200	130400	
65	65	90	10	84.5	68.5	AR 10 65 90,4		0.160 0.353	74.0	275.0	3200
	2.559	3.559	0.394	3.33	2.70				16600	61800	
65	65	115	14	106.2	70.2	AR 14 65 115		0.610 1.345	135.0	620.0	2800
	2.559	4.528	0.551	4.18	2.76				30300	139400	
70	70	95	10	89.5	73.5	AR 10 70 95,4		0.170 0.375	77.0	295.0	3000
	2.756	3.756	0.394	3.52	2.89				17300	66300	
70	70	125	16	116.0	76.0	AR 16 70 125		0.775 1.709	174.0	710.0	2600
	2.756	4.921	0.630	4.57	2.99				39100	159600	
75	75	100	10	94.5	78.5	AR 10 75 100,4		0.180 0.397	80.0	313.0	2800
	2.953	3.938	0.394	3.72	3.09				18000	70400	
75	75	135	16	126.0	82.0	AR 16 75 135		0.893 1.969	198.0	860.0	2400
	2.953	5.315	0.630	4.96	3.23				44500	193300	
80	80	105	10	99.5	83.5	AR 10 80 105,4		0.190 0.419	82.0	330.0	2700
	3.150	4.150	0.394	3.92	3.29				18400	74200	
80	80	140	16	131.0	87.0	AR 16 80 140		0.960 2.116	208.0	940.0	2300
	3.150	5.512	0.630	5.16	3.43				46800	211300	
85	85	150	18	138.0	92.0	AR 18 85 150		1.256 2.769	230.0	1010.0	2100
90	90	155	18	143.0	97.0	AR 18 90 155		1.330 2.932	245.0	1090.0	2000
100	100	170	20	157.0	109.0	AR 20 100 170		1.740 3.836	280.0	1250.0	1800
110	110	190	24	178.0	118.0	AR 24 110 190		2.500 5.512	365.0	1600.0	1700
120	120	210	24	199.0	127.0	AR 24 120 210		3.200 7.055	470.0	2300.0	1500
130	130	225	24	214.0	138.0	AR 24 130 225		3.600 7.937	510.0	2640.0	1400
140											



mm/in.		Thin Series	mm/in.		Thick Series	mm/in.		Heavy Series	mm/in.		Shaft Diameter mm
$d$	$d_1$		Wt. kg/lbs.			Wt.			Wt. kg/lbs.		
			$S^1$			$h^2$			$h^2$		
60 2.366	84 3.318	CP 60 85	0.8 0.031	0.017 0.037	CP 4 60 85	4 0.157	0.083 0.183				60
60 2.371	110 4.328							CPR 8 60 110	8 0.315	0.405 0.893	
65 2.563	89 3.515	CP 1,5 65 90	1.5 0.059	0.033 0.073	CP 4 65 90	4 0.157	0.088 0.194				65
65 2.568	115 4.525							CPR 8 65 115	8 0.315	0.430 0.948	
70 2.760	94 3.711	CP 1,5 70 95	1.5 0.059	0.034 0.076	CP 4 70 95	4 0.157	0.093 0.205				70
70 2.765	125 4.918							CPR 8 70 125	8 0.315	0.510 1.12	
75 2.967	99 3.894	CP 1,5 75 100	1.5 0.059	0.037 0.082	CP 4 75 100	4 0.157	0.099 0.218				75
75 2.961	135 5.312							CPR 8 75 135	8 0.315	0.595 1.31	
80 3.163	104 4.091	CP 1,5 80 105	1.5 0.059	0.039 0.086	CP 4 80 105	4 0.157	0.104 0.229				80
80 3.159	140 5.508							CPR 8 80 140	8 0.315	0.630 1.39	
85 3.356	150 5.902							CPR 9 85 150	9 0.354	0.815 1.80	85
90 3.553	155 6.099							CPR 9 90 155	9 0.354	0.840 1.85	90
100 3.946	170 6.690							CPR 10 100 170	10 0.394	1.13 2.49	100
110 4.340	190 7.476							CPR 12 110 190	12 0.472	1.70 3.75	110
120 4.735	210 8.264							CPR 12 120 210	12 0.472	2.10 4.63	120
130 5.128	225 8.854							CPR 12 130 225	12 0.472	2.40 5.29	130
140 5.522	240 9.445							CPR 14 140 240	14 0.550	3.20 7.05	140

<sup>(1)</sup> ±0.03 mm (±0.0012") under 150 N (34 lbs.) load

<sup>(2)</sup> ±0.05 mm (±0.0020") under 250 N (56 lbs.) load



## THRUST ASSEMBLIES AND THRUST BEARINGS – INCH SERIES

### NEEDLE ROLLER AND CAGE THRUST ASSEMBLIES CYLINDRICAL ROLLER AND CAGE THRUST ASSEMBLIES CYLINDRICAL ROLLER THRUST BEARINGS THRUST WASHERS

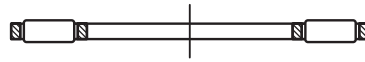
Thrust assemblies and thrust bearings of inch series are available in a variety of sizes. This catalog includes the most popular, standardized designs. If the back up surfaces cannot be used as raceways, hardened thrust washers are available.

#### REFERENCE STANDARDS ARE:

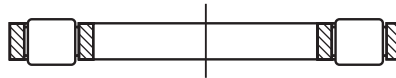
- **ANSI/ABMA Std. 21.2** – Thrust needle roller and case assemblies and thrust washers - Inch design
- **ANSI/ABMA Std. 24.2** – Thrust bearings of ball and cylindrical roller types - Inch design.

Before selecting specific thrust assemblies or thrust bearings, the engineering section of the catalog should be reviewed.

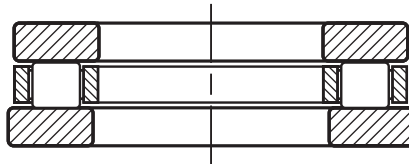
### TYPES OF INCH SERIES THRUST ASSEMBLIES, THRUST BEARINGS AND THRUST WASHERS.



**NTA**  
Needle roller and cage thrust assembly



**NTH**  
Cylindrical roller and cage thrust assembly



**NTHA**  
Cylindrical roller thrust bearing



**TRA...TRD**  
Thrust washers

C



## IDENTIFICATION

NTA is the complete prefix code for a needle roller and cage thrust assembly with inch nominal dimensions using needle rollers of the smallest practical diameter.

Cylindrical roller and cage thrust assemblies with inch nominal dimensions are identified by the prefix letters NTH. They use large diameter cylindrical rollers providing higher load ratings.

Thrust washers of inch nominal dimensions are identified by the prefix letters TR, followed by another letter such as A, B, or C etc. indicating washer thickness. TRA is the complete prefix code for the thinnest thrust washer made to inch nominal dimensions.

Most thrust washers are intended to be piloted on their bores. Some washers, however, are designed to be piloted on their outside diameters. Such washers are identified by the letter D following the thickness code letter. Thus TRJD is the complete prefix code for a thrust washer with inch nominal dimensions of J thickness and designed to be piloted by its outside diameter.

Cylindrical roller thrust bearings with prefix code NTHA are made up of one NTH assembly, one TRI or TRJ bore piloted washer and one TRID or TRJD outside diameter piloted washer.

Since the bearing designation for thrust assemblies does not appear on the bearing itself, the manufacturer's parts list or another reliable source should always be consulted when ordering bearings for service or field replacement, to make certain that the correct bearing with the correct lubricant is used.

## CONSTRUCTION

Needle roller and cage thrust assemblies (NTA) and cylindrical roller and cage thrust assemblies (NTH) have hardened cages and through hardened, precision ground rollers. The cages are securely fastened assemblies of two mating pieces. This construction minimizes cage stress and assures that the roller retaining function of the cage is unaffected by normal wear. The needle rollers and the cylindrical rollers are precision ground and lapped to close tolerance for optimum load distribution.

Thrust washers for the needle roller and cage thrust assemblies are designed for bore piloting. The thinner thrust washers are tumble burnished and may be out of flat due to heat treatment, but will flatten under load. The raceway surfaces of thick thrust washers are ground and lapped.

Thrust washers for the cylindrical roller and cage thrust assemblies are available in both bore piloted and outside diameter piloted types. Their piloting surfaces are ground and raceway surfaces are ground and lapped.

## DIMENSIONAL ACCURACY

### TOLERANCES FOR NEEDLE ROLLER AND CAGE THRUST ASSEMBLIES

Pages C270-C278 list the nominal outside diameter, bore diameter and the needle roller diameter for the inch needle roller and cage thrust assemblies and their corresponding thrust washers appear in the tabular data.

Tolerances for the bore diameters and outside diameters of inch thrust assemblies are given in Table 1.

TABLE 1 – TOLERANCES FOR BORE ( $D_{c1}$ ) AND OUTSIDE ( $D_c$ ) DIAMETERS OF NOMINAL INCH (NTA) NEEDLE ROLLER AND CAGE THRUST ASSEMBLIES

Needle Roller Diameter ( $D_w$ ) (nominal)	Deviations								
	Bore Diameter ( $D_{c1}$ )				Outside Diameter ( $D_c$ )				
	low		high		low		high		
mm	inch	mm	inch	mm	inch	mm	inch	mm	inch
1.984	0.0781	+0.05	+0.002	+0.18	+0.007	-0.25	-0.010	0.50	-0.020
2.175	0.1250	+0.05	+0.002	+0.25	+0.010	-0.25	-0.010	0.63	-0.025

### BORE INSPECTION PROCEDURE FOR ASSEMBLY

The bore diameter ( $D_{c1}$ ) of the assembly should be checked with "go" and "no go" plug gages. The "go" plug gage size is the minimum bore diameter of the assembly. The "no go" plug gage size is the maximum bore diameter of the assembly.

The assembly, under its own free weight, must fall freely from the "go" plug gage. The "no go" plug gage must not enter the bore. Where the "no go" plug gage can be forced through the bore, the assembly must not fall from the gage under its own weight.

### TOLERANCES FOR THRUST WASHERS

Tolerances for the outside diameters and bore diameters of nominal inch thrust washers are given in Tables 2 and 2A.

TABLE 2 – TOLERANCES FOR OUTSIDE DIAMETER ( $d_1$ ) OF NOMINAL INCH (TRA, TRB ETC.) THRUST WASHERS.

Nominal o.d.		Deviations					
>	≤	high		low			
mm	inch	mm	inch	mm	inch		
6.0	0.24	133.4	5.25	-0.025	-0.010	-0.76	-0.030

TABLE 2A – TOLERANCES FOR BORE DIAMETER ( $d$ ) OF NOMINAL INCH (TRA, TRB, ETC.) THRUST WASHERS.

Nominal Bore Diameter		Deviations					
>	≤	high		low			
mm	inch	mm	inch	mm	inch		
6.0	0.24	57.2	2.25	0.05	+0.002	+0.30	+0.012
57.2	2.25	133.4	5.25	+0.05	+0.002	+0.43	+0.017



## BORE INSPECTION PROCEDURE FOR THRUST WASHER

The bore diameter (d) of the thrust washer should be checked with “go” and “no go” plug gages. The “go” plug gage size is the minimum bore diameter of the thrust washer. The “no go” plug gage size is the maximum bore diameter of the thrust washer.

The thrust washer, under its own weight, must fall freely from the “go” plug gage. The “no go” plug gage must not enter the bore. Where the “no go” plug gage can be forced through the bore, the thrust washer must not fall from the gage under its own weight.

## TOLERANCES FOR CYLINDRICAL ROLLER THRUST BEARINGS

The tolerances for inch series cylindrical roller thrust bearings, cylindrical roller cage and thrust assemblies and their corresponding component thrust washers appear in the tabular data.

## MOUNTING TOLERANCES

### NEEDLE ROLLER AND CAGE THRUST ASSEMBLIES

On NTA inch type needle roller and cage thrust assemblies the cage bore has a larger contact area and a closer tolerance than the outside diameter. Therefore, bore piloting is preferred for these assemblies. To reduce wear it is suggested that the piloting surface for the cage be hardened to an equivalent of at least 55 HRC.

Where design requirements prevent bore piloting, the NTA needle roller and cage thrust assemblies may be piloted on the outside diameters. It should be noted that the “diameter to clear washer O.D.” given in the tabular data is not suitable for outside diameter piloting. For such cases suitable O.D. piloting dimensions should be determined in consultation with your Timken representative.

### THRUST WASHERS FOR USE WITH NTA NEEDLE ROLLER AND CAGE THRUST ASSEMBLIES

Ideally, a thrust washer should be stationary with respect to, and piloted by, its supporting or backing member, whether or not this is an integral part of the shaft or housing. There should be no rubbing action between the thrust washer and any other machine member. The economics of design, however, often preclude these ideal conditions and thrust washers must be employed in another manner. In such cases design details should be determined in consultation with your Timken representative.

## CYLINDRICAL ROLLER AND CAGE THRUST ASSEMBLIES

Type NTH assembly cage has a relatively large contact area on both the bore and the outside diameter. Thus these assemblies can be piloted by either the shaft or the housing. To reduce wear it is suggested that the piloting surface for the cage be hardened to an equivalent of at least 55 HRC.

When the shaft is used as the piloting surface, the outside diameter of the cage must clear the housing under all conditions. Conversely, when the housing is the piloting surface, the shaft must clear the cage bore under all conditions. It will be noted that the mounting dimensions are given in the tabular data for both shaft and housing piloting. Bore inspection procedure for the assembly given on page C267 should be used for checking the bore of NTH assemblies.

## THRUST WASHERS FOR USE WITH CYLINDRICAL ROLLER AND CAGE THRUST ASSEMBLIES

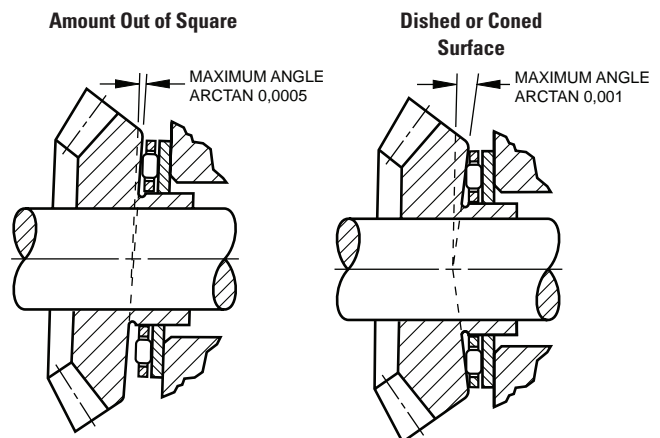
Types TRID and TRJD thrust washers for use with cylindrical roller and cage thrust assemblies are designed to pilot from the housing and to clear the shaft. Types TRI and TRJ thrust washers are designed to pilot from the shaft and clear the housing. The thrust washers should be stationary with respect to their piloting (or locating) machine members. There should be no rubbing action between the washer and any other machine member.

## BACKUP SURFACES

In some applications it is desirable to use the back up surfaces as raceways for the rollers of the thrust assemblies. When this is done, these surfaces must be hardened to an equivalent of at least 58 HRC. If this hardness cannot be achieved and thrust washers cannot be used, the load ratings must be reduced as explained in the engineering section of this catalog.

Thrust raceway surfaces must be ground to a surface of  $8 \mu\text{in } R_a$  ( $0.20 \mu\text{m } R_a$ ). When this requirement cannot be met, thrust washers must be used.

The raceways against which the rollers operate, or the surfaces against which the thrust washers bear, must be square with the axis of the shaft. Equally important, the raceway, or surface backing the thrust washer, must not be dished or coned. The permissible limits of out-of-squareness and dishing or coning are shown in figures below.



## TYPE NTHA CYLINDRICAL ROLLER THRUST BEARING

The NTHA cylindrical roller thrust bearing consists of the NTH cylindrical roller and cage thrust assembly and two thrust washers. This bearing is sold as a unit.

A typical mounting of the thrust bearing when the shaft rotates is shown in Figure a. The bore of the rotating, shaft supported thrust washer is ground for an accurate fit on the shaft. The outside diameter of the stationary, housing supported thrust washer is ground for a proper fit in the housing.

The NTHA cylindrical roller thrust bearing cage is normally shaft piloted. In the event it is necessary to pilot the cage by the housing, Figure b illustrates a possible mounting arrangement. When other mounting arrangements are dictated by the application they should be determined in consultation with your Timken representative.

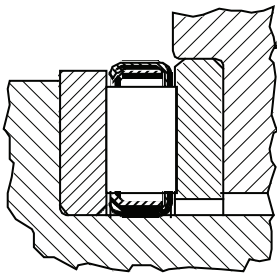


Figure a

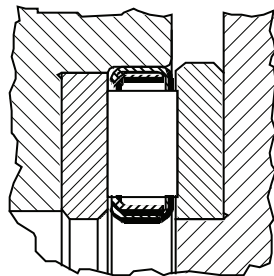


Figure b

## LOAD RATINGS

### MINIMUM AXIAL LOAD

Slippage can occur if the applied axial load is too light and the operating speed of the needle roller and cage thrust assembly is high, particularly if accompanied by inadequate lubrication. For satisfactory operation a certain minimum load must be applied to a needle roller and cage thrust assembly which can be calculated from:

$$F_{amin} = C_0/2200 \text{ [lbf]}$$

where

$C_0$  – static load rating [lbf]

$F_{amin}$  – minimum axial load [lbf]

### Coefficient Of Friction

In general, the coefficient of friction of a thrust bearing (consisting of a needle roller or a cylindrical roller and cage thrust assembly and thrust washers) is defined as the friction torque divided by the product of the applied load and the bearing pitch radius. This coefficient of friction is not a constant value, but will vary considerably with load, speed and lubricant. Generally, the coefficient of friction becomes smaller as the load is increased and larger as the speed is increased. It is suggested that a value of 0.004 to 0.005 be used as a conservative estimate.

### LUBRICATION

Oil is the preferred lubricant for needle roller or cylindrical roller and cage thrust assemblies and an ample oil flow is absolutely necessary for high speeds, or for moderate speeds when the load is relatively high.

When the application must utilize grease lubrication the needle roller and cage thrust assembly should be ordered pregreased. When the speeds are low and rotation is not continuous, the initial charge of grease may be suitable for the life of the application. When the speeds are moderate, however, the designer must provide for frequent regreasing. Since the rollers tend to expel the lubricant radially outward, relubrication passages should be directed to the bore of the cage whether oil or grease is used as the lubricant.

### SPECIAL DESIGNS

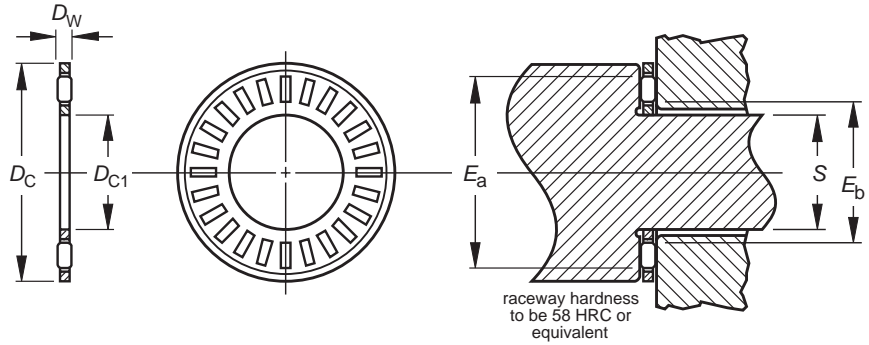
Needle roller and cage thrust assemblies and thrust washers are also made to special dimensions and configurations, as well as from special materials, when quantities permit economical manufacture.

Needle roller and cage thrust assemblies are particularly adaptable to low cost integral combinations with special thrust washers. When the use of such special designs are considered, the following pages should be reviewed for evaluation of proposed arrangements.

**NEEDLE ROLLER AND CAGE THRUST ASSEMBLIES, THRUST WASHERS**

**METRIC AND INCH SERIES**

- Dimensions for bore and O.D. of thrust assemblies and washers are nominal.
- See page C268 for details on piloting and backup surfaces.
- Thrust washers burnished at least one-quarter of bore area (remainder is rough breakaway finish).
- O.D. finish of washers will be as blanked.
- Thinner washers may be out of flat due to distortion in hardening in the free state (expected to flatten out under load).

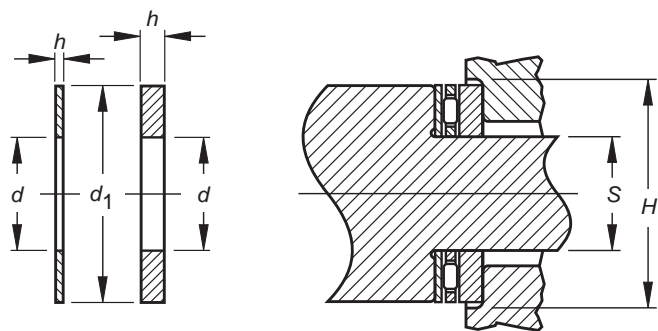


NTA

Shaft Diameter	Dimensions mm/in.					Assembly Designation	Load Ratings kN/lbf.		Limiting Speed Oil RPM	Wt. kg/lbs.
	D <sub>c1</sub>	D <sub>c</sub>	D <sub>w</sub>	E <sub>b</sub>	E <sub>a</sub>		C	C <sub>0</sub>		
1/4	6.35 0.250	17.45 0.687	1.984 0.0781	8.636 0.340	14.732 0.580	NTA-411	5.12 1150	10.76 2420	26000	0.001 0.003
5/16	7.92 0.312	19.05 0.75	1.984 0.0781	10.16 0.400	16.256 0.640	NTA-512	5.83 1310	13.17 2960	24000	0.002 0.004
3/8	9.53 0.375	20.625 0.812	1.984 0.0781	11.68 0.460	18.034 0.710	NTA-613	6.05 1360	14.32 3220	22000	0.002 0.004
1/2	12.70 0.500	23.80 0.937	1.984 0.0781	14.99 0.590	21.08 0.830	NTA-815	7.16 1610	19.13 4300	19000	0.002 0.005
9/16	14.275 0.562	25.40 1.000	1.9837 0.0781	16.51 0.650	22.606 0.890	NTA-916	7.70 1730	21.53 4840	18000	0.003 0.006
5/8	15.88 0.625	28.575 1.125	1.9837 0.0781	18.03 0.710	25.908 1.020	NTA-1018	9.79 2200	30.38 6830	15000	0.003 0.007
3/4	19.05 0.750	31.75 1.250	1.9837 0.0781	21.34 0.840	28.956 1.140	NTA-1220	10.90 2450	36.48 8200	14000	0.004 0.009

Limiting speeds listed are based on adequate oil lubrication. See page C269 for lubrication information.

Suggestions for an application requiring O.D. piloting should be determined in consultation with your Timken representative.



Thrust Washer Designation	Dimensions mm/in.				Piloting Dimensions		Dia. To Clear O.D.	Washer Wt. kg/lbs.	Shaft Diameter in.
	d	d <sub>1</sub>	Min.	Max.	Min.	Max.			
	d	d <sub>1</sub>	h		S		H		
TRA-411	6.35 0.250	17.45 0.687	0.76 0.030	0.81 0.032	6.27 0.247	6.35 0.250	18.26 0.719	0.001 0.003	1/4
TRB-411			1.52 0.060	1.60 0.063				0.002 0.005	
TRC-411			2.34 0.092	2.41 0.095				0.004 0.008	
TRA-512	7.92 0.312	19.05 0.750	0.76 0.030	0.81 0.032	7.85 0.309	7.92 0.312	19.84 0.781	0.001 0.003	5/16
TRB-512			1.52 0.060	1.60 0.063				0.003 0.006	
TRA-613	9.53 0.375	20.62 0.812	0.76 0.030	0.81 0.032	9.45 0.372	9.53 0.375	21.44 0.844	0.001 0.003	3/8
TRB-613			1.52 0.060	1.60 0.063				0.003 0.006	
TRC-613			2.34 0.092	2.41 0.095				0.004 0.009	
TRA-815	12.70 0.500	23.80 0.937	0.76 0.030	0.81 0.032	12.62 0.497	12.70 0.500	24.61 0.969	0.002 0.004	1/2
TRB-815			1.52 0.060	1.60 0.063				0.004 0.008	
TRC-815			2.34 0.092	2.41 0.095				0.005 0.012	
TRA-916	14.27 0.562	25.40 1.000	0.76 0.030	0.81 0.032	14.20 0.559	14.27 0.562	26.19 1.031	0.002 0.005	9/16
TRB-916			1.52 0.060	1.60 0.063				0.004 0.008	
TRC-916			2.34 0.092	2.41 0.095				0.006 0.013	
TRA-1018	15.88 0.625	28.58 1.125	0.76 0.030	0.81 0.032	15.80 0.622	15.88 0.625	29.36 1.156	0.003 0.006	5/8
TRB-1018			1.52 0.060	1.60 0.063				0.005 0.012	
TRC-1018			2.34 0.092	2.41 0.095				0.008 0.018	
TRD-1018			3.12 0.123	3.20 0.126				0.011 0.024	
TRE-1018			3.91 0.154	3.99 0.157				0.013 0.029	
TRA-1220	19.05 0.750	31.75 1.250	0.76 0.030	0.81 0.032	18.97 0.747	19.05 0.750	32.54 1.281	0.003 0.007	3/4

Δ If the shaft and the housing adjacent to the bearing O.D. are not concentric, the T.I.R. between the shaft and housing should be added to this dimension.

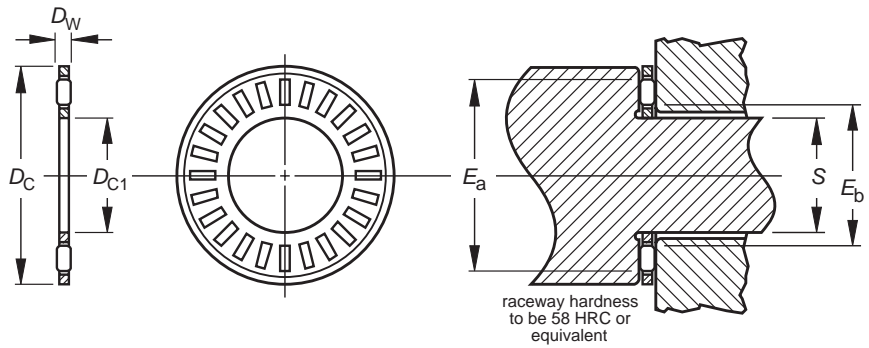
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**NEEDLE ROLLER AND CAGE THRUST ASSEMBLIES, THRUST WASHERS – continued**

**METRIC AND INCH SERIES**

- Dimensions for bore and O.D. of thrust assemblies and washers are nominal.
- See page C270 for details on piloting and backup surfaces.
- Thrust washers burnished at least one-quarter of bore area (remainder is rough breakaway finish).
- O.D. finish of washers will be as blanked.
- Thinner washers may be out of flat due to distortion in hardening in the free state (expected to flatten out under load).

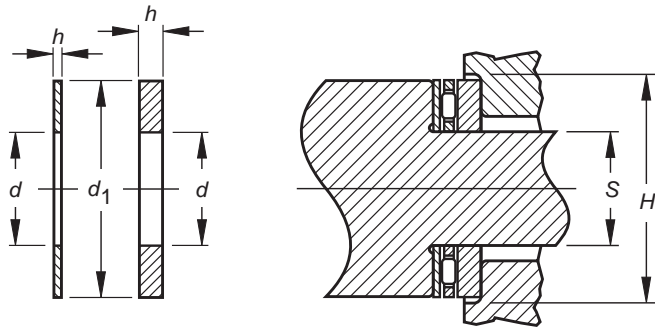


NTA

Shaft Diameter	Dimensions mm/in.					Assembly Designation	Load Ratings kN/lbf.		Limiting Speed Oil RPM	Wt. kg/lbs.
	D <sub>c1</sub>	D <sub>c</sub>	D <sub>w</sub>	E <sub>b</sub>	E <sub>a</sub>		Dynamic C	Static C <sub>0</sub>		
7/8	22.23	36.50	1.984	24.38	33.782	NTA-1423	13.43	49.82	12000	0.005
	0.875	1.437	0.0781	0.960	1.330		3020	11200		
1	22.23	42.85	1.984	25.91	39.878	NTC-1427	18.46	78.29	9800	0.008
	0.875	1.687	0.0781	1.020	1.570		4150	17600		
1	25.40	39.675	1.984	27.69	36.83	NTA-1625	13.83	53.82	11000	0.006
	1.000	1.562	0.0781	1.090	1.450		3110	12100		
1 1/8	28.58	44.45	1.9837	30.73	41.656	NTA-1828	16.68	71.17	9600	0.009
	1.125	1.75	0.0781	1.210	1.640		3750	16000		
1 1/4	31.75	49.20	1.9837	34.04	46.228	NTA-2031	20.15	93.41	8600	0.010
	1.250	1.937	0.0781	1.340	1.820		4530	21000		

Limiting speeds listed are based on adequate oil lubrication. See page C269 for lubrication information.

Suggestions for an application requiring O.D. piloting should be determined in consultation with your Timken representative.



Thrust Washer Designation	Dimensions mm/in.				Piloting Dimensions		Dia. To Clear O.D.	Washer Wt. kg/lbs.	Shaft Diameter in.
	d	d <sub>1</sub>	Min.	Max.	Min.	Max.			
			h		S		H		
TRB-1220			1.52 0.060	1.60 0.063				0.006 0.013	
TRC-1220			2.34 0.092	2.41 0.095				0.010 0.021	
TRD-1220			3.12 0.123	3.20 0.126				0.012 0.026	
TRE-1220			3.91 0.154	3.99 0.157				0.015 0.033	
TRA-1423	22.23 0.875	36.50 1.437	0.76 0.030	0.81 0.032	22.15 0.872	22.23 0.875	37.31 1.469	0.004 0.009	7/8
TRB-1423			1.52 0.060	1.60 0.063				0.008 0.017	
TRC-1423			2.34 0.092	2.41 0.095				0.012 0.026	
TRD-1423			3.12 0.123	3.20 0.126				0.015 0.034	
TRB-1427			1.52 0.060	1.60 0.063				0.013 0.029	
TRC-1427			2.34 0.092	2.41 0.095				0.020 0.044	
TRD-1427			3.12 0.123	3.20 0.126				0.026 0.057	
TRA-1625	25.40 1.000	39.67 1.562	0.76 0.030	0.81 0.032	25.32 0.997	25.40 1.000	40.49 1.594	0.005 0.010	1
TRB-1625			1.52 0.060	1.60 0.063				0.009 0.019	
TRD-1625			3.12 0.123	3.20 0.126				0.017 0.038	
TRE-1625			3.91 0.154	3.99 0.157				0.021 0.047	
TRA-1828	28.58 1.125	44.45 1.750	0.76 0.030	0.81 0.032	28.50 1.122	28.58 1.125	45.24 1.781	0.006 0.013	1 1/8
TRB-1828			1.52 0.060	1.60 0.063				0.011 0.024	
TRC-1828			2.34 0.092	2.41 0.095				0.017 0.037	
TRD-1828			3.12 0.123	3.20 0.126				0.022 0.048	
TRA-2031	31.75 1.250	49.20 1.937	0.76 0.030	0.81 0.032	31.67 1.247	31.75 1.250	50.01 1.969	0.007 0.015	1 1/4

Δ If the shaft and the housing adjacent to the bearing O.D. are not concentric, the T.I.R. between the shaft and housing should be added to this dimension.

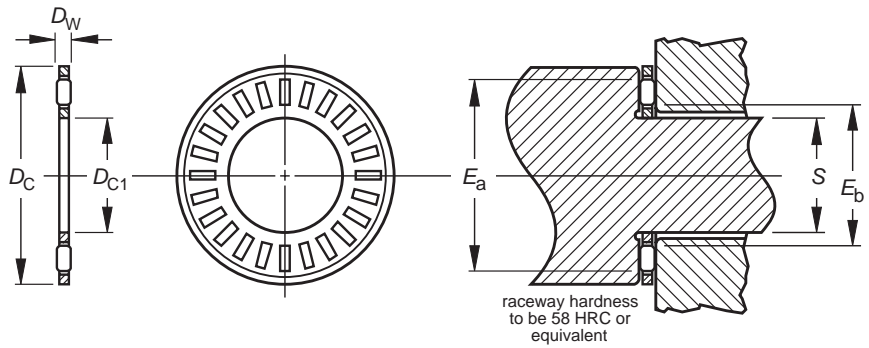
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**NEEDLE ROLLER AND CAGE THRUST ASSEMBLIES, THRUST WASHERS – continued**

**METRIC AND INCH SERIES**

- Dimensions for bore and O.D. of thrust assemblies and washers are nominal.
- See page C268 for details on piloting and backup surfaces.
- Thrust washers burnished at least one-quarter of bore area (remainder is rough breakaway finish).
- O.D. finish of washers will be as blanked.
- Thinner washers may be out of flat due to distortion in hardening in the free state (expected to flatten out under load).

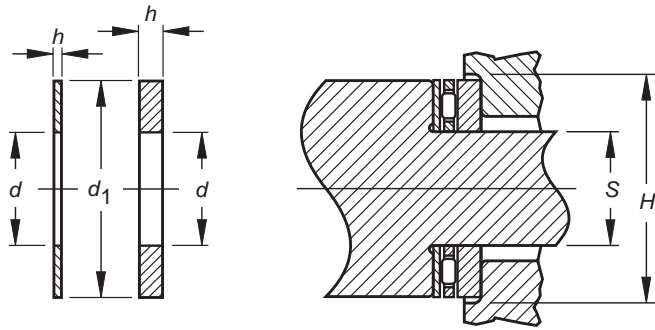


Shaft Diameter	Dimensions mm/in.					Assembly Designation	Load Ratings kN/lbf.		Limiting Speed Oil RPM	Wt. kg/lbs.
	in.	D <sub>c1</sub>	D <sub>c</sub>	D <sub>w</sub>	E <sub>b</sub>		E <sub>a</sub>	C		
1 3/8	34.93 1.375	52.375 2.062	1.9837 0.0781	37.08 1.460	49.53 1.950	NTA-2233	21.35 4800	103.20 23200	8000	0.010 0.023
1 1/2	38.10 1.500	55.55 2.187	1.9837 0.0781	40.39 1.590	52.578 2.070	NTA-2435	23.22 5220	117.88 26500	7600	0.011 0.025
1 3/4	44.45 1.750	63.50 2.500	1.984 0.0781	46.74 1.840	58.928 2.320	NTA-2840	25.31 5690	137.45 30900	6800	0.014 0.031

Limiting speeds listed are based on adequate oil lubrication. See page C269 for lubrication information.

Recommendation for an application requiring O.D. piloting should be determined in consultation with your Timken representative.





Thrust Washer Designation	Dimensions mm/in.				Piloting Dimensions		Dia. To Clear O.D.	Washer Wt. kg/lbs.	Shaft Diameter in.
	d	d <sub>1</sub>	Min.	Max.	Min.	Max.			
			h		S		H		
TRB-2031			1.52 0.060	1.60 0.063				0.014 0.030	
TRC-2031			2.34 0.092	2.41 0.095				0.020 0.044	
TRD-2031			3.12 0.123	3.20 0.126				0.026 0.058	
TRF-2031			4.70 0.185	4.78 0.188				0.041 0.090	
TRA-2233	34.93 1.375	52.37 2.062	0.76 0.030	0.81 0.032	34.85 1.372	34.93 1.375	53.19 2.094	0.007 0.016	1 3/8
TRB-2233			1.52 0.060	1.60 0.063				0.015 0.033	
TRC-2233			2.34 0.092	2.41 0.095				0.018 0.040	
TRD-2233			3.12 0.123	3.20 0.126				0.029 0.065	
TRE-2233			3.91 0.154	3.99 0.157				0.037 0.081	
TRF-2233			4.70 0.185	4.78 0.188				0.044 0.097	
TRA-2435	38.10 1.500	55.55 2.187	0.76 0.030	0.81 0.032	38.02 1.497	38.10 1.500	56.36 2.219	0.008 0.017	1 1/2
TRB-2435			1.52 0.060	1.60 0.063				0.015 0.034	
TRC-2435			2.34 0.092	2.41 0.095				0.023 0.050	
TRD-2435			3.12 0.123	3.20 0.126				0.030 0.067	
TRF-2435			4.70 0.185	4.78 0.188				0.045 0.100	
TRA-2840	44.45 1.750	63.50 2.500	0.76 0.030	0.81 0.032	44.37 1.747	44.45 1.750	64.29 2.531	0.010 0.021	1 3/4
TRB-2840			1.52 0.060	1.60 0.063				0.020 0.044	
TRC-2840			2.34 0.092	2.41 0.095				0.029 0.063	
TRD-2840			3.12 0.123	3.20 0.126				0.038 0.084	
TRF-2840			4.70 0.185	4.78 0.188				0.057 0.126	

Δ If the shaft and the housing adjacent to the bearing O.D. are not concentric, the T.I.R. between the shaft and housing should be added to this dimension.

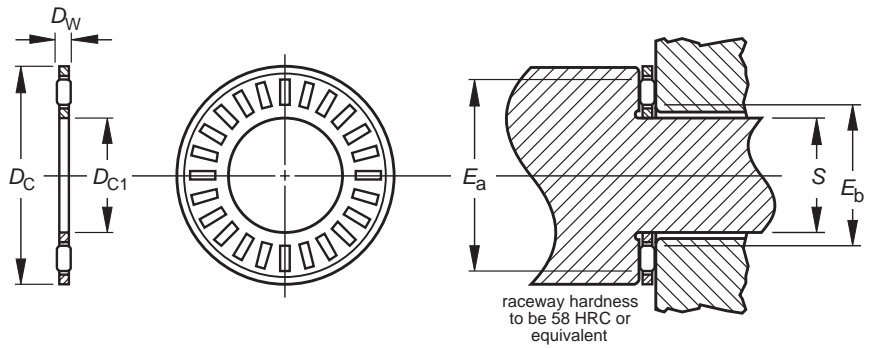
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**NEEDLE ROLLER AND CAGE THRUST ASSEMBLIES, THRUST WASHERS – continued**

**METRIC AND INCH SERIES**

- Dimensions for bore and O.D. of thrust assemblies and washers are nominal.
- See page C268 for details on piloting and backup surfaces.
- Thrust washers burnished at least one-quarter of bore area (remainder is rough breakaway finish).
- O.D. finish of washers will be as blanked.
- Thinner washers may be out of flat due to distortion in hardening in the free state (expected to flatten out under load).

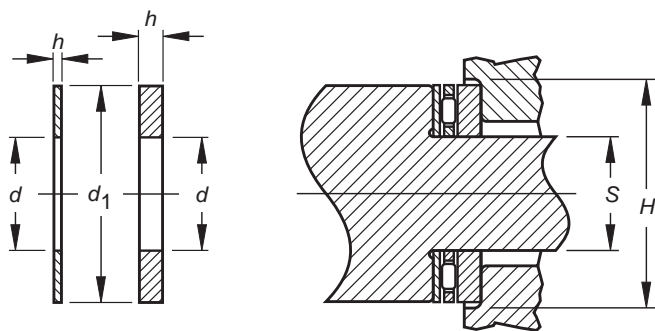


**NTA**

Shaft Diameter	Dimensions mm/in.					Assembly Designation	Load Ratings kN/lbf.		Limiting Speed Oil RPM	Wt. kg/lbs.
	in.	D <sub>c1</sub>	D <sub>c</sub>	D <sub>w</sub>	E <sub>b</sub>		E <sub>a</sub>	C		
2	50.80 2.000	69.85 2.750	1.9837 0.0781	53.09 2.090	65.278 2.570	NTA-3244	24.02 5400	132.56 29800	6100	0.015 0.033
2 1/8	53.98 2.125	73.025 2.875	1.984 0.0781	56.39 2.220	68.58 2.700	NTA-3446	24.42 5490	137.45 30900	5800	0.016 0.036
2 1/4	57.15 2.250	76.20 3.000	1.984 0.0781	59.44 2.340	71.628 2.820	NTA-3648	24.78 5570	142.34 32000	5600	0.017 0.038
2 3/4	63.50 2.500	82.55 3.250	1.9837 0.0781	65.79 2.590	77.978 3.070	NTA-4052	25.53 5740	152.13 34200	5100	0.019 0.041
3	69.85 2.750	92.075 3.625	3.175 0.1250	72.64 2.860	87.884 3.460	NTA-4458	47.60 10700	255.8 57500	4600	0.037 0.082

Limiting speeds listed are based on adequate oil lubrication. See page C269 for lubrication information.

Suggestions for an application requiring O.D. piloting should be determined in consultation with your Timken representative.



Thrust Washer Designation	Dimensions mm/in.				Piloting Dimensions		Dia. To Clear O.D.	Washer Wt. kg/lbs.	Shaft Diameter in.
	d	d <sub>1</sub>	Min.	Max.	Min.	Max.			
TRA-3244	50.80 2.000	69.85 2.750	0.76 0.030	0.81 0.032	50.72 1.997	50.80 2.000	70.64 2.781	0.011 0.024	2
TRB-3244			1.52 0.060	1.60 0.063				0.022 0.048	
TRC-3244			2.34 0.092	2.41 0.095				0.033 0.072	
TRD-3244			3.12 0.123	3.20 0.126				0.044 0.096	
TRF-3244			4.70 0.185	4.78 0.188				0.066 0.145	
TRA-3446	53.98 2.125	73.03 2.875	0.76 0.030	0.81 0.032	53.90 2.122	53.98 2.125	73.81 2.906	0.012 0.026	2 1/8
TRB-3446			1.52 0.060	1.60 0.063				0.024 0.052	
TRC-3446			2.34 0.092	2.41 0.095				0.035 0.078	
TRD-3446			3.12 0.123	3.20 0.126				0.047 0.103	
TRA-3648	57.15 2.250	76.20 3.000	0.76 0.030	0.81 0.032	57.07 2.247	57.15 2.250	76.99 3.031	0.012 0.026	2 1/4
TRB-3648			1.52 0.060	1.60 0.063				0.022 0.048	
TRC-3648			2.34 0.092	2.41 0.095				0.037 0.081	
TRD-3648			3.12 0.123	3.20 0.126				0.048 0.105	
TRF-3648			4.70 0.185	4.78 0.188				0.071 0.157	
—	—	—	—	2.247	2.250	3.156			2 1/4
TRA-4052	63.50 2.500	82.55 3.250	0.76 0.030	0.81 0.032	63.42 2.497	63.50 2.500	83.34 3.281	0.013 0.029	2 1/2
TRB-4052			1.52 0.060	1.60 0.063				0.027 0.059	
TRC-4052			2.34 0.092	2.41 0.095				0.041 0.09	
TRC-4052			3.12 0.123	3.20 0.126				0.054 0.119	
TRA-4458	69.85 2.750	92.08 3.625	0.76 0.030	0.81 0.032	69.77 2.747	69.85 2.750	92.86 3.656	0.018 0.039	2 3/4

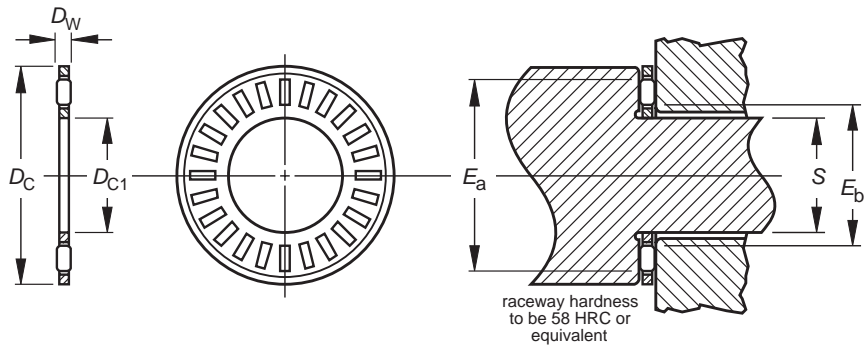
Δ If the shaft and the housing adjacent to the bearing O.D. are not concentric, the T.I.R. between the shaft and housing should be added to this dimension.

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**NEEDLE ROLLER AND CAGE THRUST ASSEMBLIES, THRUST WASHERS – continued**

**METRIC AND INCH SERIES**

- Dimensions for bore and O.D. of thrust assemblies and washers are nominal.
- See page C268 for details on piloting and backup surfaces.
- Thrust washers burnished at least one-quarter of bore area (remainder is rough breakaway finish).
- O.D. finish of washers will be as blanked.
- Thinner washers may be out of flat due to distortion in hardening in the free state (expected to flatten out under load).

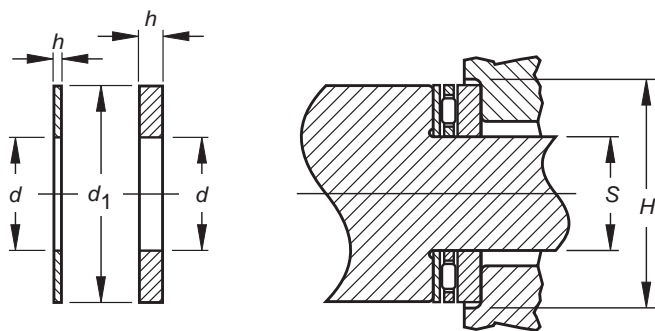


NTA

Shaft Diameter	Dimensions mm/in.					Assembly Designation	Load Ratings kN/lbf.		Limiting Speed Oil RPM	Wt. kg/lbs.
	D <sub>c1</sub>	D <sub>c</sub>	D <sub>w</sub>	E <sub>b</sub>	E <sub>a</sub>		Dynamic C	Static C <sub>0</sub>		
3	76.20 3.000	95.25 3.750	1.9837 0.0781	78.49 3.090	90.678 3.570	NTA-4860	26.96 6060	172.1 38700	4400	0.022 0.048
3 1/4	82.55 3.250	104.78 4.125	3.175 0.1250	85.34 3.360	100.58 3.960	NTA-5266	51.60 11600	294.9 66300	4000	0.042 0.092
3 3/4	95.25 3.750	117.48 4.625	3.175 0.1250	98.04 3.860	113.28 4.460	NTA-6074	56.05 12600	344.3 77400	3500	0.050 0.11
4 1/8	104.78 4.125	128.57 5.062	3.175 0.125	107.44 4.230	124.46 4.900	NTA-6681	63.61 14300	414.6 93200	3200	0.062 0.136

Limiting speeds listed are based on adequate oil lubrication. See page C269 for lubrication information.

Suggestions for an application requiring O.D. piloting should be determined in consultation with your Timken representative.



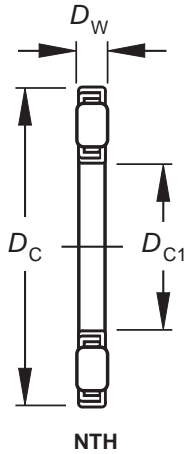
Thrust Washer Designation	Dimensions mm/in.				Piloting Dimensions		Dia. To Clear O.D.	Washer Wt. kg/lbs.	Shaft Diameter in.
	d	d <sub>1</sub>	Min.	Max.	Min.	Max.			
			h		S		H		
TRB-4458			1.52 0.060	1.60 0.063				0.035 0.077	
TRC-4458			2.34 0.092	2.41 0.095				0.051 0.113	
TRD-4458			3.12 0.123	3.20 0.126				0.069 0.152	
TRF-4458			4.70 0.185	4.78 0.188				0.104 0.229	
TRA-4860	76.20 3.000	95.25 3.750	0.76 0.030	0.81 0.032	76.12 2.997	76.20 3.000	96.04 3.781	0.015 0.034	3
TRB-4860			1.52 0.060	1.60 0.063				0.032 0.07	
TRD-4860			3.12 0.123	3.20 0.126				0.061 0.135	
TRA-5266	82.55 3.250	104.78 4.125	0.76 0.030	0.81 0.032	82.47 3.247	82.55 3.250	105.56 4.156	0.020 0.044	3 1/4
TRD-5266			3.12 0.123	3.20 0.126				0.080 0.176	
TRA-6074 3.750	95.25 4.625	117.48 0.030	0.76 0.032	0.81 3.747	95.17 3.750	95.25 4.656	118.26 0.05	0.023	3 3/4
TRB-6074			1.52 0.060	1.60 0.063				0.046 0.101	
TRC-6074			2.34 0.092	2.41 0.095				0.069 0.152	
TRD-6074			3.12 0.123	3.20 0.126				0.092 0.202	
TRA-6681	104.78 4.125	128.57 5.062	0.76 0.030	0.81 0.032	104.70 4.122	104.78 4.125	129.39 5.094	0.027 0.059	4 1/8
TRC-6681			2.34 0.092	2.41 0.095				0.081 0.178	
TRD-6681			3.12 0.123	3.20 0.126				0.109 0.24	
TRF-6681			4.70 0.185	4.78 0.188				0.161 0.354	

Δ If the shaft and the housing adjacent to the bearing O.D. are not concentric, the T.I.R. between the shaft and housing should be added to this dimension.

## CYLINDRICAL ROLLER AND CAGE THRUST ASSEMBLIES

### INCH SERIES

C



Shaft Diameter	Dimensions mm/in.			Bearing Designation	Load Ratings kN/lbf.		Limiting Speed Oil
	+0.38, -0.015 -0, -0	-0.13, -0.005 -0.51, -0.020	+0, +0.000 -0.005, -0.0002		Dynamic	Static	
in.	$D_{c1}$	$d_c$	$D_w$		C	$C_0$	RPM
1 1/2	38.15 1.502	75.44 2.970	6.35 0.250	NTH-2448	81.8 18400	280 62900	5700
2	50.85 2.002	91.31 3.595	9.53 0.375	NTH-3258	129 29000	407 91600	4700
2 1/8	54.03 2.127	94.49 3.720	9.53 0.375	NTH-3460	133 30000	433 97400	4500
2 1/4	57.20 2.252	97.66 3.845	9.53 0.375	NTH-3662	138 31100	458 103000	4400
2 3/8	60.38 2.377	100.84 3.970	9.53 0.375	NTH-3864	143 32100	484.9 109000	4200
2 1/2	63.55 2.502	104.01 4.095	9.53 0.375	NTH-4066	147 33000	511 115000	4100
2 5/8	66.73 2.627	109.60 4.315	9.53 0.375	NTH-4270	156 35100	556 125000	3900
2 3/4	69.98 2.755	112.78 4.440	9.53 0.375	NTH-4472	161 36100	587 132000	3800
3	76.33 3.005	119.13 4.690	9.53 0.375	NTH-4876	169 38000	641 144000	3600
3 1/4	82.68 3.255	125.48 4.940	9.53 0.375	NTH-5280	178 39900	698 157000	3400
3 1/2	89.03 3.505	132.26 5.207	9.53 0.375	NTH-5684	180. 40500	725 163000	3200

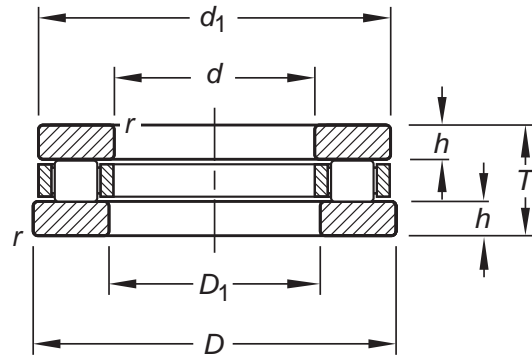
Limiting speeds listed are based on adequate oil lubrication.  
See page C269 for lubrication information.

Assembly Wt. kg/lbs.	Shaft Piloting		Piloting Dimensions mm/in. Housing Piloting		Raceway Contact		Shaft Diameter
	+0, +0.000 -13, -0.005	Min.	Max.	-13, -0.005 -0, -0.000	E <sub>b</sub>	E <sub>a</sub>	
	S <sub>p</sub>	H <sub>c</sub>	S <sub>c</sub>	H <sub>p</sub>	E <sub>b</sub>	E <sub>a</sub>	in.
<b>0.10</b> 0.23	<b>38.10</b> 1.500	<b>76.96</b> 3.030	<b>36.63</b> 1.442	<b>75.57</b> 2.975	<b>44.70</b> 1.760	<b>68.83</b> 2.710	<b>1 1/2</b>
<b>0.21</b> 0.47	<b>50.80</b> 2.000	<b>92.84</b> 3.655	<b>49.33</b> 1.942	<b>91.44</b> 3.600	<b>57.40</b> 2.260	<b>84.33</b> 3.320	<b>2</b>
<b>0.22</b> 0.49	<b>53.98</b> 2.125	<b>96.01</b> 3.780	<b>52.5</b> 2.067	<b>94.62</b> 3.725	<b>60.71</b> 2.390	<b>87.38</b> 3.440	<b>2 1/8</b>
<b>0.24</b> 0.52	<b>57.15</b> 2.250	<b>99.19</b> 3.905	<b>55.68</b> 2.192	<b>97.79</b> 3.850	<b>63.75</b> 2.510	<b>90.68</b> 3.570	<b>2 1/4</b>
<b>0.24</b> 0.54	<b>60.33</b> 2.375	<b>102.36</b> 4.030	<b>58.85</b> 2.317	<b>100.97</b> 3.975	<b>67.06</b> 2.640	<b>93.73</b> 3.690	<b>2 3/8</b>
<b>0.26</b> 0.57	<b>63.50</b> 2.500	<b>105.54</b> 4.155	<b>62.03</b> 2.442	<b>104.14</b> 4.100	<b>70.10</b> 2.760	<b>97.03</b> 3.820	<b>2 1/2</b>
<b>0.28</b> 0.62	<b>66.68</b> 2.625	<b>111.13</b> 4.375	<b>65.2</b> 2.567	<b>109.73</b> 4.320	<b>73.41</b> 2.890	<b>102.36</b> 4.030	<b>2 5/8</b>
<b>0.29</b> 0.64	<b>69.85</b> 2.750	<b>114.30</b> 4.500	<b>68.45</b> 2.695	<b>112.90</b> 4.445	<b>76.45</b> 3.010	<b>105.66</b> 4.160	<b>2 3/4</b>
<b>0.31</b> 0.69	<b>76.20</b> 3.000	<b>120.65</b> 4.750	<b>74.8</b> 2.945	<b>119.25</b> 4.695	<b>82.80</b> 3.260	<b>112.01</b> 4.410	<b>3</b>
<b>0.34</b> 0.75	<b>82.55</b> 3.250	<b>127.00</b> 5.000	<b>81.15</b> 3.195	<b>125.60</b> 4.945	<b>89.15</b> 3.510	<b>118.36</b> 4.660	<b>3 1/4</b>
<b>0.37</b> 0.81	<b>88.90</b> 3.500	<b>133.78</b> 5.267	<b>87.5</b> 3.445	<b>132.38</b> 5.212	<b>95.76</b> 3.770	<b>125.73</b> 4.950	<b>3 1/2</b>



**CYLINDRICAL ROLLER THRUST BEARINGS**

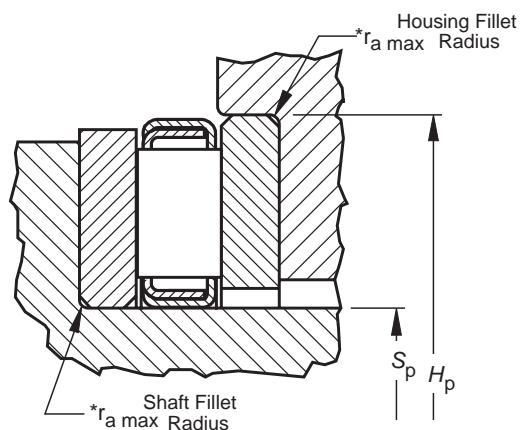
- Check for availability.
- The NTHA thrust cylindrical roller bearing consists of an NTH cage and roller assembly, one bore piloted washer and one O.D. piloted washer. The NTHA bearing is identified and sold as a unit, and is manufactured to inch nominal dimensions only.
- Load ratings given are identical to the corresponding NTH thrust cylindrical roller and cage assembly.
- It is suggested that the cage and roller assembly be bore piloted when applying NTHA bearings. When different arrangements of piloting are required, please contact your Timken representative.
- Back-up surfaces should be flat and square with the center line of the shaft.
- To order individual thrust washers see washer designation below.



**NTHA**

Shaft Diameter	Dimensions mm/in.						Bearing Designation	Bearing Wt. kg/lbs.
	Shaft Piloted Washer			Housing Piloted Washer				
in.	Min. d	Max. d	Nom. d <sub>1</sub>	Max. D	Min. D <sub>1</sub>	Nom. D <sub>1</sub>	T	
1 1/2	38.082 1.4993	38.100 1.5000	74.613 2 15/16	76.218 3.0007	76.200 3.0000	39.688 1 9/16	20.62 0.812	NTHA-2448 0.47 1.03
2	50.775 1.9990	50.800 2.0000	90.488 3 9/16	92.098 3.6259	92.075 3.6250	52.388 2 1/16	25.40 1.000	NTHA-3258 0.76 1.68
2 1/8	53.950 2.1240	53.975 2.1250	93.663 3 11/16	95.278 3.7511	95.250 3.7500	55.563 2 3/16	25.40 1.000	NTHA-3460 0.80 1.76
2 1/4	57.122 2.2489	57.150 2.2500	96.838 3 13/16	98.453 3.8761	98.425 3.8750	58.738 2 5/16	25.40 1.000	NTHA-3662 0.83 1.84
2 3/8	60.297 2.3739	60.325 2.3750	100.013 3 15/16	101.628 4.0011	101.600 4.0000	61.913 2 7/16	25.40 1.000	NTHA-3864 0.87 1.91
2 1/2	63.472 2.4989	63.500 2.5000	103.188 4 1/16	104.808 4.1263	104.775 4.1250	65.088 2 9/16	25.40 1.000	NTHA-4066 0.90 1.99
2 5/8	66.645 2.6238	66.675 2.6250	108.744 4 9/32	110.345 4.3443	110.312 4.3430	68.263 2 11/16	25.40 1.000	NTHA-4270 1.01 2.22
2 3/4	69.820 2.7488	69.850 2.7500	111.919 4 13/32	113.520 4.4693	113.487 4.4680	71.438 2 13/16	25.40 1.000	NTHA-4472 1.04 2.29
3	76.170 2.9988	76.200 3.0000	118.269 4 21/32	119.875 4.7195	119.837 4.7180	77.788 3 1/16	25.40 1.000	NTHA-4876 1.12 2.46
3 1/4	82.517 3.2487	82.550 3.2500	124.619 4 29/32	126.225 4.9695	126.187 4.9680	84.138 3 5/16	25.40 1.000	NTHA-5280 1.19 2.62
3 1/2	88.867 3.4987	88.900 3.5000	130.969 5 5/32	132.575 5.2195	132.537 5.2180	90.488 3 9/16	25.40 1.000	NTHA-5684 1.27 2.80





Load Ratings kN/lbf.		Limiting Speed Oil RPM	Dimensions mm/in.				Bore Piloted Washer	Washer Wt. kg/lbs.	O.D. Piloted Washer	Washer Wt. kg/lbs.	Shaft Diameter in.
Dynamic C	Static C <sub>0</sub>		+0, +0.000 -0.127, -0.0050	+0.127, +0.0050 -0, -0.000	r <sub>s min</sub>	+0, +0.000 -0.076, -0.0030					
81.8 18400	280 62900	5700	38.082 1.4993	76.218 3.0007	0.81 0.032	7.137 0.2810	TRI-2448 9.91 0.39	TRID-2448	9.91 0.39	1 1/2	
129 29000	408 91600	4700	50.775 1.9990	92.098 3.6259	1.57 0.062	7.938 0.3125	TRJ-3258 14.48 0.57	TRJD-3258	14.99 0.59	2	
133 30000	433 97400	4500	53.950 2.1240	95.278 3.7511	1.57 0.062	7.938 0.3125	TRJ-3460 15.24 0.60	TRJD-3460	15.49 0.61	2 1/8	
138 31100	458 103000	4400	57.122 2.2489	98.453 3.8761	1.57 0.062	7.938 0.3125	TRJ-3662 15.75 0.62	TRJD-3662	16.26 0.64	2 1/4	
143 32100	485 109000	4200	60.297 2.3739	101.628 4.0011	1.57 0.062	7.938 0.3125	TRJ-3864 16.51 0.65	TRJD-3864	16.76 0.66	2 3/8	
147 33000	512 115000	4100	63.472 2.4989	104.808 4.1263	1.57 0.062	7.938 0.3125	TRJ-4066 17.02 0.67	TRJD-4066	17.53 0.69	2 1/2	
156 35100	556 125000	3900	66.645 2.6238	110.345 4.3443	1.57 0.062	7.938 0.3125	TRJ-4270 19.05 0.75	TRJD-4270	19.56 0.77	2 5/8	
161 36100	587 132000	3800	69.820 2.7488	113.520 4.4693	1.57 0.062	7.938 0.3125	TRJ-4472 19.81 0.78	TRJD-4472	20.32 0.80	2 3/4	
169 38000	641 144000	3600	76.170 2.9988	119.875 4.7195	1.57 0.062	7.938 0.3125	TRJ-4876 21.08 0.83	TRJD-4876	21.59 0.85	3	
177 39900	698 157000	3400	82.517 3.2487	126.225 4.9695	1.57 0.062	7.938 0.3125	TRJ-5280 22.61 0.89	TRJD-5280	23.11	3 1/4	
180 40500	725 163000	3200	88.867 3.4987	132.575 5.2195	1.57 0.062	7.938 0.3125	TRJ-5684	TRJD-5284	23.88 0.94	3 1/2	

\* r<sub>as max</sub> is equal to minimum washer chamfer r<sub>s min</sub>.



**NOTES**

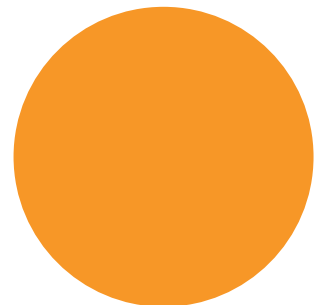
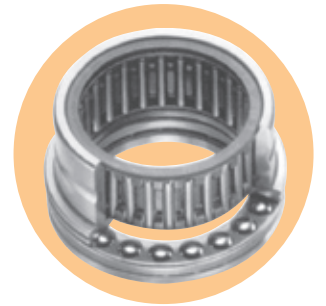
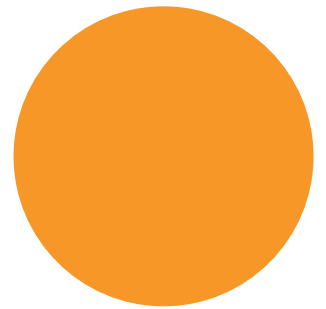
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## COMBINATION BEARINGS

**Overview:** Combined bearings incorporate a radial needle roller bearing and a thrust roller bearing into a convenient unitized package.

- **Sizes:** 5 mm - 70 mm (0.197 in. - 2.756 in.) bore.
- **Markets:** Industrial applications, machine tools, and automotive transmissions.
- **Features:** Available with needle roller or cylindrical roller thrust component, machined and drawn outer rings are available, some sizes available with integral dust caps.
- **Benefits:** An effective alternative to separate radial and thrust bearings.



C



## Combined Needle Roller Bearings - Metric Nominal Dimensions

<b>Prefix</b>	
<b>RAX</b>	radial needle roller and thrust needle (or cylindrical) roller bearing without inner ring or thrust washer
<b>RAXF</b>	closed end drawn cup design radial needle roller and needle thrust roller bearing without inner ring or thrust washer
<b>RAXZ</b>	unitized machined outer ring thrust cylindrical roller and radial needle roller bearing

**RAXF 7 15 TC**

<b>Suffix</b>	
<b>TB</b>	radial play under rollers set to lower half of F6 tolerance
<b>TC</b>	radial play under rollers set to upper half of F6 tolerance

**NAXR 20 Z.TN**

<b>Suffix</b>	
<b>TN</b>	molded polymer retainer
<b>Z</b>	thrust washer retaining dust cap

**Bore diameter**  
20 = 20 mm

<b>Series</b>	
<b>NAXR</b>	machined outer ring thrust cylindrical roller and radial needle roller bearing without inner ring
<b>700</b>	drawn cup design radial needle roller and needle thrust roller bearing without inner ring or thrust washer
<b>400</b>	machined ring radial needle roller and thrust needle roller bearing without inner ring or thrust washer
<b>500</b>	machined ring radial needle roller and thrust cylindrical roller bearing

## Inner rings for Combined Needle Roller Bearings - Metric Nominal Dimensions

<b>Prefix</b>	
<b>JR</b>	inner ring for use with NAXR series bearings

**JR 25 x 30 x 18**

**IM 10 14 16 P**

**Bore diameter**  
25 = 25 mm

**Width**  
18 = 18 mm

**Outside diameter**  
14 = 14 mm

<b>Prefix</b>	
<b>IM</b>	inner ring for use non-NAXR series bearings

<b>Suffix</b>	
<b>P</b>	ISO 492 toleranced inner ring

## Thrust Washers for Combined Needle Roller Bearings - Metric Nominal Dimensions

<b>Prefix</b>	
<b>CP</b>	thrust washer for metric needle roller bearings

**CP 15 28** Thin Washer designation

**CP 2 15 28** Thick Washer designation

**Thickness**  
2 = 2 mm

**Outside diameter**  
28 = 28 mm

**Bore diameter**  
15 = 15 mm



# ***Combined Needle Roller Bearings***



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## COMBINED BEARINGS – METRIC SERIES

Timken® Torrington® combined bearings consist of a radial bearing (needle roller bearing) and a thrust bearing (roller or needle bearing). The thrust roller bearing is usually a cylindrical roller thrust bearing.

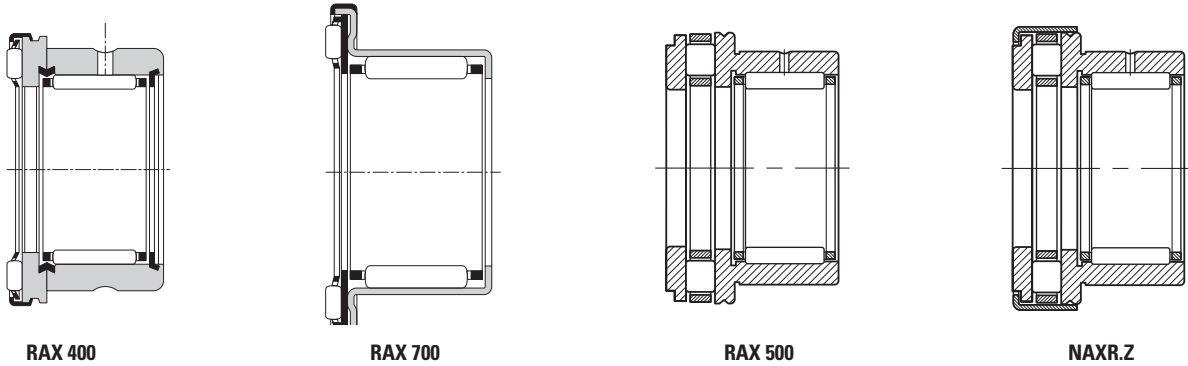
Combined bearings make an effective alternative in place of two separate bearings in terms of cost, handling and packaging. Combined bearings are possible to use with or without matching inner rings and thrust washers, though these are listed opposite the bearing part numbers, where possible, in the following pages of tables, for convenience.

### REFERENCE STANDARDS ARE:

- **DIN 5429, Part 1** – Needle roller – thrust cylindrical roller bearings, series NAXR, NAXR.Z
- **ISO 1206** – Needle roller bearings – light and medium series – dimensions and tolerances

### TYPES OF METRIC SERIES COMBINED BEARINGS

Needle roller-cylindrical roller thrust bearings



#### Suffixes

<b>TN</b>	molded cage of reinforced engineered polymer
<b>Z</b>	retained with a dust cap
<b>Z.TN</b>	retained with a dust cap, molded cage of reinforced engineered polymer
<b>TB</b>	radial play under rollers set to lower half of F6 tolerance limits
<b>TC</b>	radial play under rollers set to upper half of F6 tolerance limits

## CONSTRUCTION

Needle roller – cylindrical roller thrust bearings of series NAXR and RAXZ 500 are available with dust caps. They have the highest axial load carrying capability of all combined bearings.

Combined bearings of series RAX 700 use a thin, one-piece outer ring design similar in construction to metric drawn cups. The RAX 700 Series is available with an open or closed (RAXF) design, as are standard drawn cups. These bearings use needle rollers for both their radial and thrust complements.

The RAX 400 Series uses needle rollers for both their radial and thrust complements, as with the RAX 700 Series, but are constructed from two separate machined rings joined with a strong metal insert. The RAX 500 Series, fabricated like the 400 Series, uses heavier cylindrical rollers for their thrust complement. Both series are available with matching thrust washers and inner rings and should be considered for applications requiring higher load capacity and running accuracy.

Each of the previous two bearing types may be best used without inner rings because the radial internal clearances are smaller if the needle roller and cage assemblies operate directly on a hardened and ground shaft. Tolerance class F6 is the normal specification for the needle roller complement bore diameters of the unmounted bearings.

RAX 400 and 500 Series (without inner rings) can be supplied with a smaller radial clearance if desired. Refer to the suffix options TB and TC as listed in the chart above.

Quality requirements for shafts when used as a bearing raceway are given in the engineering section of this catalog. When it becomes impractical to meet the shaft raceway design requirements, standard inner rings may be used with these bearings.

## DIMENSIONAL ACCURACY

### TOLERANCES

Metric series combined bearings (except Series RAX 700) are manufactured to the normal tolerances which apply to the metric series radial bearings and standard thrust bearings as shown in the engineering section. The only exceptions are: the diameter tolerances of the shaft piloted washer and the bearing width tolerances shown in cross-sectional views listed on the tables in the pages provided.

Because of the nature of the RAX 700 Series design, these bearings must be inspected with suitable plug (GO and NO GO) and ring gages corresponding to metric drawn cups of equivalent bore and O.D. sizes.

The matching thrust washer thickness tolerances may be found in the metric unitized thrust bearing section of this catalog.

## BEARING MOUNTING

### MOUNTING DIMENSIONS

Simple, through-bored housings are adequate for combined bearings. The mounting tolerances for the mechanical ring combined bearings are provided in Table 1.

The shaft piloted washers of combined bearings must be supported at least over half their width. Other quality requirements for shafts and housings are given in the engineering section of this catalog. Requirements for fillets, recesses and shoulder heights are the same as for needle roller bearings as shown in "Mounting dimensions" paragraph on pages C102-C103.

When mounting these bearings in their housings with a tight fit, relatively high press-in forces will be required which may brinell the raceways of the thrust bearing arrangements. Particular care should be exercised when installing needle roller - cylindrical roller thrust bearings with dust caps and where the roller assembly of the thrust bearings cannot be removed. In order to avoid brinelling of the thrust bearing raceways the bearings should be installed with uniform, continuous pressure against the installation tool, avoiding sudden impact forces. At times it may even be desirable to heat the housing before bearing mounting.

TABLE 1 – MOUNTING TOLERANCES

Rotation Conditions	ISO tolerance zone for housing	Nominal shaft diameter, d mm		ISO tolerance zone for shaft	
				With Inner Ring	Without Inner Ring
Load Stationary Relative to Housing	K6 (M6) <sup>1</sup>	10	40	k6	h6
		40	70	m6	h6
Load Rotates Relative to Housing	M6 (N6) <sup>1</sup>	all diameters		g6	f6
RAX 700 RAXF 700	H6 (H7)	all diameters		k5	h5 (h6)

<sup>1</sup> Tighter fit for more secure arrangement

## LUBRICATION

When the applied axial loads are relatively high and the application allows the use of oil as the desired method of lubrication, bearing types NAXR and NAXK should be given consideration. Combined bearings with a dust cap may use oil lubrication although their design makes them better suited for use with grease lubrication.

Combined bearings are typically shipped protected with a corrosion-preventive compound which is not a lubricant. The bearings may be used in oil or grease lubricated applications without removal of the corrosion preventive compound, although to avoid subsequent recognition problems it may be advisable to remove the corrosion preventive compound before packing the bearings with a suitable grease.

## LOAD RATINGS

Minimum axial load for combined bearings excluding RAX700:

$$F_{amin} = C_0 / 2200 \quad (\text{kN})$$

$$\text{where } C_0 = \text{static load rating} \quad (\text{kN})$$

## DYNAMIC EQUIVALENT LOAD

Combined bearings can accommodate radial and axial loads.

Radial needle roller complement

$$P = F_r \quad (\text{kN})$$

Cylindrical or needle roller thrust complement

$$P_a = F_a \quad (\text{kN})$$

## STATIC EQUIVALENT LOAD

For all combined bearings series:

Radial needle roller complement

$$P_0 = F_r \quad (\text{kN})$$

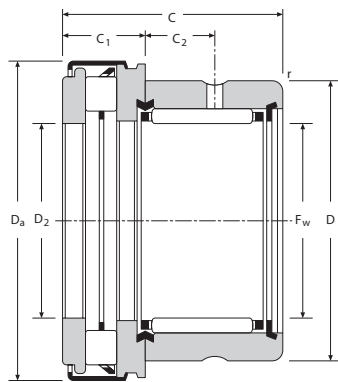
Cylindrical or needle roller thrust complement

$$P_{0a} = F_a \quad (\text{kN})$$

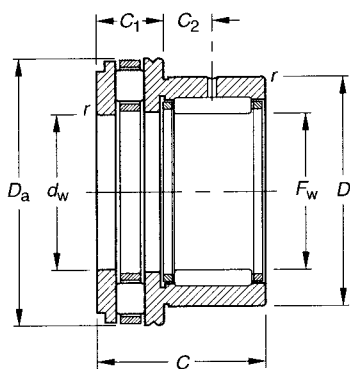


CYLINDRICAL ROLLER THRUST SERIES

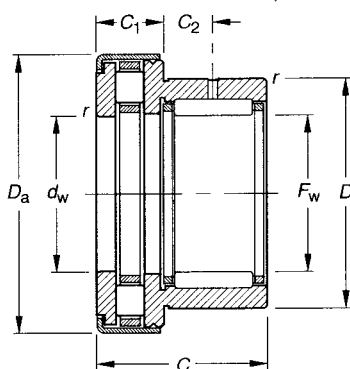
METRIC SERIES



RAXZ50



NAXR



NAXR.Z

Outside Dia.	Dimensions mm/in.							
	$F_w$	D	C	$d_w$	$D_a$	$C_1$	$C_2$	$r_{smin}$
<b>10</b>	<b>10</b> 0.394	<b>19</b> 0.748	<b>21.5</b> 0.846	<b>14</b> 0.551	<b>22.4</b> 0.882	<b>7.5</b> 0.295	<b>6</b> 0.236	<b>0.35</b> 0.014
<b>12</b>	<b>12</b> 0.472	<b>21</b> 0.827	<b>22</b> 0.866	<b>14</b> 0.551	<b>26.4</b> 1.039	<b>8</b> 0.315	<b>6</b> 0.236	<b>0.35</b> 0.014
<b>15</b>	<b>15</b> 0.591	<b>24</b> 0.945	<b>23</b> 0.906	<b>15</b> 0.591	<b>28</b> 1.102	<b>9</b> 0.354	<b>6.5</b> 0.256	<b>0.3</b> 0.012
	<b>15</b> 0.591	<b>24</b> 0.945	<b>23</b> 0.906	<b>15</b> 0.591	<b>29</b> 1.142	<b>9</b> 0.354	<b>6.5</b> 0.256	<b>0.3</b> 0.012
	<b>15</b> 0.591	<b>24</b> 0.945	<b>22</b> 0.866	<b>14</b> 0.551	<b>28.4</b> 1.118	<b>8</b> 0.315	<b>6</b> 0.236	<b>0.35</b> 0.014
<b>17</b>	<b>17</b> 0.669	<b>26</b> 1.024	<b>25</b> 0.984	<b>17</b> 0.669	<b>30</b> 1.181	<b>9</b> 0.354	<b>8.0</b> 0.315	<b>0.3</b> 0.012
	<b>17</b> 0.669	<b>26</b> 1.024	<b>25</b> 0.984	<b>17</b> 0.669	<b>31</b> 1.220	<b>9</b> 0.354	<b>8.0</b> 0.315	<b>0.3</b> 0.012
	<b>17</b> 0.669	<b>26</b> 1.024	<b>24</b> 0.945	<b>16</b> 0.630	<b>30.4</b> 1.197	<b>8</b> 0.315	<b>8</b> 0.315	<b>0.65</b> 0.026
<b>20</b>	<b>20</b> 0.787	<b>30</b> 1.181	<b>30</b> 1.181	<b>20</b> 0.787	<b>35</b> 1.378	<b>10</b> 0.394	<b>10.5</b> 0.413	<b>0.3</b> 0.012
	<b>20</b> 0.787	<b>30</b> 1.181	<b>30</b> 1.181	<b>20</b> 0.787	<b>36</b> 1.417	<b>10</b> 0.394	<b>10.5</b> 0.413	<b>0.3</b> 0.012
	<b>20</b> 0.787	<b>30</b> 1.181	<b>29</b> 1.142	<b>18</b> 0.709	<b>35.4</b> 1.394	<b>11</b> 0.433	<b>9</b> 0.354	<b>0.85</b> 0.033
<b>25</b>	<b>25</b> 0.984	<b>37</b> 1.457	<b>30</b> 1.181	<b>25</b> 0.984	<b>42</b> 1.654	<b>11</b> 0.433	<b>9.5</b> 0.374	<b>0.6</b> 0.024
	<b>25</b> 0.984	<b>37</b> 1.457	<b>30</b> 1.181	<b>25</b> 0.984	<b>43</b> 1.693	<b>11</b> 0.433	<b>9.5</b> 0.374	<b>0.6</b> 0.024
	<b>25</b> 0.984	<b>37</b> 1.457	<b>29</b> 1.142	<b>18</b> 0.709	<b>43</b> 1.693	<b>11</b> 0.433	<b>9</b> 0.354	<b>0.85</b> 0.033
<b>30</b>	<b>30</b> 1.181	<b>42</b> 1.654	<b>30</b> 1.181	<b>30</b> 1.181	<b>47</b> 1.850	<b>11</b> 0.433	<b>9.5</b> 0.374	<b>0.6</b> 0.024
	<b>30</b> 1.181	<b>42</b> 1.654	<b>30</b> 1.181	<b>30</b> 1.181	<b>48</b> 1.890	<b>11</b> 0.433	<b>9.5</b> 0.374	<b>0.6</b> 0.024
	<b>30</b> 1.181	<b>42</b> 1.654	<b>29</b> 1.142	<b>18</b> 0.709	<b>48</b> 1.890	<b>11</b> 0.433	<b>9</b> 0.354	<b>0.85</b> 0.033
<b>35</b>	<b>35</b> 1.378	<b>47</b> 1.850	<b>30</b> 1.181	<b>35</b> 1.378	<b>52</b> 2.047	<b>12</b> 0.472	<b>9.0</b> 0.354	<b>0.6</b> 0.024
	<b>35</b> 1.378	<b>47</b> 1.850	<b>30</b> 1.181	<b>35</b> 1.378	<b>53</b> 2.087	<b>12</b> 0.472	<b>9.0</b> 0.354	<b>0.6</b> 0.024
	<b>35</b> 1.378	<b>47</b> 1.850	<b>30</b> 1.181	<b>18</b> 0.709	<b>54</b> 2.126	<b>12</b> 0.472	<b>9</b> 0.354	<b>0.85</b> 0.033
<b>40</b>	<b>40</b> 1.575	<b>52</b> 2.047	<b>32</b> 1.260	<b>40</b> 1.575	<b>60</b> 2.362	<b>13</b> 0.512	<b>10.0</b> 0.394	<b>0.6</b> 0.024
	<b>40</b> 1.575	<b>52</b> 2.047	<b>32</b> 1.260	<b>40</b> 1.575	<b>61</b> 2.402	<b>13</b> 0.512	<b>10.0</b> 0.394	<b>0.6</b> 0.024
	<b>40</b> 1.575	<b>52</b> 2.047	<b>31</b> 1.220	<b>18</b> 0.709	<b>61</b> 2.402	<b>13</b> 0.512	<b>9</b> 0.354	<b>0.85</b> 0.033



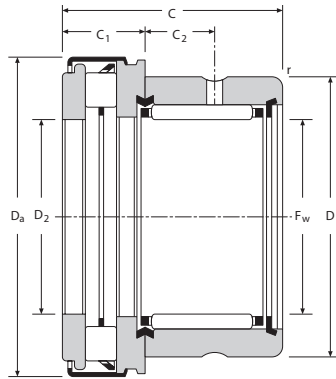
Bearing Designation			Limiting Speed Oil	Load Ratings kN/lbs.				Wt. kg/lbs.	Matching Inner Ring Designation	Shaft Dia. mm
RAXZ	NAXR	NAXR.Z		Radial		Thrust				
			RPM	Dynamic C	Static C <sub>0</sub>	Dynamic C	Static C <sub>0</sub>			
RAXZ 510			15500	5.9 1330	7.2 1610	8.2 1840	17.9 4020	0.026 0.057	IM 7 10 16 P	10
RAXZ 512			13000	6.8 1520	9.0 2030	12.7 2860	29.5 6630	0.033 0.073	IM 9 12 16 P	12
	NAXR15		12000	9.7 2180	12.6 2830	12.1 2720	26.3 5910	0.032 0.071	JR12x15x16	15
		NAXR15.Z	12000	9.7 2180	12.6 2830	12.1 2720	26.3 5910	0.035 0.077	JR12x15x16	
RAXZ 515			11500	9.7 2170	12.6 2830	14.0 3150	34.0 7640	0.036 0.079	IM 12 15 16 P	
	NAXR17		11000	11.4 2560	16.1 3620	12.6 2830	28.6 6430	0.050 0.110	JR14x17x17	17
		NAXR17.Z	11000	11.4 2560	16.1 3620	12.6 2830	28.6 6430	0.053 0.117	JR14x17x17	
RAXZ 517			10500	11.8 2650	16.3 3660	15.0 3370	39.0 8770	0.044 0.097	IM 14 17 17 P	
	NAXR20TN		9500	14.8 3330	23.7 5330	23.6 5310	56.8 12800	0.090 0.198	JR17x20x20	20
		NAXR20Z.TN	9500	14.8 3330	23.7 5330	23.6 5310	56.8 12800	0.095 0.209	JR17x20x20	
RAXZ 520			9000	14.8 3330	23.7 5330	22.0 4950	54.0 12100	0.070 0.154	IM 15 20 20 P	
	NAXR25TN		8000	18.8 4230	29.8 6700	31.2 7010	81.0 18200	0.146 0.322	JR20x25x20	25
		NAXR25Z.TN	8000	18.8 4230	29.8 6700	31.2 7010	81.0 18200	0.152 0.335	JR20x25x20	
RAXZ 525			7500	15.1 3390	26.2 5890	25.5 5730	70.0 15700	0.105 0.231	IM 20 25 20 P	
	NAXR30TN		6700	20.2 4540	34.6 7780	33.0 7420	91.1 20500	0.162 0.357	JR25x30x20	30
		NAXR30Z.TN	6700	20.2 4540	34.6 7780	33.0 7420	91.1 20500	0.169 0.373	JR25x30x20	
RAXZ 530			6500	20.2 4540	34.6 7780	26.5 5960	77.0 17300	0.118 0.260	IM 25 30 20 P	
	NAXR35		6000	22.1 4970	40.8 9170	30.9 6950	86.0 19300	0.186 0.410	JR30x35x20	35
		NAXR35.Z	6000	22.1 4970	40.8 9170	30.9 6950	86.0 19300	0.195 0.430	JR30x35x20	
RAXZ 535			5500	22.1 4970	40.8 9170	33.8 7600	94.0 21100	0.146 0.322	IM 30 35 20 P	
	NAXR40		5300	23.8 5350	47.0 10600	44.5 10000	126.0 28300	0.288 0.635	JR35x40x20	40
		NAXR40.Z	5300	23.8 5350	47.0 10600	44.5 10000	126.0 28300	0.299 0.659	JR35x40x20	
RAXZ 540			5000	23.8 5350	47.0 10600	46.0 10300	129.0 29000	0.174 0.384	IM 35 40 20 P	

Continued on next page.

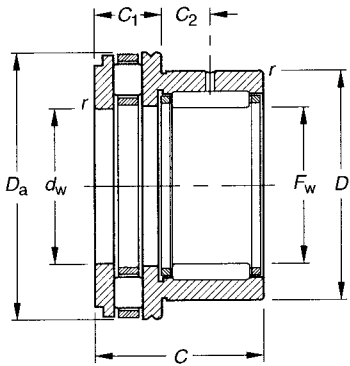




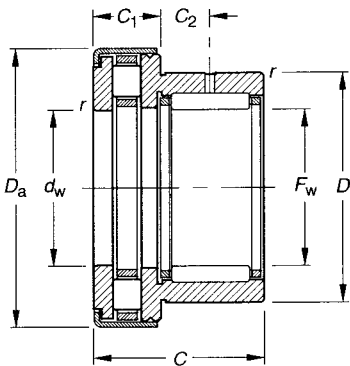
**CYLINDRICAL ROLLER THRUST SERIES — *continued***



**RAXZ50**



**NAXR**



**NAXR.Z**

Outside Dia.	Dimensions mm/in.							
	$F_w$	D	C	$E_7$	$D_a$	$C_1$	$C_2$	$r_{smin}$
45	45 1.772	58 2.283	32 1.260	45 1.772	65 2.559	14 0.551	9.0 0.354	0.6 0.024
	45 1.772	58 2.283	32 1.260	45 1.772	66 2.598	14 0.551	9.0 0.354	0.6 0.024
	45 1.772	58 2.283	31 1.220	18 0.709	66 2.598	13 0.512	9 0.354	0.85 0.033
50	50 1.969	62 2.441	35 1.378	50 1.969	70 2.756	14 0.551	10.0 0.394	0.6 0.024
	50 1.969	62 2.441	35 1.378	50 1.969	71 2.795	14 0.551	10.0 0.394	0.6 0.024
	50 1.969	62 2.441	34 1.339	21 0.827	71 2.795	13 0.512	11 0.433	1.3 0.051
60	60 2.362	72 2.835	36 1.417	21 0.827	86 3.386	15 0.591	11 0.433	1.3 0.051
70	70 2.756	85 3.346	36 1.417	21 0.827	96 3.780	15 0.591	11 0.433	1.3 0.051

C

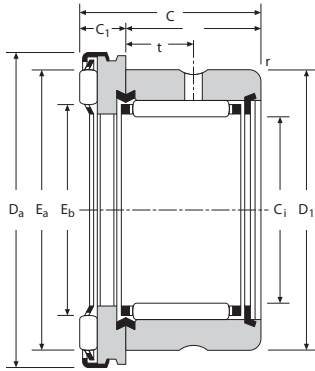
Bearing Designation			Limiting Speed Oil	Load Ratings kN/lbs.				Wt. kg/lbs.	Matching Inner Ring Designation	Shaft Dia.
RAXZ	NAXR	NAXR.Z		Radial		Thrust				
			RPM	Dynamic C	Static C <sub>0</sub>	Dynamic C	Static C <sub>0</sub>		mm	
	NAXR45TN		4800	24.9 5600	51.8 11600	47.0 10600	140.0 31500	0.360 0.794	JR40x45x20	45
		NAXR45Z.TN	4800	24.9 5600	51.8 11600	47.0 10600	140.0 31500	0.370 0.816	JR40x45x20	
RAXZ 545			4500	24.9 5600	51.8 11600	49.0 11000	143.0 32100	0.206 0.454	IM 40 45 20 P	
	NAXR50		4300	30.2 6790	68.5 15400	49.7 11200	155.0 34800	0.432 0.952	JR45x50x25	50
		NAXR50.Z	4300	30.2 6790	68.5 15400	49.7 11200	155.0 34800	0.452 0.996	JR45x50x25	
RAXZ 550			4000	30.2 6790	68.5 15400	51.0 11500	157.0 35300	0.232 0.511	IM 45 50 25 P	
RAXZ 560			3500	31.9 7170	78.1 17600	71.0 16000	255.0 57300	0.327 0.721	IM 55 60 25 P	60
RAXZ 570			3000	36.1 8120	84.7 19000	77.0 17300	295.0 66300	0.435 0.959	IM 60 70 25 P	70

C

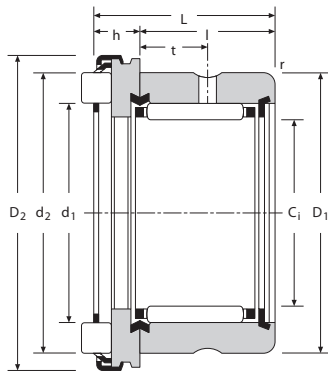




NEEDLE ROLLER AND CYLINDRICAL ROLLER THRUST SERIES  
METRIC SERIES



RAX 400



RAX 500

Outside Dia.	Dimensions mm/in.							
	-1 -0.004 -2 -0.008		E7				+0.05 +0.0019 -0.06 -0.0024	
mm	F <sub>w</sub>	C	D	d <sub>a</sub>	E <sub>b</sub>	E <sub>a</sub>	C <sub>1</sub>	C <sub>2</sub>
10	10	19	19	22	12	18.6	5	6
	0.3937	0.748	0.7480	0.8661	0.47	0.73	0.197	0.236
12	10	19.5	19	22	12.2	18.5	5.5	6
	0.3937	0.768	0.7480	0.8661	0.48	0.73	0.217	0.236
15	12	19	21	26	15	22.6	5	6
	0.4724	0.748	0.8268	1.0236	0.59	0.89	0.197	0.236
17	15	19	24	28	17	24.6	5	6
	0.5906	0.748	0.9449	1.1024	0.67	0.97	0.197	0.236
20	15	20	24	28	16.8	24.9	6	6
	0.5906	0.787	0.9449	1.1024	0.66	0.98	0.236	0.236
25	17	21	26	30	19	26.6	5	8
	0.6693	0.827	1.0236	1.1811	0.75	1.05	0.197	0.315
30	17	22	26	30	18.8	26.9	6	8
	0.6693	0.866	1.0236	1.1811	0.74	1.06	0.236	0.315
35	20	24	30	35	22	31.6	6	9
	0.7874	0.945	1.1811	1.3780	0.87	1.24	0.236	0.354
40	20	26	30	35	22	31.6	8	9
	0.7874	1.024	1.1811	1.3780	0.87	1.24	0.315	0.354
45	25	24	37	42	27.7	37.4	6	9
	0.9843	0.945	1.4567	1.6535	1.09	1.47	0.236	0.354
50	25	26	37	42	27.7	37.4	8	9
	0.9843	1.024	1.4567	1.6535	1.09	1.47	0.315	0.354
55	30	24	42	47	32.7	42.4	6	9
	1.1811	0.945	1.6535	1.8504	1.29	1.67	0.236	0.354
60	30	26	42	47	32.7	42.3	8	9
	1.1811	1.024	1.6535	1.8504	1.29	1.67	0.315	0.354
65	35	24	47	53	37.2	49	6	9
	1.3780	0.945	1.8504	2.0866	1.46	1.93	0.236	0.354
70	35	27	47	53.4	37.8	47.8	9	9
	1.3780	1.063	1.8504	2.1024	1.49	1.88	0.354	0.354
75	40	24	52	60	43	54.9	6	9
	1.5748	0.945	2.0472	2.3622	1.69	2.16	0.236	0.354
80	45	24	58	65	48	59.9	6	9
	1.7717	0.945	2.2835	2.5591	1.89	2.36	0.236	0.354
85	45	28	58	65.4	47.8	59.8	10	9
	1.7717	1.102	2.2835	2.5748	1.88	2.35	0.394	0.354
90	50	27	62	70	53.3	65.7	6	11
	1.9685	1.063	2.4409	2.7559	2.10	2.59	0.236	0.433
95	50	31	62	70.4	52.8	64.8	10	11
	1.9685	1.220	2.4409	2.7717	2.08	2.55	0.394	0.433
100	60	28	72	85	63.5	79.2	7	11
	2.3622	1.102	2.8346	3.3465	2.50	3.12	0.276	0.433
105	60	32	72	85.4	63.5	79.5	11	11
	2.3622	1.260	2.8346	3.3622	2.50	3.13	0.433	0.433
110	70	28	85	95	73.5	89.2	7	11
	2.7559	1.102	3.3465	3.7402	2.89	3.51	0.276	0.433
115	70	32	85	95.4	73.5	89.5	11	11
	2.7559	1.260	3.3465	3.7559	2.89	3.52	0.433	0.433

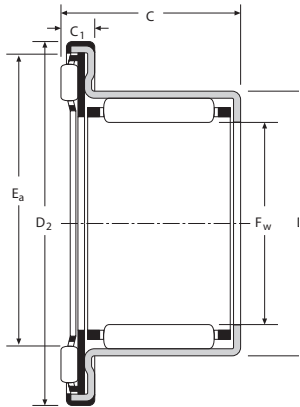
Bearing Designation		Limiting Speed Oil	Load Ratings kN/lbs.				Wt. kg/lbs.	Matching Inner Ring	Thin Plate	Thick Plate	Shaft Dia. mm
400 Series	500 Series		Radial		Thrust						
		RPM	Dynamic C	Static C <sub>0</sub>	Dynamic C	Static C <sub>0</sub>					
RAX 410		15500	5.90 1330	7.16 1610	5.00 1120	10.9 2450		CP 10 22	CP 2 10 22	10	
	RAX 510	15500	5.90 1330	7.16 1610	8.20 1840	17.9 4020	0.025 0.055		CP 10 22	CP 2 10 22	
RAX 412		13000	6.78 1520	9.03 2030	7.10 1600	18.5 4160	0.032 0.071	IM 9 12 16 P	CP 12 26	CP 2 12 26	12
RAX 415		11500	9.66 2170	12.6 2830	7.60 1710	20.8 4680	0.034 0.075	IM 12 15 16 P	CP 15 28	CP 2 15 28	15
	RAX 515	11500	9.66 2170	12.6 2830	14.0 3150	34.0 7640	0.036 0.079	IM 12 15 16 P	CP 15 28	CP 2 15 28	
RAX 417		10500	11.8 2650	16.3 3660	8.10 1820	23.0 5170	0.041 0.090	IM 14 17 17 P	CP 17 30	CP 2 17 30	17
	RAX 517	10500	11.8 2650	16.3 3660	15.0 3370	39.0 8770	0.044 0.097	IM 14 17 17 P	CP 17 30	CP 2 17 30	
RAX 420		9000	14.8 3330	23.7 5330	11.8 2650	39.0 8770	0.066 0.146	IM 15 20 20 P	CP 20 35	CP 3 20 35	20
	RAX 520	9000	14.8 3330	23.7 5330	22.0 4950	54.0 12100	0.070 0.154	IM 15 20 20 P	CP 20 35	CP 3 20 35	
RAX 425		7500	15.1 3390	26.2 5890	13.3 2990	49.0 11000	0.099 0.218	IM 20 25 20 P	CP 25 42	CP 3 25 42	25
	RAX 525	7500	15.1 3390	26.2 5890	25.5 5730	70.0 15700	0.105 0.231	IM 20 25 20 P	CP 25 42	CP 3 25 42	
RAX 430		6500	20.2 4540	34.6 7780	14.5 3260	57.0 12800	0.111 0.245	IM 25 30 20 P	CP 30 47	CP 3 30 47	30
	RAX 530	6500	20.2 4540	34.6 7780	26.5 5960	77.0 17300	0.118 0.260	IM 25 30 20 P	CP 30 47	CP 3 30 47	
RAX 435		5500	22.1 4970	40.8 9170	18.9 4250	84.0 18900	0.130 0.287	IM 30 35 20 P	CP 35 52	CP 3 35 52	35
	RAX 535	5500	22.1 4970	40.8 9170	33.8 7600	94.0 21100	0.146 0.322	IM 30 35 20 P	CP 35 52	CP 3 35 52	
RAX 440		5000	23.8 5350	47.0 10600	20.4 4590	96.0 21600	0.150 0.331	IM 35 40 20 P	CP 40 60	CP 3 40 60	40
RAX 445		4500	24.9 5600	51.8 11600	21.8 4900	109.0 24500	0.179 0.395	IM 40 45 20 P	CP 45 65	CP 3 45 65	45
	RAX 545	4500	24.9 5600	51.8 11600	49.0 11000	143.0 32100	0.206 0.454	IM 40 45 20 P	CP 45 65	CP 3 45 65	
RAX 450		4000	30.2 6790	68.5 15400	22.5 5060	118.0 26500	0.205 0.452	IM 45 50 25 P	CP 50 70	CP 3 50 70	50
	RAX 550	4000	30.2 6790	68.5 15400	51.0 11500	157.0 35300	0.232 0.511	IM 45 50 25 P	CP 50 70	CP 3 50 70	
RAX 460		3500	31.9 7170	78.1 17600	31.5 7080	193.0 43400	0.282 0.622	IM 55 60 25 P	CP 60 85	CP 4 60 85	60
	RAX 560	3500	31.9 7170	78.1 17600	71.0 16000	255.0 57300	0.327 0.721	IM 55 60 25 P	CP 60 85	CP 4 60 85	
RAX 470		3000	36.1 8120	84.7 19000	34.5 7760	223.0 50100	0.386 0.851	IM 60 70 25 P	CP 1,5 70 95	CP 4 70 95	70
	RAX 570	3000	36.1 8120	84.7 19000	77.0 17300	295.0 66300	0.435 0.959	IM 60 70 25 P	CP 1,5 70 95	CP 4 70 95	



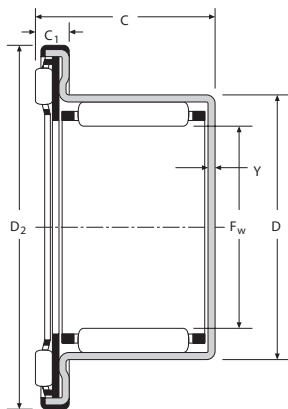


## OPEN AND CLOSED BEARINGS

### METRIC SERIES



RAX 700



RAXF 700

Outside Dia.	Dimensions mm/in.							Bearing Designation	
	$F_w$	$D$	$C$	$D_a$	$E_{ab}$	$E_a$	$C_1$	Open End	Closed End
<b>5</b>	<b>5</b> 0.1969	<b>9</b> 0.3543	<b>11</b> 0.433	<b>15.5</b> 0.6102	<b>7.2</b> 0.28	<b>11.2</b> 0.44	<b>3.3</b> 0.130	<b>RAX 705</b>	
<b>12</b>	<b>12</b> 0.4724	<b>18</b> 0.7087	<b>14.2</b> 0.559	<b>27.5</b> 1.0827	<b>15</b> 0.59	<b>22.6</b> 0.89	<b>4.2</b> 0.165	<b>RAX 712</b>	<b>RAXF 712</b>
<b>14</b>	<b>14</b> 0.5512	<b>20</b> 0.7874	<b>14.2</b> 0.559	<b>29.5</b> 1.1614	<b>17</b> 0.67	<b>24.6</b> 0.97	<b>4.2</b> 0.165	<b>RAX 714</b>	<b>RAXF 714</b>
<b>15</b>	<b>15</b> 0.5906	<b>21</b> 0.8268	<b>14.2</b> 0.559	<b>31.5</b> 1.2402	<b>19</b> 0.75	<b>26.6</b> 1.05	<b>4.2</b> 0.165	<b>RAX 715</b>	<b>RAXF 715</b>
<b>18</b>	<b>18</b> 0.7087	<b>24</b> 0.9449	<b>18.2</b> 0.717	<b>33.5</b> 1.3189	<b>21</b> 0.83	<b>28.6</b> 1.13	<b>4.2</b> 0.165	<b>RAX 718</b>	<b>RAXF 718</b>
<b>20</b>	<b>20</b> 0.7874	<b>26</b> 1.0236	<b>18.2</b> 0.717	<b>36.5</b> 1.4370	<b>22</b> 0.87	<b>31.6</b> 1.24	<b>4.2</b> 0.165	<b>RAX 720</b>	<b>RAXF 720</b>
<b>25</b>	<b>25</b> 0.9843	<b>33</b> 1.2992	<b>22.2</b> 0.874	<b>45.5</b> 1.7913	<b>30</b> 1.18	<b>39.6</b> 1.56	<b>4.2</b> 0.165	<b>RAX 725</b>	<b>RAXF 725</b>
<b>30</b>	<b>30</b> 1.1811	<b>38</b> 1.4961	<b>22.2</b> 0.874	<b>50.5</b> 1.9882	<b>35</b> 1.38	<b>44.7</b> 1.76	<b>4.2</b> 0.165	<b>RAX 730</b>	<b>RAXF 730</b>
<b>35</b>	<b>35</b> 1.3780	<b>43</b> 1.6929	<b>22.2</b> 0.874	<b>56.5</b> 2.2244	<b>39</b> 1.54	<b>50.9</b> 2.00	<b>4.2</b> 0.165	<b>RAX 735</b>	
<b>40</b>	<b>40</b> 1.5748	<b>48</b> 1.8898	<b>22.2</b> 0.874	<b>61.5</b> 2.4213	<b>43</b> 1.69	<b>54.9</b> 2.16	<b>4.2</b> 0.165	<b>RAX 740</b>	<b>RAXF 740</b>
<b>45</b>	<b>45</b> 1.7717	<b>52</b> 2.0472	<b>22.2</b> 0.874	<b>66.5</b> 2.6181	<b>48</b> 1.89	<b>59.9</b> 2.36	<b>4.2</b> 0.165	<b>RAX 745</b>	

mm/in.	Limiting Speed Oil	Load Ratings kN/lbs.				Wt. kg/lbs.	mm/in. Ring Gage	Matching Inner Ring	Thin Plate	Thick Plate	Shaft Dia. mm
		Radial		Thrust							
Y	RPM	Dynamic C	Static C <sub>0</sub>	Dynamic C	Static C <sub>0</sub>						
–	25000	2.15 480	1.95 440	3.15 710	6.35 1430	0.005 0.010	9.000 0.3543				5
13.2 0.520	13000	6.30 1420	7.20 1620	6.90 1550	17.7 3980	0.017 0.036	18.000 0.7087	IM 8 12 12,4	CP 12 26	CP 2 12 26	12
13.2 0.520	11500	6.90 1550	8.50 1910	7.40 1660	20.0 4500	0.018 0.040	20.000 0.7874	IM 10 14 12,4	CP 14 26	CP 2 14 26	14
13.2 0.520	10500	7.40 1660	9.30 2090	7.80 1750	22.0 4950	0.020 0.044	21.000 0.8268	IM 12 15 12,4	CP 15 28	CP 2 15 28	15
17.2 0.677	10000	11.5 2590	17.7 3980	8.00 1800	23.0 5170	0.027 0.060	24.000 0.9449	IM 13 18 16,4	CP 18 30	CP 2 18 30	18
17.2 0.677	9000	12.2 2740	19.5 4380	11.8 2650	39.0 8770	0.031 0.068	26.000 1.0236	IM 15 20 16,4	CP 20 35	CP 3 20 35	20
21.2 0.835	7200	20.5 4610	32.0 7190	13.7 3080	52.0 11700	0.055 0.121	33.000 1.2992	IM 20 25 20,4	CP 25 42	CP 3 25 42	25
21.2 0.835	6300	22.3 5010	37.5 8430	14.9 3350	60.0 13500	0.063 0.139	38.000 1.4961	IM 25 30 20,4	CP 30 47	CP 3 30 47	30
21.2 0.835	5500	24.5 5510	45.0 10120	19.4 4360	88.0 19800	0.075 0.165	43.000 1.6929	IM 30 35 20,4	CP 35 52	CP 3 35 52	35
21.2 0.835	5000	26.2 5890	51.0 11470	20.4 4590	96.0 21600	0.086 0.190	48.000 1.8898	IM 35 40 20,4	CP 40 60	CP 3 40 60	40
21.2 0.835	4500	24.8 5580	55.0 12360	21.8 4900	109 24500	0.088 0.194	52.000 2.0472	IM 40 45 20,4	CP 45 65	CP 3 45 65	45





# NEEDLE ROLLER BEARINGS



## NOTES

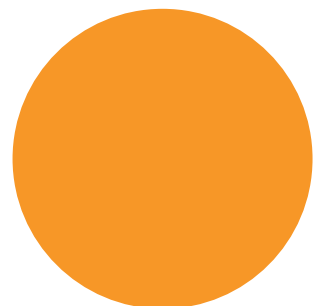
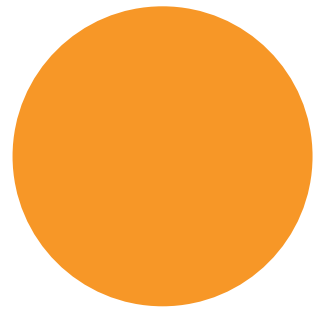




## DRAWN CUP ROLLER CLUTCHES

**Overview:** Drawn cup needle roller clutches are similar to drawn cup needle bearings in design, but allow free rotation in only one direction while transmitting torque in the opposite direction. These designs use the same small radial section as drawn cup needle roller bearings and are offered as clutch-only units or as clutch and bearing assemblies.

- **Sizes:** 3 mm - 35 mm bore (1/8 in. - 1.4 in.) bore.
- **Markets:** Office equipment, paper-towel dispensers, exercise equipment, appliances and two-speed gearboxes.
- **Features:** Compact, lightweight and operate directly on a hardened shaft.
- **Benefits:** Installation is easily accomplished with a simple press fit.





## Drawn Cup Roller Clutches

### Metric Series

- FCS, FC-K** regular clutch, single roller per stainless steel spring
- FC** regular clutch, multi-roller per stainless steel spring
- FCL-K** light series clutch, single roller per stainless steel spring
- FCB** regular clutch and bearing assembly, multi-roller per stainless steel spring
- FCBL-K, FCBN -K** light series clutch and bearing assembly, single roller per stainless steel spring

**FCL - 10 - K**

**Bore, in millimeters**

### Inch Series

- RC** regular clutch, single roller per integral spring
- RC-FS** regular clutch, single roller per stainless steel spring
- RCB** regular clutch and bearing assembly, single roller per integral spring
- RCB-FS** regular clutch and bearing assembly, single roller per stainless steel spring

**Outside Diameter**  
14 =  $\frac{14}{16}$  =  $\frac{7}{8}$  in.

**RC - 10 14 10 - FS**

**Bore**  
10 =  $\frac{10}{16}$  =  $\frac{5}{8}$  in.

**Width**  
10 =  $\frac{10}{16}$  =  $\frac{5}{8}$  in.

# ***Drawn Cup Roller Clutches***

	<i>Page</i>
Introduction .....	C302
Drawn Cup Roller Clutches – Metric Series .....	C308
Drawn Cup Roller Clutches and Bearing Assemblies – Metric Series .....	C310
Drawn Cup Roller Clutches – Inch Series .....	C312
Drawn Cup Roller Clutch and Bearing Assemblies – Inch Series .....	C314

C





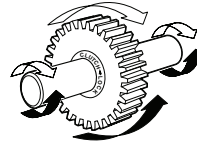
## DRAWN CUP ROLLER CLUTCHES

### METRIC AND INCH SERIES

The Timken® Torrington® drawn cup roller clutch transmits torque between shaft and housing in one direction and allows free overrun in the opposite direction. When transmitting torque, either the shaft or the housing can be the input member. Applications are generally described as indexing, backstopping or overrunning.

#### LOCK FUNCTION

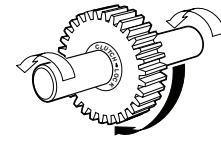
Shaft drives gear clockwise (white arrows)



or gear can drive shaft counter-clockwise (black arrows)

#### OVERRUN FUNCTION

Shaft overruns in gear counter clockwise (white arrows)



or gear overruns on shaft clockwise (black arrow)

C

## IDENTIFICATION

The prefix letters in the designation of the Timken Torrington drawn cup roller clutches and drawn cup roller clutch and bearing assemblies denote whether these are manufactured to metric or inch nominal dimensions. Designation codes for clutches and clutch and bearing assemblies with metric nominal dimensions begin with the letter "F". Designation codes for clutches and clutch and bearing assemblies with inch nominal dimensions begin with the letter "R".

The basic types of clutches and clutch and bearing assemblies are listed below:

### METRIC SERIES TYPES

- FCS, FC-K** regular clutch, single roller per stainless steel spring
- FC** regular clutch, multi-roller per stainless steel spring
- FCB** regular clutch and bearing assembly, multi-roller per stainless steel spring
- FCL-K** light series clutch, single roller per stainless steel spring
- FCBL-K** light series clutch and bearing assembly, single roller per stainless steel spring.

### INCH SERIES TYPES

- RC** regular clutch, single roller per integral spring
- RC-FS** regular clutch, single roller per stainless steel spring
- RCB** regular clutch and bearing assembly, single roller per integral spring
- RCB-FS** regular clutch and bearing assembly, single roller per stainless steel spring

### Types Of Clutches And Clutch And Bearing Assemblies



Drawn Cup Roller Clutch Type FC with Steel Springs



Drawn Cup Clutch & Bearing Assembly Type FCB with Steel Springs



Drawn Cup Roller Clutch, Types FCS, FC-K, FCL-K, and RC-FS with Steel Springs



Drawn Cup Clutch & Bearing Assembly Types FCBL-K and RCB-FS with Steel Springs



Drawn Cup Roller Clutch, Type RC with Integral Springs



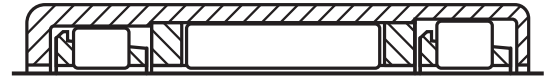
Drawn Cup Clutch & Bearing Assembly Type RCB with Integral Springs

## CONSTRUCTION

In many respects, construction is similar to that of drawn cup bearings. Design and manufacture of drawn cup clutches, just as with drawn cup bearings, was pioneered and developed by Timken. The well established design utilizes the same low profile radial section as drawn cup bearings. The precisely formed interior ramps provide surfaces against which the needle rollers wedge to positively lock the clutch with the shaft when rotated in the proper direction. These ramps, formed during the operation of drawing the cup, are case hardened to assure long wear life. The incorporation of ramp forming into the cup drawing operation is a manufacturing innovation that contributes much to the low cost of the unit.

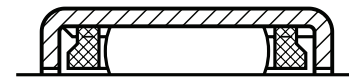
Two designs of precision molded clutch cages are employed. Clutch and clutch and bearing assembly types FC, FC-K, FCS, FCL-K, RC-FS, FCB, FCBL-K and RCB-FS use a glass fiber reinforced nylon cage equipped with inserted stainless steel leaf springs. The stainless steel springs permit higher rates of clutch engagement and achieve greater spring life. The nylon cage permits operation at higher temperatures. Clutch types RC and RCB utilize a one-piece cage of acetyl resin plastic with integral leaf style springs used for lower temperatures than permitted for the units with nylon cages.

Types FCB, FCBL-K, RCB and RCB-FS clutch and bearing assemblies have cages for retention and guidance of the needle rollers in the bearings located on both sides of the clutch unit.



Clutch And Bearing Assembly

Types FC, FC-K, FCS, FCL-K, RC and RC-FS are of clutch-only configurations for use with external radial support (usually two drawn cup needle roller bearings). Separate bearings position the shaft and housing concentrically and carry the radial load during overrun.



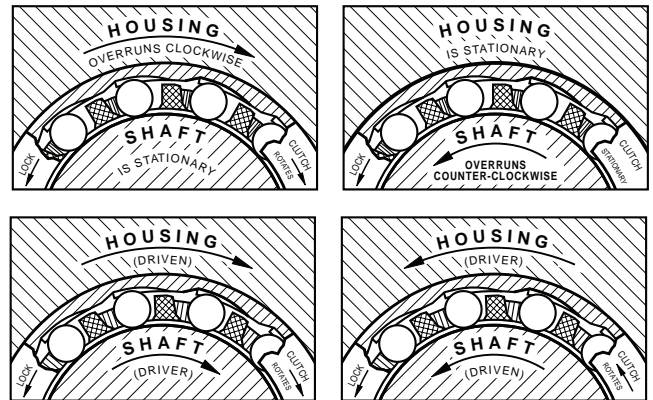
Clutch Only

## OPERATION

Operation is in two modes; the overrun mode and the lock mode. Operational mode is controlled by the direction of the clutch or shaft rotation with respect to the locking ramps.

In the overrun mode shown in the drawings below, the relative rotation between the housed clutch and the shaft causes the rollers to move away from their locking position against the locking ramps in the drawn cup. The housing and the clutch are then free to overrun in one direction, or the shaft is free to overrun in the other direction.

In the lock mode shown in the drawings below, the relative rotation between the housed clutch and the shaft is opposite to that in the overrun mode. The rollers, assisted by the leaf type springs, become wedged between the locking ramps and the shaft to transmit torque between the two members. Either the member housing the clutch drives the shaft in one direction, or the shaft can drive the clutch and its housing member in the other direction.



Clearance between the rollers and cup ramps is exaggerated in these drawings.



## APPLICATION

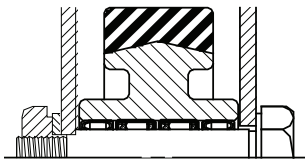
Timken® Torrington® clutches and clutch and bearing assemblies are successfully applied in a wide range of commercial products where indexing, backstopping and overrunning operations must be performed reliably. The sketches on these pages illustrate some of the many possible uses.

When applying the clutch-only unit, separate bearings on each side of the clutch are required to position the shaft concentrically with the housing and to carry the radial loads during overrun. Drawn cup needle roller bearings with the same radial section as the clutch should be used in the through bored housings for simplicity and economy. Two clutches can be used side by side for greater torque capacity.

Where the radial loads are light, the clutch and bearing assembly can be used without additional support bearings. This reduces the overall assembly width, the number of stocked and ordered parts, and assembly costs as well.

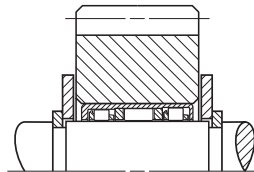
Timken Torrington drawn cup roller clutches are manufactured to commercial hardware standards and are used extensively in appliances, business machines, industrial and recreation equipment and a wide range of other applications.

Clutch & Bearing Arrangement



for Heavy Loads

Clutch & Bearing Assembly



for Light Loads

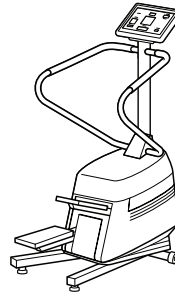
In any application where our clutch may be considered, it will be part of a system in which the operating conditions and the clutch mounting will affect its function. Before any clutch selection is made, it is important that the following catalog section be carefully studied to understand the effects of these factors. Consideration should be given to operating conditions such as:

- Magnitude of externally applied torque as well as inertial torque.
- Magnitude of applied radial loads during overrunning.
- Potential for vibration or axial shaft movement within the clutch during engagement.
- Engagement rate, as it pertains to the selection of stainless steel or plastic leaf springs.
- Oil lubricant supply during high overrunning speeds.
- External and internal environmental temperatures that can affect clutch performance.
- Lubricant selection effect on clutch engagement.
- Indexing inaccuracies resulting from backlash [lost motion].

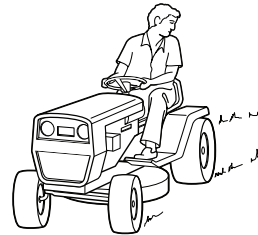
Consideration should be given to the shaft and housing design requirements such as:

- Shaft hardness and strength particularly when approaching torque rating limits.
- Shaft roundness, taper and surface finish necessary to ensure sufficient fatigue life and torque carrying ability.
- Housing strength [hardness and cross section] to support the applied torque loads.
- Housing roundness, taper and surface finish necessary to ensure uniform torque and load distribution.

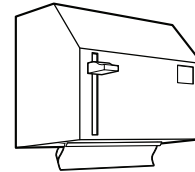
A test program under all expected operating conditions should be carried out before putting a new application into production. Timken customer engineers are constantly working with and testing new applications, and, their experience can be of great help to the designer considering the use of a drawn cup roller clutch.



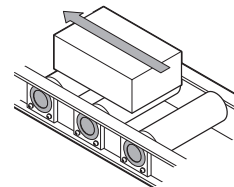
Stair Steppers, and other Athletic Equipment



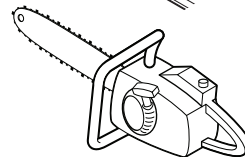
Lawnmower Differential



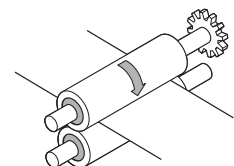
Tape Dispensers and Similar Web Roll Feed Mechanisms



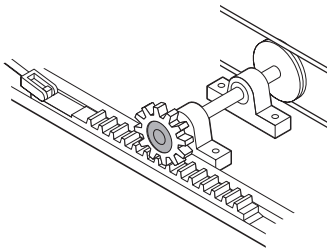
Conveyor Rollers



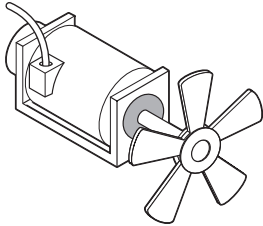
Chainsaw Starters



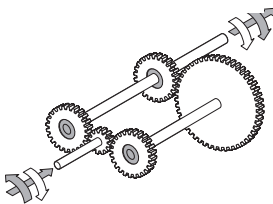
Paper Feed Rolls in Business Machines



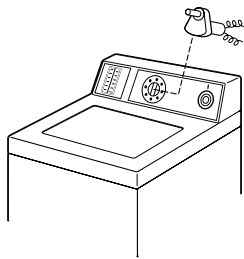
Rack Indexing Drive



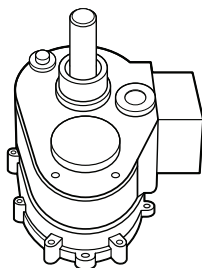
Motor Backstops



2 Speed Gearbox with Reversing Input



Timing Motor Freewheels



Washing Machine Transmission

## HOUSING DESIGN

Drawn cup clutches and clutch and bearing assemblies are mounted with a simple press fit in their housings. Through-bored and chamfered housings are preferred. A 30° angle is suggested and care should be taken to round the edge where the chamfer meets the housing bore. A sharp edge at this location can greatly increase installation forces. Provisions for axial location, such as shoulders or snap rings, are not required. The case hardened cups have a long fatigue life, but must be properly supported to

realize this benefit. Steel housings are preferred and must be used for applications involving high torque loads to prevent radial expansion of the clutch cups. The suggested minimum housing outside diameters in the tables of dimensions are for steel.

The housing bore should be round within one-half of the diameter tolerance.

The taper within the length of the outer ring should not exceed 0.013 mm (.0005 inch).

The surface finish of the housing bore should not exceed 1.6 mm R<sub>a</sub> (63 microinches R<sub>a</sub>).

The torque ratings given in the clutch tables are based on a steel housing of a large section. When other housing material must be used (such as aluminum, powdered metal and plastics) the torque rating of the clutch will be reduced. Such housings may be satisfactory for lightly torqued applications but your Timken representative should be consulted for appropriate housing and shaft suggestions. Otherwise, an insufficient press fit and use of a lower strength housing material can result in more internal clearance and reduced performance of the clutch.

When using non-steel housings, thorough testing of the design is suggested.

Adhesive compounds can be used to prevent creeping rotation of the clutch in plastic housings with low friction properties. Adhesives will not provide proper support in oversized metal housings. When using adhesives, care must be taken to keep the adhesive out of the clutches and bearings.

## SHAFT DESIGN

The clutch or clutch and bearing assembly operates directly on the shaft whose specifications of dimension, hardness and surface finish are well within standard manufacturing limits.

Either case hardening or through-hardening grades of good bearing quality steel are satisfactory for raceways. Steels modified for free machining, such as those high in sulfur content and particularly those containing lead, are seldom satisfactory for raceways.

For long fatigue life, the shaft raceway, must have a hardness equivalent to 58 HRC, and ground to the suggested diameter shown in the tables of dimensions. It may be through hardened, or it may be case hardened, with an effective case depth of 0.4 mm (0.015 inch). (Effective case depth is defined as the distance from the surface inward to the equivalent of 50 HRC hardness level after grinding.)

Taper within the length of the raceway should not exceed 0.008 mm (0.0003 inch), or one-half the diameter tolerance, whichever is smaller. The radial deviation from true circular form of the raceway should not exceed 0.0025 mm (0.0001 inch) for diameters up to and including 25 mm (1.0 inch). For raceways greater than 25 mm (1.0 inch) the allowable radial deviation should not exceed 0.0025 mm (0.0001 inch) multiplied by a factor of the raceway diameter divided by 25 (1.0 inch). Surface finish on the raceway should not exceed 0.4 mm (16 microinches) R<sub>a</sub>. Deviations will reduce the load capacity and fatigue life of the shaft.

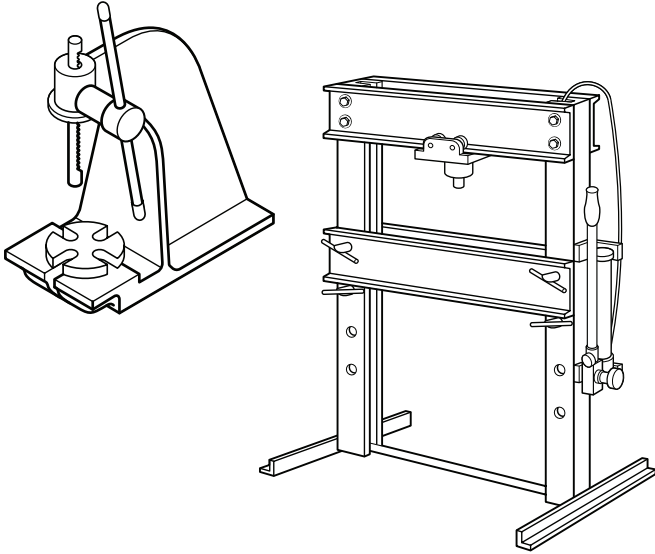




## INSTALLATION

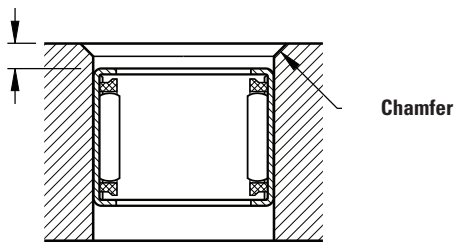
Simplicity of installation promotes additional cost savings. The drawn cup roller clutch, or the clutch and bearing assembly, must be pressed into its housing. Procedures are virtually identical with those for installing drawn cup bearings as detailed on pages C40 and C62. The unit is pressed into the bore of a gear hub or pulley hub, or housing of the proper size, and no shoulders, splines, keys, screws or snap rings are required.

Installation procedures are summarized in the following sketches:



Use an arbor press or hydraulic ram press which will exert steady pressure. Never use a hammer or other tool requiring pounding to drive the clutch into its housing.

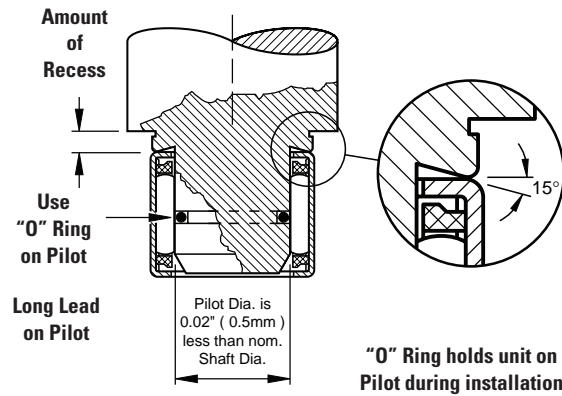
Amount of Recess



Make sure that the housing bore is chamfered to permit easy introduction of the clutch and bearing or the clutch unit. Press unit slightly beyond the chamfer in the housing bore to assure full seating. Through-bored housings are always preferred. If the housing has a shoulder, never seat the clutch against the shoulder. For further details see pages C40 and C62.

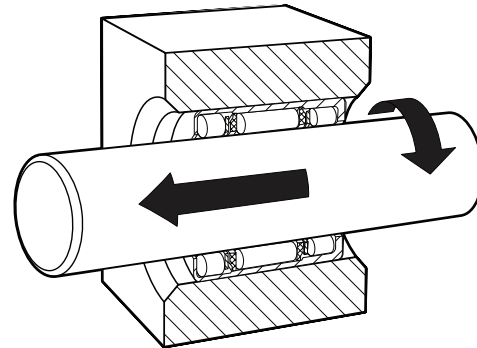


**IMPORTANT:** The mounted clutch or clutch and bearing assembly engages when the housing is rotated relative to the shaft in the direction of the arrow and LOCK marking [LOCK] stamped on the cup. Make sure that the unit is oriented properly before pressing it into its housing.



Use an installation tool as shown in the diagram above. If clutch is straddled by needle roller bearings, press units into position in proper sequence and preferably leave a small clearance between units.

When assembling the shaft, it should be rotated in the overrun direction during insertion. The end of the shaft should have a large chamfer or rounding.





## APPLIED LOADS

The clutch-only unit is designed to transmit purely torque loads. Applied torque should not exceed the catalog ratings which are based on the compressive strength of well-aligned clutch components. Bearings on either side of the clutch are to assure concentricity between the shaft and the housing and to support radial loads during clutch overrun. Integral clutch and bearing assemblies are available for this purpose where the radial loads are light. The total maximum dynamic radial load that may be shared by the two needle roller and cage radial bearing assemblies should not be greater than  $C/3$ .

In determining the total torque load on a clutch, it is essential to consider the torque due to inertial forces developed in the mechanism, in addition to the externally applied torque. The larger the clutch and the greater the mass of the mechanism controlled by it, the more important this consideration becomes.

Clutch lockup depends on friction. For this reason applications involving severe vibrations or axial motion of the shaft within the clutch are to be avoided. The applications where there are overhanging or overturning loads should incorporate bearings that will maintain alignment between the shaft and the clutch housing. Consult your Timken representative for suggestions.

## LUBRICATION

Oil is the preferred lubricant, as it minimizes wear and heat generation. For those applications where oil is not practical, clutches are packed with a soft grease containing mineral oil. Thick grease will retard roller engagement and can cause individual rollers to slip, possibly overloading any engaged rollers.

## TEMPERATURE

Temperature extremes can cause clutch malfunctions and failure. The molded plastic cage with integral springs holds its necessary resiliency and strength when the operating temperature within the clutch is kept below 90 degrees Celsius (200 degrees Fahrenheit). The clutch with reinforced nylon cage and separate steel springs operates well at temperatures up to 120 degrees C (250 degrees Fahrenheit) continuously and to 150 degrees Celsius (300 degrees Fahrenheit) intermittently. Excessive thickening of the lubricant at low temperatures may prevent some or all of the rollers from engaging. New applications should be tested under expected operating conditions to determine whether or not temperature problems exist.

## BACKLASH

Backlash, or lost motion, prior to engagement is minimal. The variation in backlash from one cycle to another is extremely low. Grease lubrication or improper fitup [housing bore and shaft diameter] may increase backlash. Angular displacement between the shaft and housing increases as an applied torque load is increased.

## RATE OF ENGAGEMENT

Clutch lockup depends upon static friction. Axial motion between shaft and clutch rollers prevents lockup.

Clutches with integral springs engage satisfactorily at cyclic rates up to 200 engagements per minute. Intermittent operation at higher rates has been successful. The steel spring type clutches have proven dependability at rates up to 6000 or 7000 engagements per minute. Even higher cyclic rates may be practical. Since grease may impair engagement at high cyclic rates, a light oil should be used.

## OVERRUN LIMIT SPEED

Exact limiting speeds are not easily predictable. The value for each clutch given in the tabular data is not absolute but serves as a guide for the designer. Oil lubrication is absolutely necessary for high speed operations. Consult your Timken representative when overrunning speeds are high.

## INSPECTION

Although the outer cup of the clutch is accurately drawn from strip steel, it can go slightly out of round during heat treat. When the assembly is pressed into a ring gage or properly prepared housing of correct size and wall thickness, it becomes round and properly sized. Direct measurement of the outside diameter of a drawn cup assembly is an incorrect procedure. The proper inspection procedure is as follows:

1. Press the assembly into a ring gage of the proper size as given in the tabular data.
2. Gage the bore with the specified plug gages of the proper size, as given in the tables of dimensions.
  - a. The locking plug is rotated to insure lockup when the clutch is operated at low limit shaft and is mounted in a high limit housing strong enough to properly size the clutch.
  - b. The overrun plug is rotated to ensure free over-running when the clutch is operated on a high limit shaft and is mounted in a low limit housing.
  - c. The go plug and no go plug insure proper size of the bearings in the clutch and bearing assemblies.

Gage sizes are listed in the tables of dimensions. Plug gage sizes reflect adjustment for the loose and tight conditions resulting from high or low housings or shafts.





**DRAWN CUP ROLLER CLUTCHES**

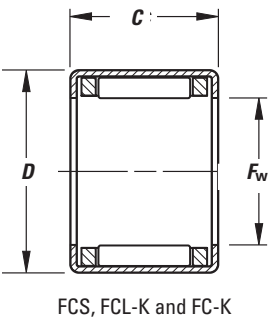
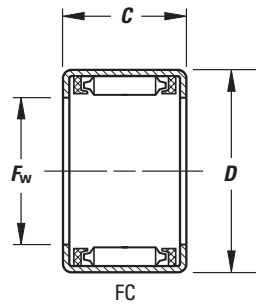
**METRIC SERIES**

- For proper application, separate bearings suggested (adjacent to clutch) to carry radial loads and assure concentricity between shaft and housing.
- Clutch engages when housing rotated (relative to the shaft) in direction of arrow marking [LOCK] as labeled on cup
- Proper inspection requires use of ring gage and bore plug gage(s) — see the inspection section page C307.
- Full details on installation given on page C306.

- Shaft raceway and housing bore diameters necessary for proper mounting and operation are listed on the opposite page.
- Types FC, FCS, FC-K and FCL-K clutches have stainless steel springs inserted in molded cage to position rollers for lockup.

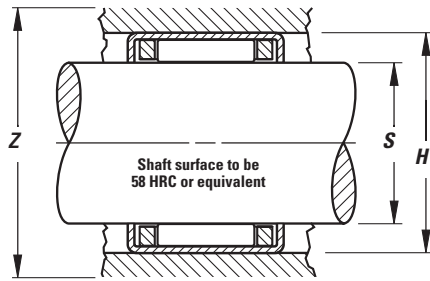


The mounted clutch and bearing assembly engages when the housing is rotated relative to the shaft in the direction of the arrow marking [← LOCK] stamped on the cup



Shaft Diameter	Dimensions mm/in.			Clutch Designation	Torque Rating N•m/in.-lbf.	Minimum O.D. of Steel Housing for Rated Torque mm/in.	Overrun Limiting Speed for Rotating Shaft RPM	Suitable Drawn Cup Bearing <sup>1</sup>
	mm	F <sub>w</sub>	D					
4	4 0.1575	8 0.315	6 0.236	FC-4-K	0.349 3.09	11 0.433	26000	HK0408
6	6 0.2362	10 0.3937	12 0.472	FCS-6	2.15 19	14 0.551	22000	HK0608
8	8 0.315	12 0.4724	12 0.472	FCL-8-K	3.39 30	17 0.669	21000	HK0808
	8 0.315	14 0.5512	12 0.472	FC-8	4.42 39.1	20 0.787	21000	—
10	10 0.3937	14 0.5512	12 0.472	FCL-10-K	4.6 40.7	20 0.787	19000	HK1010
	10 0.3937	16 0.6299	12 0.472	FC-10	5.82 51.5	25 0.984	19000	—
12	12 0.4724	18 0.7087	16 0.63	FC-12	14 124	27 1.063	19000	HK1212
16	16 0.6299	22 0.8661	16 0.63	FC-16	21.7 192	31 1.22	14000	HK1612
20	20 0.7874	26 1.0236	16 0.63	FC-20	32.6 289	38 1.496	11000	HK2012
25	25 0.9843	32 1.2598	20 0.787	FC-25	71 628	46 1.811	8700	HK2512
30	30 1.1811	37 1.4567	20 0.787	FC-30	99.1 877	51 2.008	7300	HK3012

<sup>1</sup> See pages C42-C49 for suitable bearing types and sizes.



.25 mm (.010 in.) min.

Ring Gage	Gaging mm/in.		Mounting mm/in.				Wt. kg/lbs. Approx.
	Clutch Locking Plug	Clutch Overrun Plug	Shaft Raceway Diameter		Housing Bore		
			Max.	Min.	Min.	Max.	
			S		H		
<b>7.984</b> 0.3143	<b>3.980</b> 0.1567	<b>4.004</b> 0.1576	<b>4.000</b> 0.1575	<b>3.995</b> 0.1573	<b>7.984</b> 0.3143	<b>7.993</b> 0.3147	<b>0.001</b> 0.002
<b>9.984</b> 0.3931	<b>5.980</b> 0.2354	<b>6.004</b> 0.2364	<b>6.000</b> 0.2362	<b>5.995</b> 0.236	<b>9.984</b> 0.3931	<b>9.993</b> 0.3934	<b>0.003</b> 0.007
<b>11.980</b> 0.4717	<b>7.976</b> 0.314	<b>8.005</b> 0.3152	<b>8.000</b> 0.315	<b>7.994</b> 0.3147	<b>11.980</b> 0.4717	<b>11.991</b> 0.4721	<b>0.003</b> 0.007
<b>13.98</b> 0.5504	<b>7.976</b> 0.314	<b>8.005</b> 0.3152	<b>8.000</b> 0.315	<b>7.994</b> 0.3147	<b>13.980</b> 0.5504	<b>13.991</b> 0.5508	<b>0.007</b> 0.015
<b>13.980</b> 0.5504	<b>9.976</b> 0.3928	<b>10.005</b> 0.3939	<b>10.000</b> 0.3937	<b>9.994</b> 0.3935	<b>13.980</b> 0.5504	<b>13.991</b> 0.5508	<b>0.004</b> 0.009
<b>15.980</b> 0.6291	<b>9.976</b> 0.3928	<b>10.005</b> 0.3939	<b>10.000</b> 0.3937	<b>9.994</b> 0.3935	<b>15.980</b> 0.6291	<b>15.991</b> 0.6296	<b>0.009</b> 0.02
<b>17.980</b> 0.7079	<b>11.974</b> 0.4714	<b>12.006</b> 0.4727	<b>12.000</b> 0.4724	<b>11.992</b> 0.4721	<b>17.980</b> 0.7079	<b>17.991</b> 0.7083	<b>0.012</b> 0.026
<b>21.976</b> 0.8652	<b>15.972</b> 0.6288	<b>16.006</b> 0.6302	<b>16.000</b> 0.6299	<b>15.992</b> 0.6296	<b>21.976</b> 0.8652	<b>21.989</b> 0.8657	<b>0.018</b> 0.04
<b>25.976</b> 1.0227	<b>19.970</b> 0.7862	<b>20.007</b> 0.7877	<b>20.000</b> 0.7874	<b>19.991</b> 0.787	<b>25.976</b> 1.0227	<b>25.989</b> 1.0232	<b>0.021</b> 0.046
<b>31.972</b> 1.2587	<b>24.967</b> 0.983	<b>25.007</b> 0.9845	<b>25.000</b> 0.9843	<b>24.991</b> 0.9839	<b>31.972</b> 1.2587	<b>31.988</b> 1.2594	<b>0.034</b> 0.075
<b>36.972</b> 1.4556	<b>29.967</b> 1.1798	<b>30.007</b> 1.1814	<b>30.000</b> 1.1811	<b>29.991</b> 1.1807	<b>36.972</b> 1.4556	<b>36.988</b> 1.4562	<b>0.042</b> 0.093

C





## DRAWN CUP ROLLER CLUTCHES AND BEARING ASSEMBLIES

### METRIC SERIES

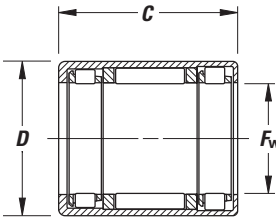
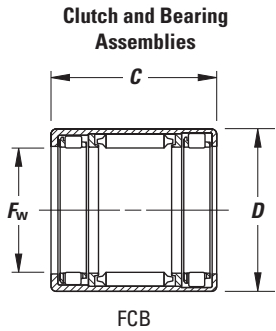
- Clutch and bearing assembly engages when housing rotated (relative to shaft) in direction of arrow marking [LOCK] as labeled on cup.
- Shaft raceway and housing bore diameters necessary for proper mounting and operation are listed on the opposite page.
- Proper inspection requires use of ring gage and bore plug gage(s) — see the inspection section page C307.

- Full details on installation given on page C306.
- Types FCB, FCBL-L and FCBN-K clutch and bearing assemblies have stainless steel springs inserted in molded cage to position rollers for lockup.



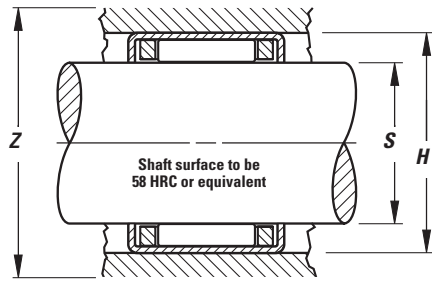
The mounted clutch and bearing assembly engages when the housing is rotated relative to the shaft in the direction of the arrow marking [← LOCK] stamped on the cup

C



Shaft Diameter	Dimensions mm/in.			Clutch and Bearing Assembly Designation	Torque Rating N•m/in. -lbf.	Minimum O.D. of Steel Housing for Rated Torque	Load Ratings		Overrun Limiting Speed for Rotating Shaft RPM
	F <sub>w</sub>	D	C				Static kN/lbf.	Dynamic kN/lbf.	
8	8 0.3150	12 0.4724	22 0.866	FCBL-8-K	3.39 30.0	17 0.669	3.28 740	3.62 810	21000
8	8 0.3150	14 0.5512	20 0.787	FCB-8	4.42 39.1	20 0.787	3.04 680	4.22 950	21000
10	10 0.3937	16 0.6299	20 0.787	FCB-10	5.82 51.5	25 0.984	3.80 850	4.84 1 090	19000
12	12 0.4724	18 0.7087	26 1.024	FCB-12	14.00 124	27 1.063	5.84 1 310	6.30 1 420	19000
20	20 0.7874	26 1.0236	26 1.024	FCB-20	32.60 289	38 1.496	9.46 2 130	8.16 1 830	11000
25	25 0.9843	32 1.2598	30 1.181	FCB-25	71.00 628	46 1.811	13.1 2 940	11.3 2 540	8700
30	30 1.1811	37 1.4567	30 1.181	FCB-30	99.10 877	51 2.008	14.9 3 350	11.5 2 590	7300

Load Ratings are based on a minimum raceway hardness of 58 HRC or equivalent.



.25 mm (.010 in.) min.

Ring Gage	Gaging mm/in.			Mounting mm/in.				Wt. kg/lbs. Approx.
	Clutch Locking Plug	Clutch Overrun and Bearing Go Plug	Bearing No Go Plug	Shaft Raceway Diameter		Housing Bore		
				Max.	Min.	Min.	Max.	
				<b>S</b>		<b>H</b>		
<b>11.980</b> 0.4717	<b>7.976</b> 0.3140	<b>8.005</b> 0.3152	<b>8.033</b> 0.3163	<b>8.000</b> 0.3150	<b>7.994</b> 0.3147	<b>11.980</b> 0.4717	<b>11.991</b> 0.4721	<b>0.005</b> 0.011
<b>13.980</b> 0.5504	<b>7.976</b> 0.3140	<b>8.005</b> 0.3152	<b>8.033</b> 0.3163	<b>8.000</b> 0.3150	<b>7.994</b> 0.3147	<b>13.980</b> 0.5504	<b>13.991</b> 0.5508	<b>0.011</b> 0.024
<b>15.980</b> 0.6291	<b>9.976</b> 0.3928	<b>10.005</b> 0.3939	<b>10.033</b> 0.3950	<b>10.000</b> 0.3937	<b>9.994</b> 0.3935	<b>15.980</b> 0.6291	<b>15.991</b> 0.6296	<b>0.013</b> 0.029
<b>17.980</b> 0.7079	<b>11.974</b> 0.4714	<b>12.006</b> 0.4727	<b>12.036</b> 0.4739	<b>12.000</b> 0.4724	<b>11.992</b> 0.4721	<b>17.980</b> 0.7079	<b>17.991</b> 0.7083	<b>0.018</b> 0.040
<b>25.976</b> 1.0227	<b>19.970</b> 0.7862	<b>20.007</b> 0.7877	<b>20.043</b> 0.7891	<b>20.000</b> 0.7874	<b>19.991</b> 0.7870	<b>25.976</b> 1.0227	<b>25.989</b> 1.0232	<b>0.028</b> 0.062
<b>31.972</b> 1.2587	<b>24.967</b> 0.9830	<b>25.007</b> 0.9845	<b>25.043</b> 0.9859	<b>25.000</b> 0.9843	<b>24.991</b> 0.9839	<b>31.972</b> 1.2587	<b>31.988</b> 1.2594	<b>0.048</b> 0.106
<b>36.972</b> 1.4556	<b>29.967</b> 1.1798	<b>30.007</b> 1.1814	<b>30.043</b> 1.1828	<b>30.000</b> 1.1811	<b>29.991</b> 1.1807	<b>36.972</b> 1.4556	<b>36.988</b> 1.4562	<b>0.054</b> 0.119





**DRAWN CUP ROLLER CLUTCHES**

**INCH SERIES**

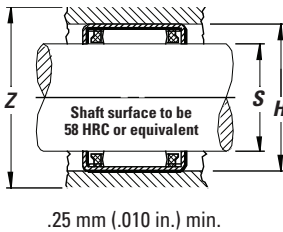
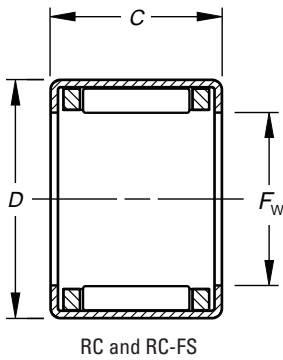
- For proper application, separate bearings suggested (adjacent to clutch) to carry radial loads and assure concentricity between shaft and housing.
- Clutch engages when housing rotated (relative to the shaft) in direction of arrow marking [LOCK] as labeled on cup.
- Proper inspection requires use of ring gage and bore plug gage(s) — see the inspection section page C307.
- Full details on installation given on page C306.

- Shaft raceway and housing bore diameters necessary for proper mounting and operation are listed on the opposite page.
- Type RCFS clutches have stainless steel springs inserted in molded cage to position rollers for lockup.



The mounted clutch engages when the housing is rotated relative to the shaft in the direction of the arrow marking [← LOCK] stamped on the cup.

C



Shaft Diameter	Dimensions mm/in.			Clutch Designations		Torque Rating N•m/in.-lbs.	Minimum O.D. of Steel Housing For Rated Torque	Overrun Limiting Speed for Rotating Shaft
	F <sub>w</sub>	D	C	With Stainless Steel Springs	With Integral Springs			
in.							Z	RPM
1/8	3.18 0.125	7.14 0.281	6.35 0.250	—	RC-02	0.323 2.86	11.2 0.44	34000
1/4	6.35 0.250	11.13 0.438	12.70 0.500	—	RC-040708	2.02 17.9	15.7 0.62	20000
3/8	9.53 0.375	15.88 0.625	12.70 0.500	RC-061008-FS*	RC-061008	5.45 48.2	22.4 0.88	18000
1/2	12.70 0.500	19.05 0.750	12.70 0.500	RC-081208-FS*	RC-081208	8.85 78.3	27.9 1.10	17000
5/8	15.88 0.625	22.23 0.875	15.88 0.625	RC-101410-FS*	RC-101410	16.8 149	30.5 1.20	14000
3/4	19.05 0.750	25.40 1.000	15.88 0.625	RC-121610-FS*	RC-121610	23.3 206	35.6 1.40	12000
1	25.40 1.000	33.35 1.313	15.88 0.625	RC-162110-FS*	RC-162110	49.6 439	48.3 1.90	8700

\* Suffix "-FS" is not always stamped on the clutch cup. Type RC-FS with stainless steel springs is always readily identified by RED clutch cage.

<sup>1</sup> See pages C82-C89 for other suitable bearing types and sizes.

	Ring Gage	Gaging mm/in.		Mounting mm/in.				Wt. kg/lbs.
		Clutch Locking Plug	Clutch Overrun Plug	Shaft Raceway Diameter		Housing Bore		
				Max.	Min.	Min.	Max.	
				<b>S</b>		<b>H</b>		
—	<b>7.155</b> 0.2817	<b>3.160</b> 0.1244	<b>3.195</b> 0.1258	<b>3.175</b> 0.1250	<b>3.167</b> 0.1247	<b>7.142</b> 0.2812	<b>7.155</b> 0.2817	<b>0.001</b> 0.002
<b>J-45</b>	<b>11.125</b> 0.4380	<b>6.337</b> 0.2495	<b>6.383</b> 0.2513	<b>6.350</b> 0.2500	<b>6.337</b> 0.2495	<b>11.100</b> 0.4370	<b>11.125</b> 0.4380	<b>0.004</b> 0.008
<b>JH-68</b>	<b>15.888</b> 0.6255	<b>9.512</b> 0.3745	<b>9.558</b> 0.3763	<b>9.525</b> 0.3750	<b>9.512</b> 0.3745	<b>15.862</b> 0.6245	<b>15.888</b> 0.6255	<b>0.008</b> 0.017
<b>JH-87</b>	<b>19.063</b> 0.7505	<b>12.687</b> 0.4995	<b>12.733</b> 0.5013	<b>12.700</b> 0.5000	<b>12.687</b> 0.4995	<b>19.037</b> 0.7495	<b>19.063</b> 0.7505	<b>0.009</b> 0.020
<b>JH-1010</b>	<b>22.238</b> 0.8755	<b>15.862</b> 0.6245	<b>15.908</b> 0.6263	<b>15.875</b> 0.6250	<b>15.862</b> 0.6245	<b>22.212</b> 0.8745	<b>22.238</b> 0.8755	<b>0.014</b> 0.030
<b>J-126</b>	<b>25.387</b> 0.9995	<b>19.012</b> 0.7485	<b>19.058</b> 0.7503	<b>19.050</b> 0.7500	<b>19.037</b> 0.7495	<b>25.387</b> 0.9995	<b>25.413</b> 1.0005	<b>0.015</b> 0.034
<b>JH-1612</b>	<b>33.325</b> 1.3120	<b>25.362</b> 0.9985	<b>25.408</b> 1.0003	<b>25.400</b> 1.0000	<b>25.387</b> 0.9995	<b>33.325</b> 1.3120	<b>33.350</b> 1.3130	<b>0.026</b> 0.058

C





**DRAWN CUP ROLLER CLUTCH AND BEARING ASSEMBLIES**

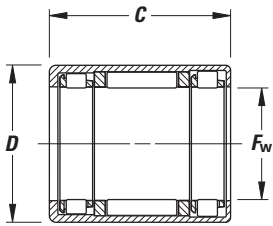
**INCH SERIES**

- Clutch and bearing assembly engages when housing rotated (relative to shaft) in direction of arrow marking [LOCK] as labeled on cup.
- Shaft raceway and housing bore diameters necessary for proper mounting and operation are listed.
- Proper inspection requires use of ring gage and bore plug gage(s) — see the inspection section page C307.

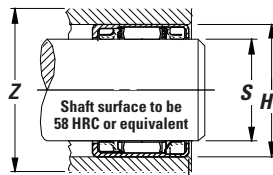
- Full details on installation given on page C306.
- Clutch and bearing assemblies have spring integrally molded (type RCB) stainless steel springs inserted (type RCB-FS) in molded cage to position rollers for lockup.



The mounted clutch and bearing assemblies engages when the housing is rotated relative to the shaft in the direction of the arrow marking [← LOCK] stamped on the cup.



RCB and RCB-FS



.25 mm (.010 in.) min.

Shaft Diameter	Dimensions mm/in.			Clutch and Bearing Designations With		Torque Rating N•m/in.-lbf.	Minimum O.D. of Steel Housing For Rated Torque	Load Ratings kN/lbf.	
	F <sub>w</sub>	D	C	Stainless Steel Springs	Integral Springs			Z	C
$\frac{3}{8}$	9.53 0.375	15.88 0.625	22.23 0.875	RCB-061014-FS*	RCB-061014	5.45 48.2	22.4 0.88	4.89 1100	6.01 1350
$\frac{1}{2}$	12.70 0.500	19.05 0.750	22.23 0.875	RCB-081214-FS*	RCB-081214	8.85 78.3	27.9 1.1	6.49 1460	7.12 1600
$\frac{5}{8}$	15.88 0.625	22.23 0.875	25.40 1.000	RCB-101416-FS*	RCB-101416	16.8 149.0	30.5 1.2	8.14 1830	8.05 1810
$\frac{3}{4}$	19.05 0.750	25.40 1.000	25.40 1.000	RCB-121616-FS*	RCB-121616	23.3 206.0	35.6 1.4	9.79 2200	8.90 2000
1	25.40 1.000	33.35 1.313	27.00 1.063	RCB-162117-FS*	RCB-162117	49.6 439.0	48.3 1.9	17.6 3960	15.4 3460

\* Suffix "-FS" is not always stamped on the clutch cup. Type RC-FS with stainless steel springs is always readily identified by RED clutch cage.



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Overrun	Gaging mm/in.				Mounting mm/in.				Wt. kg/lbs.
	Ring Gage Plug	Lock Plug Diameter	Overrun Plug Bore	No Go Bearing	Shaft Raceway		Housing Approx.		
					Max.	Min.	Min.	Max.	
RPM					S		H		
18000	<b>15.888</b> 0.6255	<b>9.512</b> 0.3745	<b>9.553</b> 0.3761	<b>9.589</b> 0.3775	<b>9.525</b> 0.3750	<b>9.512</b> 0.3745	<b>15.862</b> 0.6245	<b>15.888</b> 0.6255	<b>0.014</b> 0.030
17000	<b>19.063</b> 0.7505	<b>12.687</b> 0.4995	<b>12.728</b> 0.5011	<b>12.764</b> 0.5025	<b>12.700</b> 0.5000	<b>12.687</b> 0.4995	<b>19.037</b> 0.7495	<b>19.063</b> 0.7505	<b>0.016</b> 0.036
14000	<b>22.238</b> 0.8755	<b>15.862</b> 0.6245	<b>15.903</b> 0.6261	<b>15.939</b> 0.6275	<b>15.875</b> 0.6250	<b>15.862</b> 0.6245	<b>22.212</b> 0.8745	<b>22.238</b> 0.8755	<b>0.023</b> 0.050
12000	<b>25.387</b> 0.9995	<b>19.012</b> 0.7485	<b>19.053</b> 0.7501	<b>19.088</b> 0.7515	<b>19.050</b> 0.7500	<b>19.037</b> 0.7495	<b>25.387</b> 0.9995	<b>25.413</b> 1.0005	<b>0.026</b> 0.057
8700	<b>33.325</b> 1.3120	<b>25.362</b> 0.9985	<b>25.403</b> 1.0001	<b>25.438</b> 1.0015	<b>25.400</b> 1.0000	<b>25.387</b> 0.9995	<b>33.325</b> 1.3120	<b>33.350</b> 1.3130	<b>0.045</b> 0.100



# NEEDLE ROLLER BEARINGS



## NOTES



## NEEDLE ROLLER BEARING ACCESSORIES

### NEEDLE/CYLINDRICAL ROLLERS

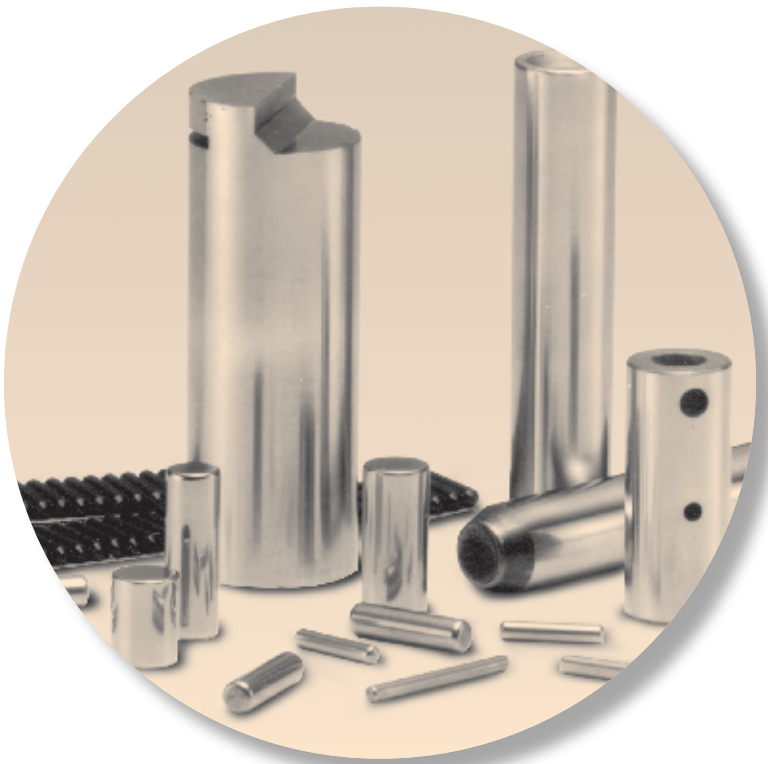
**Overview:** Loose needle and cylindrical rollers are mainly used as bearing rolling elements to reduce friction and torque in rotating and pivoting applications. However, these precision rollers have many other uses such as shafts or locating pins.

- **Sizes:** Diameters from 1.5 mm (0.0591 in.) to 14 mm (0.551 in.). Lengths from 5 mm (0.20 in.) to 57.2 mm (1.25 in.).
- **Markets:** Vehicle and industrial transmissions, universal joints, and two-cycle engines.
- **Features:** Cylindrical and needle sizes are available. Needle rollers are available with flat and rounded ends, metric series needle rollers available in Grade 2, 3 or 5.
- **Benefits:** Provide the maximum load carrying capacity within the smallest envelope at a low cost.

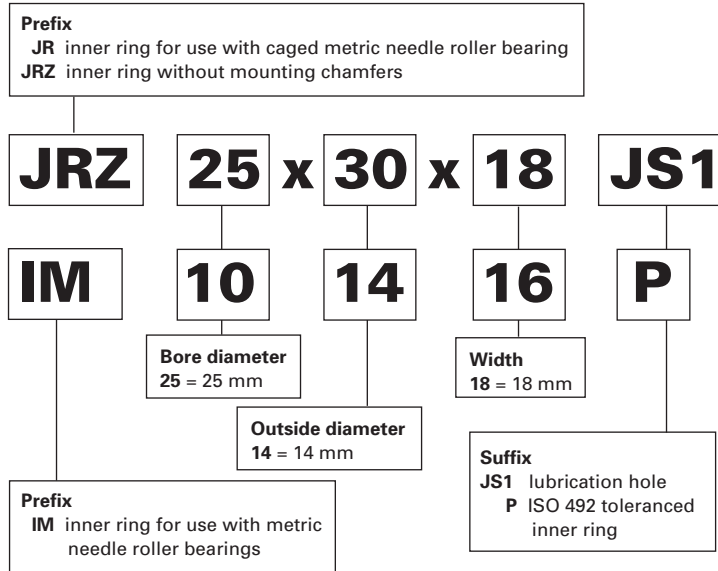
### METRIC INNER RINGS

**Overview:** Inner rings are made from bearing quality steel and their O.D. and bore are precision ground. They function as the inner raceway for a needle roller bearing by providing a surface that meets all shaft raceway design requirements (hardness, surface finish, roundness, etc.).

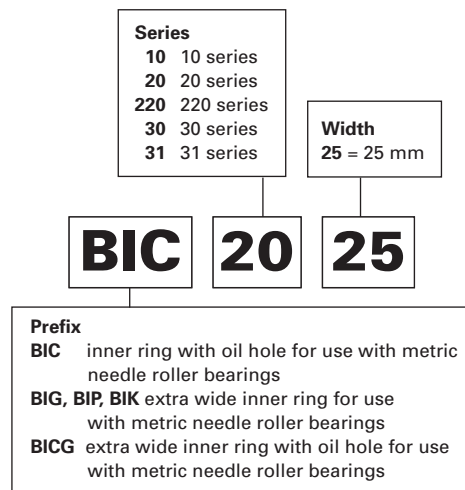
- **Sizes:** 5 mm (0.197 in.) bore to 180 mm (7.087 in.) outside diameter.
- **Markets:** Automotive, truck, power transmissions, and industrial applications.
- **Features:** Available with and without chamfers, some are available with a profiled outside diameter.
- **Benefits:** When it is not practical to manufacture the shaft to raceway quality, an inner ring allows a customer to obtain acceptable bearing performance.



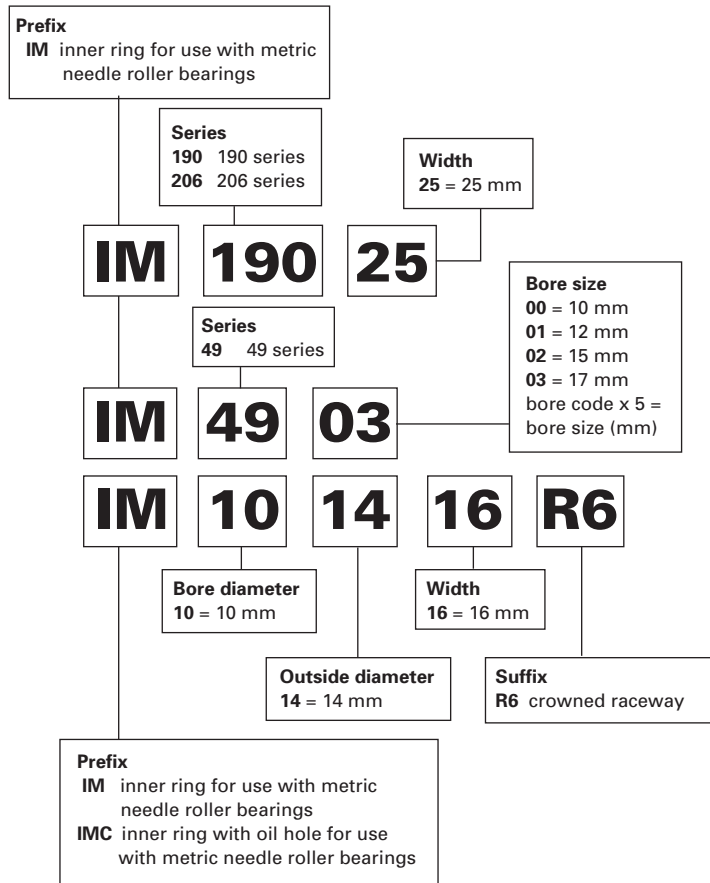
## Standard Inner Rings for Needle Roller Bearings - Metric Nominal Dimensions



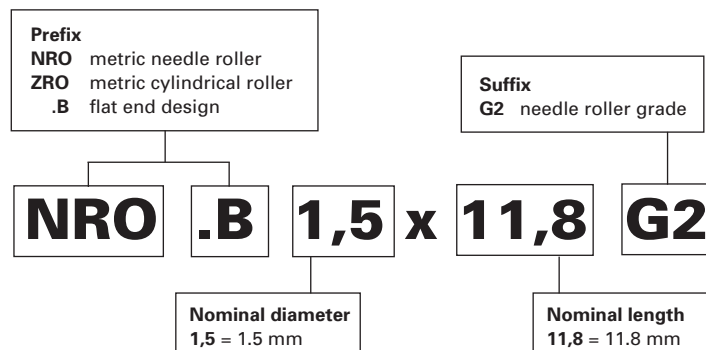
## Extra Wide Inner Rings for Needle Roller Bearings - Metric Nominal Dimensions



## Inner Rings for Full Complement Needle Roller Bearings - Metric Nominal Dimensions



## Loose Rollers - Metric Nominal Dimensions



C



# ***Needle Roller Bearings***

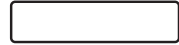
	<i>Page</i>
<b>Introduction Needle Rollers Metric Series . . . . .</b>	<b>C322</b>
<b>Inner and Outer Raceway Dimensions, mm . . . . .</b>	<b>C328</b>
<b>Introduction Needle Rollers Inch Series . . . . .</b>	<b>C331</b>
<b>Inner Rings Metric Series . . . . .</b>	<b>C338</b>
<b>Inner Rings For Full Complement Needle Roller Bearings Metric Series . . . . .</b>	<b>C347</b>
<b>Extra Wide Inner Rings Metric Series . . . . .</b>	<b>C350</b>
<b>End Washers Metric Series . . . . .</b>	<b>C353</b>

C





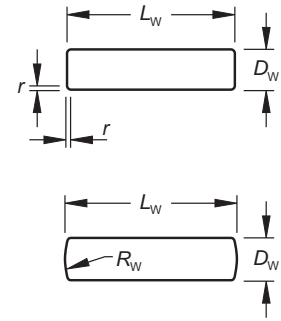
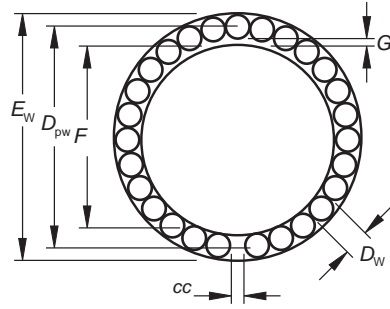
## NEEDLE ROLLER BEARINGS



Flat End



Rounded End



C

### NEEDLE ROLLERS – METRIC SERIES

Needle rollers are made from rolling bearing quality steel hardened to 60-64 HRC or equivalent. Nominal metric needle rollers in various grades are standardized at national and international levels. The grades determine the dimensional and form tolerances of the needle rollers. Metric series needle rollers may differ by their end form: type A has rounded ends and type B has flat ends. Timken prefers to supply needle rollers in the most economical flat end or type B design in G2 grade. Metric series needle rollers of type A may also be made available on request, and in other G3 or G5 grades.

### METRIC SERIES NEEDLE ROLLER DIMENSIONS

Nominally metric needle rollers, conforming to the International Standard ISO 3096, are shown in Table 1. The symbols used in Table 1 as well as in subsequent tables and figures are summarized in Table 5. Needle rollers with flat ends, which are the preferred design are shown in Table 1. Chamfer dimension limits are also shown, the use of which results in the maximum possible effective contact length between roller and raceway. Yet, the relieves at the needle roller ends help to reduce stress concentration resulting in more uniform stress distribution, optimum load ratings, and longer life.

Every needle roller gage is separately packed and the packages are marked accordingly.

### Reference standards are:

- **ISO 3096** – Rolling bearings – Needle rollers – Dimensions and tolerances
- **DIN 5402** – Sheet 3 – Rolling bearing components – Needle rollers.

### EXAMPLE OF METRIC SERIES NEEDLE ROLLER DESIGNATION AND PACKAGE MARKING:

NRO.B1,5x13,8G2  
M2M4

- NRO – Needle roller
- .B – Flat end needle rollers
- 1,5 – Nominal diameter  $D_w = 1,5$  mm
- 13,8 – Nominal length  $L_w = 13,8$  mm
- G2 – Needle roller grade (see table 2)
- M2M4 – deviation of needle roller gage  $-2/-4$  mm

The actual finished diameter is between 1.498 and 1.496 mm.

In the marking of the needle roller gage, P identifies zero (0) or plus (+), M identifies minus (-). If a shipment of needle rollers of the same size comprises several boxes, each box contains needle rollers of the same grade. The gage may vary from box to box. Each individual box, however, contains needle rollers of identical gage.



NEEDLE ROLLERS – METRIC SERIES

mm/in.		Needle Roller Designation	Wt. kg/lbs. 1000 pcs Approx.	Chamfer Dimension Limits mm/in.		
Dia.	Length			Rad.	Axial	
D <sub>w</sub>	L <sub>w</sub>			r <sub>s</sub> min		
1.5 0.0591	5.8 0.228	NRO.B1.5x5.8G2	0.080 0.176	0.1 0.004	0.4 0.016	0.6 0.024
1.5 0.0591	6.8 0.268	NRO.B1.5x6.8G2	0.094 0.207	0.1 0.004	0.4 0.016	0.6 0.024
1.5 0.0591	7.8 0.307	NRO.B1.5x7.8G2	0.108 0.238	0.1 0.004	0.4 0.016	0.6 0.024
1.5 0.0591	9.8 0.386	NRO.B1.5x9.8G2	0.136 0.300	0.1 0.004	0.4 0.016	0.6 0.024
1.5 0.0591	11.8 0.465	NRO.B1.5x11.8G2	0.164 0.362	0.1 0.004	0.4 0.016	0.6 0.024
1.5 0.0591	13.8 0.543	NRO.B1.5x13.8G2	0.191 0.421	0.1 0.004	0.4 0.016	0.6 0.024
2 0.0787	7.8 0.307	NRO.B2x7.8G2	0.190 0.419	0.1 0.004	0.6 0.024	0.8 0.031
2 0.0787	9.8 0.386	NRO.B2x9.8G2	0.240 0.529	0.1 0.004	0.6 0.024	0.8 0.031
2 0.0787	11.8 0.465	NRO.B2x11.8G2	0.290 0.639	0.1 0.004	0.6 0.024	0.8 0.031
2 0.0787	13.8 0.543	NRO.B2x13.8G2	0.340 0.750	0.1 0.004	0.6 0.024	0.8 0.031
2 0.0787	15.8 0.622	NRO.B2x15.8G2	0.390 0.860	0.1 0.004	0.6 0.024	0.8 0.031
2 0.0787	17.8 0.701	NRO.B2x17.8G2	0.440 0.970	0.1 0.004	0.6 0.024	0.8 0.031
2 0.0787	19.8 0.780	NRO.B2x19.8G2	0.490 1.080	0.1 0.004	0.6 0.024	0.8 0.031
2.5 0.0984	7.8 0.307	NRO.B2.5x7.8G2	0.300 0.661	0.1 0.004	0.6 0.024	0.8 0.031
2.5 0.0984	9.8 0.386	NRO.B2.5x9.8G2	0.380 0.838	0.1 0.004	0.6 0.024	0.8 0.031
2.5 0.0984	11.8 0.465	NRO.B2.5x11.8G2	0.450 0.992	0.1 0.004	0.6 0.024	0.8 0.031
2.5 0.0984	13.8 0.543	NRO.B2.5x13.8G2	0.530 1.168	0.1 0.004	0.6 0.024	0.8 0.031
2.5 0.0984	15.8 0.622	NRO.B2.5x15.8G2	0.610 1.345	0.1 0.004	0.6 0.024	0.8 0.031
2.5 0.0984	17.8 0.701	NRO.B2.5x17.8G2	0.690 1.521	0.1 0.004	0.6 0.024	0.8 0.031
2.5 0.0984	19.8 0.780	NRO.B2.5x19.8G2	0.760 1.676	0.1 0.004	0.6 0.024	0.8 0.031
2.5 0.0984	21.8 0.858	NRO.B2.5x21.8G2	0.840 1.852	0.1 0.004	0.6 0.024	0.8 0.031
2.5 0.0984	23.8 0.937	NRO.B2.5x23.8G2	0.920 2.028	0.1 0.004	0.6 0.024	0.8 0.031
3 0.1181	9.8 0.386	NRO.B3x9.8G2	0.540 1.190	0.1 0.004	0.6 0.024	0.8 0.031
3 0.1181	11.8 0.465	NRO.B3x11.8G2	0.650 1.433	0.1 0.004	0.6 0.024	0.8 0.031
3 0.1181	13.8 0.543	NRO.B3x13.8G2	0.760 1.676	0.1 0.004	0.6 0.024	0.8 0.031
3 0.1181	15.8 0.622	NRO.B3x15.8G2	0.870 1.918	0.1 0.004	0.6 0.024	0.8 0.031
3 0.1181	17.8 0.701	NRO.B3x17.8G2	0.990 2.183	0.1 0.004	0.6 0.024	0.8 0.031
3 0.1181	19.8 0.780	NRO.B3x19.8G2	1.100 2.425	0.1 0.004	0.6 0.024	0.8 0.031
3 0.1181	21.8 0.858	NRO.B3x21.8G2	1.210 2.668	0.1 0.004	0.6 0.024	0.8 0.031
3 0.1181	23.8 0.937	NRO.B3x23.8G2	1.320 2.910	0.1 0.004	0.6 0.024	0.8 0.031
3 0.1181	25.8 1.016	NRO.B3x25.8G2	1.430 3.153	0.1 0.004	0.6 0.024	0.8 0.031
3 0.1181	27.8 1.094	NRO.B3x27.8G2	1.540 3.395	0.1 0.004	0.6 0.024	0.8 0.031

mm/in.		Needle Roller Designation	Wt. kg/lbs. 1000 pcs Approx.	Chamfer Dimension Limits mm/in.		
Dia.	Length			Rad.	Axial	
D <sub>w</sub>	L <sub>w</sub>			r <sub>s</sub> min		
3.5 0.1378	11.8 0.465	NRO.B3.5x11.8G2	0.910 2.006	0.1 0.004	0.9 0.035	1.0 0.039
3.5 0.1378	13.8 0.543	NRO.B3.5x13.8G2	1.040 2.293	0.1 0.004	0.9 0.035	1.0 0.039
3.5 0.1378	15.8 0.622	NRO.B3.5x15.8G2	1.190 2.624	0.1 0.004	0.9 0.035	1.0 0.039
3.5 0.1378	17.8 0.701	NRO.B3.5x17.8G2	1.340 2.954	0.1 0.004	0.9 0.035	1.0 0.039
3.5 0.1378	21.8 0.858	NRO.B3.5x21.8G2	1.640 3.616	0.1 0.004	0.9 0.035	1.0 0.039
3.5 0.1378	23.8 0.937	NRO.B3.5x23.8G2	1.850 4.079	0.1 0.004	0.9 0.035	1.0 0.039
3.5 0.1378	25.8 1.016	NRO.B3.5x25.8G2	1.950 4.299	0.1 0.004	0.9 0.035	1.0 0.039
3.5 0.1378	29.8 1.173	NRO.B3.5x29.8G2	2.250 4.960	0.1 0.004	0.9 0.035	1.0 0.039
3.5 0.1378	34.8 1.370	NRO.B3.5x34.8G2	2.650 5.842	0.1 0.004	0.9 0.035	1.0 0.039
4 0.1575	11.8 0.465	NRO.B4x11.8G2	1.600 3.527	0.1 0.004	0.9 0.035	1.0 0.039
4 0.1575	13.8 0.543	NRO.B4x13.8G2	1.360 2.998	0.1 0.004	0.9 0.035	1.0 0.039
4 0.1575	15.8 0.622	NRO.B4x15.8G2	1.550 3.417	0.1 0.004	0.9 0.035	1.0 0.039
4 0.1575	17.8 0.701	NRO.B4x17.8G2	1.750 3.858	0.1 0.004	0.9 0.035	1.0 0.039
4 0.1575	19.8 0.780	NRO.B4x19.8G2	1.950 4.299	0.1 0.004	0.9 0.035	1.0 0.039
4 0.1575	21.8 0.858	NRO.B4x21.8G2	2.150 4.740	0.1 0.004	0.9 0.035	1.0 0.039
4 0.1575	23.8 0.937	NRO.B4x23.8G2	2.350 5.181	0.1 0.004	0.9 0.035	1.0 0.039
4 0.1575	25.8 1.016	NRO.B4x25.8G2	2.550 5.622	0.1 0.004	0.9 0.035	1.0 0.039
4 0.1575	27.8 1.094	NRO.B4x27.8G2	2.740 6.041	0.1 0.004	0.9 0.035	1.0 0.039
4 0.1575	29.8 1.173	NRO.B4x29.8G2	2.950 6.504	0.1 0.004	0.9 0.035	1.0 0.039
4 0.1575	34.8 1.370	NRO.B4x34.8G2	3.400 7.496	0.1 0.004	0.9 0.035	1.0 0.039
4 0.1575	39.8 1.567	NRO.B4x39.8G2	3.900 8.598	0.1 0.004	0.9 0.035	1.0 0.039
5 0.1969	15.8 0.622	NRO.B5x15.8G2	2.430 5.357	0.1 0.004	0.9 0.035	1.0 0.039
5 0.1969	19.8 0.780	NRO.B5x19.8G2	3.050 6.724	0.1 0.004	0.9 0.035	1.0 0.039
5 0.1969	21.8 0.858	NRO.B5x21.8G2	3.360 7.408	0.1 0.004	0.9 0.035	1.0 0.039
5 0.1969	23.8 0.937	NRO.B5x23.8G2	3.670 8.091	0.1 0.004	0.9 0.035	1.0 0.039
5 0.1969	25.8 1.016	NRO.B5x25.8G2	3.980 8.774	0.1 0.004	0.9 0.035	1.0 0.039
5 0.1969	27.8 1.094	NRO.B5x27.8G2	4.290 9.458	0.1 0.004	0.9 0.035	1.0 0.039
5 0.1969	29.8 1.173	NRO.B5x29.8G2	4.600 10.141	0.1 0.004	0.9 0.035	1.0 0.039
5 0.1969	34.8 1.370	NRO.B5x34.8G2	5.400 11.905	0.1 0.004	0.9 0.035	1.0 0.039
5 0.1969	39.8 1.567	NRO.B5x39.8G2	6.150 13.558	0.1 0.004	0.9 0.035	1.0 0.039
5 0.1969	49.8 1.961	NRO.B5x49.8G2	7.500 16.535	0.1 0.004	0.9 0.035	1.0 0.039
6 0.2362	17.8 0.701	NRO.B6x17.8G2	3.950 8.708	0.1 0.004	0.9 0.035	1.0 0.039



## METRIC SERIES NEEDLE ROLLER TOLERANCES

TABLE 2 – VARIATION OF GAGE LOT DIAMETER, PREFERRED GAGES AND CIRCULARITY DEVIATION (VALUES IN MM)

Grade Gage Lot Diameter	Variation of High/Low Deviation of Mean Diameter Max.	Gages Deviation Max.											Circularity
		V <sub>DWL</sub>		D <sub>wmp</sub>									
2	2	high low	0 -2	-1 -3	-2 -4	-3 -5	-4 -6	-5 -7	-6 -8	-7 -9	-8 -10	1	
3	3	high low	0 -3	-1.5 -4.5	-3 -6	-4.5 -7.5	-6 -9	-7 -10	1.5				
5	5	high low		0 -5		-3 -8		-5 -10	2.5				

Note 1 - Tolerance values apply only at the middle of the needle roller length.

Note 2 - Needle rollers of any nominal dimensions and any of the quoted grades will be supplied sub-divided into the gages listed in Table 2 at our option, if nothing to the contrary is agreed upon at the time of ordering.

## END FORM TOLERANCES

Table 3 specifies the applicable end configuration for rounded end and flat end needle rollers of all grades.

TABLE 3 – END CONFIGURATION LIMITS FOR METRIC NEEDLE ROLLERS

Rounded End Needle Rollers End Radius		Nominal Diameter of Needle Roller		Flat End Needle Rollers Chamfer Dimension Limits (Dimensions in millimeters)		
Min.	Max.	>	≤	Radial		Axial
R <sub>w</sub> *	D <sub>w</sub>	r <sub>s min</sub> *	r <sub>s max</sub>			
—	—	—	1	0.1	0.3	0.5
D <sub>w</sub>	L <sub>w</sub>	1	1.5	0.1	0.4	0.6
2	2	1.5	3	0.1	0.6	0.8
		3	6	0.1	0.9	1

Notes: \*The chamfer of a needle roller shall clear a fillet radius equal to r<sub>s min</sub> which should also be considered for designs using rounded end needle rollers.

## NEEDLE ROLLER LENGTH TOLERANCE

Tolerances on the length L<sub>w</sub> for needle rollers of all grades: h13, see Table 4.

TABLE 4 – TOLERANCES FOR NEEDLE ROLLER LENGTH, NOMINAL METRIC NEEDLE ROLLERS

Nominal Length, L <sub>w</sub> mm		Tolerance Limits mm (ISO h13)	
>	≤	Max.	Min.
3	6	0	-0.18
6	10	0	-0.22
10	18	0	-0.27
18	30	0	-0.33
30	50	0	-0.39

## DESIGN CALCULATIONS FOR NEEDLE ROLLER BEARING COMPLEMENTS

In the majority of full complement needle roller applications, needle roller complements of less than 35 needle rollers per row and a ratio of length to diameter between 4:1 and 8:1 is advantageous. Other combinations of quantity and length to diameter ratios of needle rollers have been used successfully. Specific design requirements usually dictate the appropriate selection.

In general, needle roller complements for rotating motion should employ a smaller number of large diameter needle rollers, while needle roller complements subjected to oscillating motion (especially under high loads) should employ a large number of smaller diameter needle rollers.

Oscillating applications with small angular travel encourage the development of fretting corrosion. The best performance under these conditions has been achieved by using the largest practical number of small diameter needle rollers.

## CALCULATION OF RACEWAY DIAMETERS

The calculation of inner and outer raceway diameters may be carried out using either the formula given in Table 5 or more conveniently the raceway calculation form in Table 6. To assist the designer in making these calculations, the values of K required for calculation of needle roller complements of 6 through 60 needle rollers are listed in Table 7. Values of K for other numbers of needle rollers can be calculated using the formulas given in Table 5.

Table 8 lists the suggested values for minimum radial internal clearance (G<sub>r min</sub>) and the minimum circumferential clearance divided by π (cc<sub>min</sub>/π), to be used for calculating needle roller complements for normal rotating applications where the speeds, loads and shaft deflections are moderate.

Applications with poor lubrication, unusual motion, large misalignment, raceway distortions, load reversals, high speeds, etc. can not be characterized as normal rotating applications. These miscellaneous applications require adjustment of the minimum clearances listed in Table 8. The factors in Table 9 may be used for general guidance in the adjustment of the minimal clearances. For any of the listed miscellaneous applications or any application where abnormal factors such as those listed above exist, and particularly when the inner raceway diameter will exceed 50 mm, consult your Timken representative for design assistance.

TABLE 5 – DESIGN FACTORS FOR NEEDLE ROLLERS

Z	number of needle rollers per bearing path
K	chordal factor, $K = 1/\sin(180^\circ/Z)$
cc	total circumferential clearance. See Tables 8 and 9 for $cc_{min}/\pi$ values.
$G_r$	radial internal clearance. See Tables 8 and 9 for $G_{r min}$ values
$D_{pw}$	pitch diameter: $D_{pw} = K \cdot D_{W max} + (cc_{min}/\pi) = E_{min} - D_{W max}$ $= F_{max} + G_{r min} + D_{W max}$
E	outer raceway bore diameter: $E_{min} = D_{pw} + D_{W max} = (K + 1) \cdot D_{W max} + (cc_{min}/\pi)$ $= F_{max} + G_{r min} + 2D_{W max}$
F	inner raceway diameter: $F_{max} = D_{pw} - D_{W max} - G_{r min}$ $= (K-1) \cdot D_{W max} + (cc_{min}/\pi) - G_{r min}$ $= E_{min} - 2D_{W max} - G_{r min}$
$D_w$	nominal needle roller diameter
$D_{we}$	needle roller diameter applicable in the calculation of load ratings: $D_{we} = D_{pw} - F_{max} - G_{r min} = \frac{D_{pw} - cc_{min}/\pi}{K}$ $= \frac{F_{max} + G_{r min} - (cc_{min}/\pi)}{(K-1)}$ $= E_{min} - D_{pw} = \frac{E_{min} - cc_{min}/\pi}{(K+1)}$
$L_w$	overall needle roller length
$R_w$	end radius, rounded end needle roller
$r_s$	corner rounding, flat end needle roller
$L_{we}$	needle roller length applicable in the calculation of load ratings, for rounded end needle rollers: $L_{we} = L_{w max} - (L_{w max} - \sqrt{L_{w max}^2 - D_{we}^2})$ for flat end needle rollers: $L_{we} = L_{w max} - (2 \cdot r_{s min})$

Note: If length of contact of the needle roller with the raceway is reduced because of undercuts, chamfers, etc.  $L_{we}$  must be reduced correspondingly.

## RACEWAY DIAMETER TOLERANCES

Table 10 lists the recommended tolerances that should be applied to the dimensions for the maximum inner raceway and minimum outer raceway diameter after they have been calculated using the information given in Table 5 or Table 6.

TABLE 6 – RACEWAY CALCULATION FORM

STEP	SOURCE	DESIGN FACTOR	MILLIMETERS
1	given	$D_w$ , needle roller diameter	3000 max.
2	Table 7	K, for 30 needle rollers	9.56677
3	(1) X (2)	$KD_w$	28700
4	Table 8	$cc_{min}/\pi = 0.025$	0.025 min.
5	(3) + (4)	$D_{pw}$ pitch diameter	28725
6	given	$D_w$ , needle roller diameter	3000 max.
7	(5) - (6)		25725
8	Table 8	$G_r$ , radial clearance	0.013 min.
9	(7) - (8)	F, inner raceway diameter	25712 max. 25703 min.*
10	(5) + (6)	E, outer raceway diameter	31725 min. 31741 max.*

\*From Table 10

## CLEARANCES IN NEEDLE ROLLER COMPLEMENTS

Needle rollers, supplied in bulk, are generally used for full complement assemblies. Successful operation of a full complement of needle rollers not only requires careful selection of radial internal clearance but, more importantly, depends on proper circumferential clearance, or the total clearance between needle rollers.

Needle roller guidance in a full complement assembly depends largely on contact between needle rollers. Too little circumferential clearance causes overheating. Too much circumferential clearance in a heavily loaded full complement of needle rollers causes loss of needle roller guidance and results in needle roller skew and resultant end thrusting.

Control of radial clearance and circumferential clearance is influenced by the needle roller diameter tolerance, as well as the tolerances of the inner and outer raceway diameters.

## END CLEARANCE

The total needle roller end clearance, or end play, normally should be 0.20 mm minimum per path of needle rollers.

TABLE 7

K VALUES											
Z	K	Z	K	Z	K	Z	K	Z	K	Z	K
6	2.00000	16	5.12583	26	8.29623	36	11.47371	46	14.65364	56	17.86471
7	2.30476	17	5.44219	27	8.61379	37	11.79163	47	14.97171	57	18.15285
8	2.61313	18	5.75877	28	8.93140	38	12.10957	48	15.28979	58	18.47100
9	2.92380	19	6.07553	29	9.24907	39	12.42752	49	15.60788	59	18.78916
10	3.23607	20	6.39245	30	9.56677	40	12.74549	50	15.92597	60	19.10732
11	3.54947	21	6.70951	31	9.88452	41	13.06348	51	16.24408		
12	3.86370	22	7.02667	32	10.20230	42	13.38149	52	16.56219		
13	4.17858	23	7.34394	33	10.52011	43	13.69951	53	16.88031		
14	4.49396	24	7.66130	34	10.83795	44	14.01754	54	17.19843		
15	4.80973	25	7.97873	35	11.15582	45	14.33559	55	17.51657		



**TABLE 8 – MINIMUM CLEARANCES, NORMAL ROTATING APPLICATIONS**

F Nominal Inner Raceway Diameter mm		$c_{cmin}/\pi$	$G_{rmin}$
>	≤	mm	mm
—	3	0.025	0.006
3	6	0.025	0.008
6	10	0.025	0.009
10	18	0.025	0.011
18	30	0.025	0.013
30	50	0.05	0.016
50	80	0.05	0.019
80	120	0.05	0.022

**TABLE 9 – MINIMUM CLEARANCES, MISCELLANEOUS APPLICATIONS**

Application	$c_{cmin}/\pi$	$G_{rmin}$
universal joint	$1/3 \cdot \text{normal}$	$1/2 \cdot \text{normal}$
transmission pilot	normal	$3 \cdot \text{normal}$
constant mesh gear	$0.2 \cdot \text{roller dia.}$	normal
transmission planet	normal	normal
crank pin for two cycle engine	$5 \cdot \text{normal}$	$7 \cdot \text{normal}$

**TABLE 10 – SUGGESTED RACEWAY DIAMETER TOLERANCES**

F Nominal Inner Raceway Diameter mm		Tolerance Limits (ISO h5)	
>	≤	mm	
		High	Low
3	6	0	-0.005
6	10	0	-0.006
10	18	0	-0.008
18	30	0	-0.009
30	50	0	-0.011
50	80	0	-0.013
80	120	0	-0.015

E Nominal Outer Raceway Diameter mm		Tolerance Limits (ISO H6)	
>	≤	mm	
		Low	High
3	6	0	+0.008
6	10	0	+0.009
10	18	0	+0.011
18	30	0	+0.013
30	50	0	+0.016
50	80	0	+0.019
80	120	0	+0.022

## LOAD RATING AND LIFE CALCULATIONS FOR FULL COMPLEMENTS OF NEEDLE ROLLERS

Before selecting the quantity and size of needle rollers to be used in a needle roller complement, it is usually necessary to calculate the load rating required using the applied load, speed and desired life. For a review of bearing size selection, see the engineering section.

Since it is not practical to tabulate the dynamic and static load ratings for the great number of needle roller complements that can be assembled by using different quantities, diameters and lengths of rollers, formulae are provided for the necessary calculations.

For convenience, values of  $f_c$  and values of  $Z^{3/4}$  have been combined into single factors ( $f_c \cdot Z^{3/4}$ ). These factors for a wide range of roller complements are tabulated in Table 11.

### BASIC DYNAMIC LOAD RATINGS

The basic dynamic load rating  $C$ , for any roller bearing can be calculated from the formula:

$$C = f_c \cdot (i \cdot L_{we} \cdot \cos \alpha)^{7/9} \cdot Z^{3/4} \cdot D_{we}^{29/27}$$

where:  $f_c$  = a factor which depends on the geometry of the bearing components, the accuracy to which the various components are made, and the material. Maximum values are listed in such standards as ISO 281 and USA ANSI-ABMA Standard 11.

$i$  = number of rows of rollers in any one bearing.

$\alpha$  = nominal angle of contact. Since  $\alpha = 0$  for a radial roller bearing,  $\cos \alpha = 1$ .

Other symbols are explained in Table 5.

For single path radial roller bearings, where  $i = 1$  and  $\cos \alpha = 1$ , the basic dynamic load rating formula can be written as:

$$C = f_c \cdot Z^{3/4} \cdot L_{we}^{7/9} \cdot D_{we}^{29/27}$$

TABLE 11 – VALUES OF  $F_c Z^{3/4}$  FOR METRIC UNITS

Z	$f_c Z^{3/4}$ kN - mm units
6	0.267
7	0.336
8	0.400
9	0.459
10	0.514
11	0.565
12	0.613
13	0.658
14	0.701
15	0.742
16	0.781
17	0.818
18	0.853
19	0.887
20	0.919
21	0.951
22	0.981
23	1.011
24	1.039
25	1.067
26	1.094
27	1.120
28	1.145
29	1.170
30	1.195
31	1.219
32	1.242
33	1.265
34	1.288
35	1.310
36	1.331
37	1.353
38	1.374
39	1.394
40	1.415
41	1.435
42	1.454
43	1.474
44	1.493
45	1.512
46	1.531
47	1.549
48	1.568
49	1.586
50	1.604
51	1.621
52	1.639
53	1.656
54	1.673
55	1.690
56	1.707
57	1.724
58	1.740
59	1.757
60	1.773

**Example:**

Calculate the basic dynamic load rating for a full complement of 28 flat end rollers, 3 mm diameter and 17.8 mm length.

$$C = f_c \cdot Z^{3/4} \cdot L_{we}^{7/9} \cdot D_{we}^{29/27}$$

$$f_c Z^{3/4} \text{ from Table 11} = 1145$$

$$D_{we}^{29/27} = 3^{29/27} = 3,254$$

$$L_{we} = 17.8 - 0.2 = 17.6 \text{ mm}$$

$$L_{we}^{7/9} = 17.6^{7/9} = 9305$$

$$C = 1145 \cdot 9305 \cdot 3254 = 34.7 \text{ kN}$$

When a couple load (overturning moment) is imposed on a single row of needle rollers, the resulting uneven distribution of load can seriously affect bearing life. In such cases, two rows of needle rollers are generally suggested.

**BASIC STATIC LOAD RATING**

The basic static load rating ( $C_0$ ) for any roller bearing, including needle roller bearings, can be calculated from the following formula included in ISO 76, USA ANSI-ABMA Standard 11, and other Standards:

$$C_0 = f_0 \cdot \left(1 - \frac{D_{we} \cdot \cos \alpha}{D_{pw}}\right) \cdot i \cdot Z \cdot L_{we} \cdot D_{we} \cos \alpha$$

where:  $f_0 = 0,044$  when kilo-newton and millimeter units are used.

$D_{pw}$  = pitch diameter of the needle roller complement (mm).

$i$  = number of rows of rollers in any one bearing.

$\alpha$  = nominal angle of contact. Since  $\alpha = 0$  for radial roller bearing,  $\cos \alpha = 1$ .

The other symbols are described in Table 5.



# NEEDLE ROLLER BEARINGS

## INNER AND OUTER RACEWAY DIMENSIONS, MM

Z	D <sub>w</sub> = 1.5				D <sub>w</sub> = 2.0				D <sub>w</sub> = 2.5			
	Max.	Min.	Min.	Max.	Max.	Min.	Min.	Max.	Max.	Min.	Min.	Max.
	F		E		F		E		F		E	
14	5.258	5.253	8.266	8.275	7.004	6.998	11.013	11.024	8.751	8.745	13.760	13.771
15	5.732	5.727	8.740	8.749	7.635	7.629	11.644	11.655	9.540	9.534	14.549	14.560
16	6.205	6.199	9.214	9.223	8.268	8.262	12.277	12.288	10.329	10.321	15.340	15.351
17	6.679	6.673	9.688	9.697	8.900	8.894	12.909	12.920	11.119	11.111	16.130	16.141
18	7.154	7.148	10.163	10.174	9.534	9.528	13.543	13.554	11.911	11.903	16.922	16.933
19	7.629	7.623	10.638	10.649	10.165	10.157	14.176	14.187	12.703	12.695	17.714	17.725
20	8.105	8.099	11.114	11.125	10.799	10.791	14.810	14.821	13.495	13.487	18.506	18.519
21	8.580	8.574	11.589	11.600	11.433	11.425	15.444	15.455	14.288	14.280	19.299	19.312
22	9.056	9.050	12.065	12.076	12.067	12.059	16.078	16.089	15.081	15.073	20.092	20.105
23	9.532	9.526	12.541	12.552	12.702	12.694	16.713	16.724	15.874	15.865	20.885	20.898
24	10.008	10.000	13.017	13.028	13.337	13.329	17.348	17.359	16.667	16.659	21.678	21.691
25	10.482	10.474	13.493	13.504	13.971	13.963	17.982	17.993	17.461	17.453	22.472	22.485
26	10.958	10.950	13.969	13.980	14.606	14.598	18.617	18.630	18.253	18.244	23.266	23.279
27	11.435	11.427	14.446	14.457	15.242	15.234	19.253	19.266	19.046	19.037	24.059	24.072
28	11.911	11.903	14.922	14.933	15.877	15.869	19.888	19.901	19.841	19.832	24.854	24.867
29	12.388	12.380	15.399	15.410	16.512	16.504	20.523	20.536	20.635	20.626	25.648	25.661
30	12.864	12.856	15.875	15.886	17.148	17.140	21.159	21.172	21.429	21.420	26.442	26.455
31	13.341	13.333	16.352	16.363	17.783	17.775	21.794	21.807	22.223	22.214	27.236	27.249
32	13.817	13.809	16.828	16.839	18.417	18.408	22.430	22.443	23.018	23.009	28.031	28.044
33	14.294	14.286	17.305	17.316	19.052	19.043	23.065	23.078	23.812	23.803	28.825	28.838
34	14.771	14.763	17.782	17.793	19.688	19.679	23.701	23.714	24.607	24.598	29.620	29.633
35	15.248	15.240	18.259	18.272	20.324	20.315	24.337	24.350	25.402	25.393	30.415	30.431
36	15.725	15.717	18.736	18.749	20.959	20.950	24.972	24.985	26.196	26.187	31.209	31.225
37	16.201	16.193	19.212	19.225	21.595	21.586	25.608	25.621	26.991	26.982	32.004	32.020
38	16.678	16.670	19.689	19.702	22.231	22.222	26.244	26.257	27.786	27.777	32.799	32.815
39	17.155	17.147	20.166	20.179	22.867	22.858	26.880	26.893	28.581	28.572	33.594	33.610
40	17.632	17.624	20.643	20.656	23.503	23.494	27.516	27.529	29.376	29.367	34.389	34.405
41	18.107	18.098	21.120	21.133	24.139	24.130	28.152	28.165	30.193	30.182	35.209	35.225
42	18.584	18.575	21.597	21.610	24.775	24.766	28.788	28.801	30.988	30.977	36.004	36.020
43	19.061	19.052	22.074	22.087	25.411	25.402	29.424	29.437	31.783	31.772	36.799	36.815
44	19.538	19.529	22.551	22.564	26.047	26.038	30.060	30.076	32.578	32.567	37.594	37.610
45	20.015	20.006	23.028	23.041	26.683	26.674	30.696	30.712	33.373	33.362	38.389	38.405
46	20.492	20.483	23.505	23.518	27.319	27.310	31.332	31.348	34.168	34.157	39.184	39.200
47	20.970	20.961	23.983	23.996	27.955	27.946	31.968	31.984	34.963	34.952	39.979	39.995
48	21.447	21.438	24.460	24.473	28.592	28.583	32.605	32.621	35.758	35.747	40.774	40.790
49	21.924	21.915	24.937	24.950	29.228	29.219	33.241	33.257	36.554	36.543	41.570	41.586
50	22.401	22.392	25.414	25.427	29.864	29.855	33.877	33.893	37.349	37.338	42.365	42.381
51	22.878	22.869	25.891	25.904	30.502	30.511	34.538	34.554	38.144	38.133	43.160	43.176
52	23.355	23.346	26.368	26.381	31.158	31.147	35.174	35.190	38.939	38.928	43.955	43.971
53	23.832	23.823	26.845	26.858	31.795	31.784	35.811	35.827	39.735	39.724	44.751	44.767
54	24.310	24.301	27.323	27.336	32.431	32.420	36.447	36.463	40.530	40.519	45.546	45.562
55	24.787	24.778	27.800	27.813	33.067	33.056	37.083	37.099	41.325	41.314	46.341	46.357
56	25.264	25.255	28.277	28.290	33.703	33.692	37.719	37.735	42.121	42.110	47.137	47.153
57	25.741	25.732	28.754	28.767	34.340	34.329	38.356	38.372	42.916	42.905	47.932	47.948
58	26.219	26.210	29.232	29.245	34.976	34.965	38.992	39.008	43.712	43.701	48.728	48.744
59	26.696	26.687	29.709	29.722	35.612	35.601	39.628	39.644	44.507	44.496	49.523	49.539
60	27.173	27.164	30.186	30.202	36.249	36.238	40.265	40.281	45.302	45.291	50.318	50.337

## Timken® Torrington® Metric Series Needle Roller Designation and Load Rating Multiplier (D<sub>we</sub><sup>29/27</sup>L<sub>we</sub><sup>7/9</sup>)

Needle Roller Designation	D <sub>w</sub> = 1.5	Needle Roller Designation	D <sub>w</sub> = 2.0	Needle Roller Designation	D <sub>w</sub> = 2.5
	D <sub>we</sub> <sup>(29/27)</sup> L <sub>we</sub> <sup>(7/9)</sup>		D <sub>we</sub> <sup>(29/27)</sup> L <sub>we</sub> <sup>(7/9)</sup>		D <sub>we</sub> <sup>(29/27)</sup> L <sub>we</sub> <sup>(7/9)</sup>
NRO.B1.5x5.8G2	5.903	NRO.B2x7.8G2	10.195	NRO.B2.5x7.8G2	12.957
NRO.B1.5x6.8G2	6.707	NRO.B2x9.8G2	12.227	NRO.B2.5x9.8G2	15.538
NRO.B1.5x7.8G2	7.485	NRO.B2x11.8G2	14.166	NRO.B2.5x11.8G2	18.002
NRO.B1.5x9.8G2	8.977	NRO.B2x13.8G2	16.031	NRO.B2.5x13.8G2	20.373
NRO.B1.5x11.8G2	10.400	NRO.B2x15.8G2	17.837	NRO.B2.5x15.8G2	22.667
NRO.B1.5x13.8G2	11.770	NRO.B2x17.8G2	19.591	NRO.B2.5x17.8G2	24.897
		NRO.B2x19.8G2	21.302	NRO.B2.5x19.8G2	27.071
		NRO.B2x21.8G2	22.974	NRO.B2.5x21.8G2	29.196
				NRO.B2.5x23.8G2	31.278

INNER AND OUTER RACEWAY DIMENSIONS, MM

Z	D <sub>w</sub> = 3.0				D <sub>w</sub> = 3.5				D <sub>w</sub> = 4.0			
	Max.	Min.	Min.	Max.	Max.	Min.	Min.	Max.	Max.	Min.	Min.	Max.
	F		E		F		E		F		E	
14	10.496	10.488	16.507	16.518	12.243	12.235	19.254	19.267	13.990	13.982	22.001	22.014
15	11.443	11.435	17.454	17.465	13.348	13.340	20.359	20.372	15.253	15.245	23.264	23.277
16	12.391	12.383	18.402	18.415	14.454	14.446	21.465	21.478	16.517	16.509	24.528	24.541
17	13.341	13.333	19.352	19.365	15.562	15.554	22.573	22.586	17.783	17.775	25.794	25.807
18	14.290	14.282	20.301	20.314	16.670	16.662	23.681	23.694	19.047	19.038	27.060	27.073
19	15.241	15.233	21.252	21.265	17.778	17.770	24.789	24.802	20.314	20.305	28.327	28.340
20	16.191	16.183	22.202	22.215	18.886	18.877	25.899	25.912	21.582	21.573	29.595	29.608
21	17.143	17.135	23.154	23.167	19.995	19.986	27.008	27.021	22.850	22.841	30.863	30.879
22	18.092	18.083	24.105	24.118	21.105	21.096	28.118	28.131	24.119	24.110	32.132	32.148
23	19.044	19.035	25.057	25.070	22.216	22.207	29.229	29.242	25.388	25.379	33.401	33.417
24	19.996	19.987	26.009	26.022	23.327	23.318	30.340	30.356	26.657	26.648	34.670	34.686
25	20.948	20.939	26.961	26.974	24.438	24.429	31.451	31.467	27.927	27.918	35.940	35.956
26	21.901	21.892	27.914	27.927	25.549	25.540	32.562	32.578	29.197	29.188	37.210	37.226
27	22.853	22.844	28.866	28.879	26.660	26.651	33.673	33.689	30.489	30.478	38.505	38.521
28	23.806	23.797	29.819	29.832	27.772	27.763	34.785	34.801	31.760	31.749	39.776	39.792
29	24.759	24.750	30.772	30.788	28.884	28.875	35.897	35.913	33.030	33.019	41.046	41.062
30	25.712	25.703	31.725	31.741	29.996	29.987	37.009	37.025	34.301	34.290	42.317	42.333
31	26.666	26.657	32.679	32.695	31.130	31.119	38.146	38.162	35.572	35.561	43.588	43.604
32	27.619	27.610	33.632	33.648	32.242	32.231	39.258	39.274	36.843	36.832	44.859	44.875
33	28.572	28.563	34.585	34.601	33.354	33.343	40.370	40.386	38.114	38.103	46.130	46.146
34	29.526	29.517	35.539	35.555	34.467	34.456	41.483	41.499	39.386	39.375	47.402	47.418
35	30.501	30.490	36.517	36.533	35.579	35.568	42.595	42.611	40.657	40.646	48.673	48.689
36	31.455	31.444	37.471	37.487	36.692	36.681	43.708	43.724	41.929	41.918	49.945	49.961
37	32.409	32.398	38.425	38.441	37.805	37.794	44.821	44.837	43.201	43.190	51.217	51.236
38	33.363	33.352	39.379	39.395	38.917	38.906	45.933	45.949	44.472	44.461	52.488	52.507
39	34.317	34.306	40.333	40.349	40.030	40.019	47.046	47.062	45.744	45.733	53.760	53.779
40	35.270	35.259	41.286	41.302	41.143	41.132	48.159	48.175	47.016	47.005	55.032	55.051
41	36.224	36.213	42.240	42.256	42.256	42.245	49.272	49.288	48.288	48.277	56.304	56.323
42	37.178	37.167	43.194	43.210	43.369	43.358	50.385	50.404	49.560	49.549	57.576	57.595
43	38.133	38.122	44.149	44.165	44.482	44.471	51.498	51.517	50.829	50.816	58.848	58.867
44	39.087	39.076	45.103	45.119	45.595	45.584	52.611	52.630	52.101	52.088	60.120	60.139
45	40.041	40.030	46.057	46.073	46.709	46.698	53.725	53.744	53.373	53.360	61.392	61.411
46	40.995	40.984	47.011	47.027	47.822	47.811	54.838	54.857	54.646	54.633	62.665	62.684
47	41.949	41.938	47.965	47.981	48.935	48.924	55.951	55.970	55.918	55.905	63.937	63.956
48	42.903	42.892	48.919	48.935	50.045	50.032	57.064	57.083	57.190	57.177	65.209	65.228
49	43.858	43.847	49.874	49.890	51.159	51.146	58.178	58.197	58.463	58.450	66.482	66.501
50	44.812	44.801	50.828	50.847	52.272	52.259	59.291	59.310	59.735	59.722	67.754	67.773
51	45.766	45.755	51.782	51.801	53.385	53.372	60.404	60.423	61.007	60.994	69.026	69.045
52	46.721	46.710	52.737	52.756	54.499	54.486	61.518	61.537	62.280	62.267	70.299	70.318
53	47.675	47.664	53.691	53.710	55.612	55.599	62.631	62.650	63.552	63.539	71.571	71.590
54	48.629	48.618	54.645	54.664	56.726	56.713	63.745	63.764	64.825	64.812	72.844	72.863
55	49.584	49.573	55.600	55.619	57.839	57.826	64.858	64.877	66.097	66.084	74.116	74.135
56	50.535	50.522	56.554	56.573	58.952	58.939	65.971	65.990	67.370	67.357	75.389	75.408
57	51.490	51.477	57.509	57.528	60.066	60.053	67.085	67.104	68.642	68.629	76.661	76.680
58	52.444	52.431	58.463	58.482	61.180	61.167	68.199	68.218	69.915	69.902	77.934	77.953
59	53.398	53.385	59.417	59.436	62.293	62.280	69.312	69.331	71.188	71.175	79.207	79.226
60	54.353	54.340	60.372	60.391	63.407	63.394	70.426	70.445	72.460	72.447	80.479	80.501

Timken® Torrington® Metric Series Needle Roller Designation and Load Rating Multiplier (D<sub>w</sub><sup>29/27</sup> L<sub>w</sub><sup>7/9</sup>)

Needle Roller Designation	D <sub>w</sub> = 3.0	Needle Roller Designation	D <sub>w</sub> = 3.5	Needle Roller Designation	D <sub>w</sub> = 4.0
	D <sub>w</sub> <sup>(29/27)</sup> L <sub>w</sub> <sup>(7/9)</sup>		D <sub>w</sub> <sup>(29/27)</sup> L <sub>w</sub> <sup>(7/9)</sup>		D <sub>w</sub> <sup>(29/27)</sup> L <sub>w</sub> <sup>(7/9)</sup>
NRO.B3x9.8G2	18.900	NRO.B3.5x11.8G2	25.839	NRO.B4x11.8G2	29.824
NRO.B3x11.8G2	21.897	NRO.B3.5x13.8G2	29.242	NRO.B4x13.8G2	33.752
NRO.B3x13.8G2	24.780	NRO.B3.5x15.8G2	32.535	NRO.B4x15.8G2	37.553
NRO.B3x15.8G2	27.571	NRO.B3.5x17.8G2	35.736	NRO.B4x17.8G2	41.247
NRO.B3x17.8G2	30.283	NRO.B3.5x19.8G2	38.856	NRO.B4x19.8G2	44.848
NRO.B3x19.8G2	32.927	NRO.B3.5x21.8G2	41.906	NRO.B4x21.8G2	48.369
NRO.B3x21.8G2	35.512	NRO.B3.5x23.8G2	44.894	NRO.B4x23.8G2	51.818
NRO.B3x23.8G2	38.044	NRO.B3.5x25.8G2	47.826	NRO.B4x25.8G2	55.202
NRO.B3x25.8G2	40.529	NRO.B3.5x29.8G2	53.544	NRO.B4x27.8G2	58.528
NRO.B3x27.8G2	42.971	NRO.B3.5x34.8G2	60.454	NRO.B4x29.8G2	61.801





# NEEDLE ROLLER BEARINGS

## INNER AND OUTER RACEWAY DIMENSIONS, MM

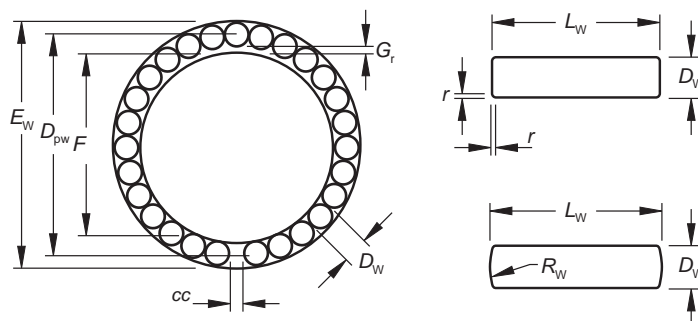
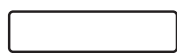
Z	D <sub>w</sub> = 5.0				D <sub>w</sub> = 6.0			
	Max.	min.	Min.	Max.	Max.	Min.	Min.	Max.
	F		E		F		E	
14	17.484	17.476	27.495	27.508	20.976	20.967	32.989	33.005
15	19.061	19.052	29.074	29.087	22.870	22.861	34.883	34.899
16	20.641	20.632	30.654	30.670	24.767	24.758	36.780	36.796
17	22.223	22.214	32.236	32.252	26.665	26.656	38.678	38.694
18	23.806	23.797	33.819	33.835	28.565	28.556	40.578	40.594
19	25.390	25.381	35.403	35.419	30.487	30.478	42.503	42.519
20	26.974	26.965	36.987	37.003	32.389	32.378	44.405	44.421
21	28.560	28.551	38.573	38.589	34.291	34.280	46.307	46.323
22	30.167	30.156	40.183	40.199	36.194	36.183	48.210	48.226
23	31.754	31.743	41.770	41.786	38.098	38.087	50.114	50.133
24	33.340	33.329	43.356	43.372	40.002	39.991	52.018	52.037
25	34.928	34.917	44.944	44.960	41.906	41.895	53.922	53.941
26	36.515	36.504	46.531	46.547	43.811	43.800	55.827	55.846
27	38.103	38.092	48.119	48.135	45.717	45.706	57.733	57.752
28	39.691	39.680	49.707	49.723	47.622	47.611	59.638	59.657
29	41.279	41.268	51.295	51.311	49.528	49.517	61.544	61.563
30	42.868	42.857	52.884	52.900	51.432	51.419	63.451	63.470
31	44.457	44.446	54.473	54.489	53.338	53.325	65.357	65.376
32	46.045	46.034	56.061	56.080	55.245	55.232	67.264	67.283
33	47.635	47.624	57.651	57.670	57.152	57.139	69.171	69.190
34	49.224	49.213	59.240	59.259	59.059	59.046	71.078	71.097
35	50.810	50.797	60.829	60.848	60.966	60.953	72.985	73.004
36	52.400	52.387	62.419	62.438	62.873	62.860	74.892	74.911
37	53.989	53.976	64.008	64.027	64.781	64.768	76.800	76.819
38	55.579	55.566	65.598	65.617	66.688	66.675	78.707	78.726
39	57.169	57.156	67.188	67.207	68.596	68.583	80.615	80.637
40	58.758	58.745	68.777	68.796	70.504	70.491	82.523	82.545
41	60.348	60.335	70.367	70.386	72.412	72.399	84.431	84.453
42	61.938	61.925	71.957	71.976	74.320	74.307	86.339	86.361
43	63.529	63.516	73.548	73.567	76.228	76.215	88.247	88.269
44	65.119	65.106	75.138	75.157	78.136	78.123	90.155	90.177
45	66.709	66.696	76.728	76.747	80.042	80.027	92.064	92.086
46	68.299	68.286	78.318	78.337	81.950	81.935	93.972	93.994
47	69.890	69.877	79.909	79.928	83.858	83.843	95.880	95.902
48	71.480	71.467	81.499	81.521	85.767	85.752	97.789	97.811
49	73.070	73.057	83.089	83.111	87.675	87.660	99.697	99.719
50	74.661	74.648	84.680	84.702	89.584	89.569	101.606	101.628
51	76.251	76.238	86.270	86.292	91.492	91.477	103.514	103.536
52	77.842	77.829	87.861	87.883	93.401	93.386	105.423	105.445
53	79.433	79.420	89.452	89.474	95.310	95.295	107.332	107.354
54	81.020	81.005	91.042	91.064	97.219	97.204	109.241	109.263
55	82.611	82.596	92.633	92.655	99.127	99.112	111.149	111.171
56	84.202	84.187	94.224	94.246	101.036	101.021	113.058	113.080
57	85.792	85.777	95.814	95.836	102.945	102.930	114.967	114.989
58	87.383	87.368	97.405	97.427	104.854	104.839	116.876	116.898
59	88.974	88.959	98.996	99.018	106.763	106.748	118.785	118.807
60	90.565	90.550	100.587	100.609	108.672	108.657	120.694	120.719

## Timken® Torrington® Metric Series Needle Roller Designation and Load Rating Multiplier (D<sub>w</sub><sup>29/27</sup> L<sub>w</sub><sup>7/9</sup>)

Needle Roller Designation	D <sub>w</sub> = 5.0	Needle Roller Designation	D <sub>w</sub> = 6.0
	D <sub>w</sub> <sup>(29/27)</sup> L <sub>w</sub> <sup>(7/9)</sup>		D <sub>w</sub> <sup>(29/27)</sup> L <sub>w</sub> <sup>(7/9)</sup>
NRO.B5x15.8G2	47.723	NRO.B6X17.8G2	63.756
NRO.B5x19.8G2	56.995		
NRO.B5x21.8G2	61.469		
NRO.B5x23.8G2	65.852		
NRO.B5x25.8G2	70.153		
NRO.B5x27.8G2	74.379		
NRO.B5x29.8G2	78.539		
NRO.B5x34.5G2	88.676		
NRO.B5x39.8G2	98.491		
NRO.B5x49.8G2	117.342		



## NEEDLE ROLLERS – INCH SERIES



### INTRODUCTION

Before selecting a specific needle roller complement, the engineering section of this catalog should be reviewed for detailed information concerning:

- bearing type selection
- bearing life and reliability
- definition of load ratings
- life and load relationships
- effect of raceway hardness
- example of life calculation
- lubrication
- shaft design
- housing design

In addition to these general considerations, material which follows should also be reviewed when selecting a needle roller complement.

Standard inch series needle rollers are furnished in two styles – elliptical end or the most economical design: flat end. Materials, dimensions and tolerances for standard needle rollers are specified in this section.

When required, needle rollers having spherical ends, conical ends, trunnion ends or crank pin ends, as well as other end designs, can be furnished. Your Timken representative should be consulted before final needle roller selection is made.

### INCH SERIES – NEEDLE ROLLER DIMENSIONS

Needle rollers are made from rolling bearing quality steel hardened to 60-64 HRC or equivalent. Nominally inch needle rollers are given in Table 1. Your Timken representative should be consulted for availability. The symbols used in Tables 1 as well as in subsequent tables and figures are summarized in Table 2.

Needle rollers with elliptical ends permit the use of a more generous fillet between the raceway and the locating shoulder than possible with flat end rollers. Also, due to the length of the elliptical end, the possibility of the roller's cylindrical surface operating over the edge of the raceway is less, thus reducing the chance of occurrence of harmful stress concentrations. On the other hand, where design considerations permit their use, flat end rollers achieve the maximum possible effective contact length between roller and raceway along with maximum load ratings and longer life.

### CLEARANCES IN NEEDLE ROLLER COMPLEMENTS

Needle rollers, supplied in bulk, are generally used to assemble full complement bearings. Successful operation of a full complement of rollers not only requires careful selection of radial clearance but, more importantly, depends on proper circumferential clearance, or the total clearance between rollers.

Circumferential guidance in a full complement of needle rollers depends largely on roller-to-roller contact. Too little circumferential clearance causes overheating. Too much circumferential clearance in a heavily loaded full complement of needle rollers causes loss of roller guidance and results in roller skew and heavy end thrust.

Control of radial clearance and circumferential clearance is influenced by the roller diameter tolerance, as well as the tolerances of the inner and outer raceway diameters.

### END CLEARANCE

The total needle roller end clearance, or end play, normally should be 0.008 inch minimum per path of needle rollers.

### NOMINAL INCH NEEDLE ROLLERS TOLERANCES

Unless otherwise specified, inch needle rollers are normally manufactured with a tolerance of +0.0000 in. -0.0002 in. This tolerance has proven acceptable and ensures satisfactory control of circumferential clearance. The needle roller length tolerance may vary with the end configuration. The normal roller length tolerance for rounded end rollers is +0.000 in. -0.020 in.

Timken also manufactures needle rollers with 0.0001 in. diameter tolerance. These offer enhanced load carrying capability and improved control of circumferential clearance. For needle rollers of greater precision, please consult with your Timken representative.

Nominal dimensions for typical inch series needle rollers are shown in Table 1. Timken supplies rollers with smaller and larger length-to-diameter ratios for special applications. Rollers with dimensions other than those shown in Table 1 can be obtained provided the quantities permit economical production. For example, although the largest needle rollers shown in Table 1 are 0.2500 in. (the usual limits for needle rollers), Timken produces quantities of rollers as large as 0.6250 in. diameter.

Your Timken representative should be contacted with the following information about the required needle rollers:

- nominal metric or inch
- diameter and tolerance (e.g., .1250 in., + 0 in. -.0002 in.)
- length and tolerance (e.g., .560 in., + 0 in. -.020 in.)
- end form (e.g., elliptical end or flat end)
- material (e.g., high carbon chrome steel)
- special features required (e.g., Controlled Stress)
- quantity required



TABLE 1 – NOMINAL DIMENSIONS FOR TYPICAL INCH NEEDLE ROLLERS

Nominal Diameter $D_w$	Nominal Length																						
	$L_w$																						
Inch	0.12	0.16	0.19	0.22	0.25	0.28	0.31	0.38	0.44	0.5	0.56	0.62	0.75	0.88	1	1.12	1.25	1.38	1.5	1.75	2	2.25	2.5
0.0625					*	*	*	*	*	*	*	*	*	*									
0.0781							*	*	*	*	*	*	*	*									
0.0938								*	*	*	*	*	*	*	*								
0.125										*	*	*	*	*	*								
0.1562												*	*	*	*	*	*	*	*	*			
0.1875													*	*	*	*	*	*	*	*	*		
0.2188														*	*	*	*	*	*	*	*	*	
0.25															*	*	*	*	*	*	*	*	*

\* Indicates preferred needle roller sizes. Consult with your Timken representative.

## DESIGN CALCULATIONS FOR NEEDLE ROLLER BEARING COMPLEMENTS

In the majority of full complement needle roller applications, roller complements of less than 35 needle rollers per row and a ratio of roller length to roller diameter between 4:1 and 8:1 is advantageous. Other combinations of quantity and length-to-diameter ratios of needle rollers have been used successfully. Specific design requirements usually dictate the appropriate selection.

In general, roller complements for rotating motion should employ a smaller number of larger diameter needle rollers, while roller complements subjected to oscillating motion (especially under high loads) should employ a larger number of smaller diameter needle rollers.

Oscillating applications with small angular travel encourage the development of fretting corrosion. The best performance under these conditions has been achieved by using the largest practical number of small diameter needle rollers.

## CALCULATION OF RACEWAY DIAMETERS

It may be convenient to use the Bearing Calculation Form in Table 3 to calculate the maximum inner raceway and the minimum outer raceway diameters of a bearing. The formula given in Table 2 can also be used. To assist the designer in making these calculations, the values of K required for calculation of needle roller complements of 6 through 60 needle rollers are listed in Table 4. Values of K for other numbers of needle rollers will be furnished on request, or can be calculated from the formula given in Table 2.

Table 5 lists the suggested values for minimum radial clearance and ( $G_{r\ min}$ ) minimum circumferential clearance divided by  $\pi$  ( $cc_{\min}/\pi$ ), to be used for calculating needle roller complements for normal rotating applications where the speeds, loads and shaft deflections are moderate.

Applications with poor lubrication, unusual motion, large misalignment, raceway distortions, load reversals, high speeds, etc., can not be characterized as normal rotating applications. These miscellaneous applications require adjustment of the minimum clearances listed in Table 5. The factors in Table 6 may be used for general guidance in the adjustment of the minimal clearances. For any of the listed miscellaneous applications or any application where abnormal factors such as those listed above exist, and particularly when the inner raceway diameter will exceed 2 inches, your Timken representative should be consulted for design assistance.

TABLE 2 – DESIGN FACTORS FOR NEEDLE ROLLERS

Z	number of needle rollers per bearing path
K	chordal factor, $K = 1/\sin(180^\circ/Z)$
cc	total circumferential clearance. See Tables 8 and 9 for $cc_{\min}/\pi$ values.
$G_r$	radial internal clearance. See Tables 8 and 9 for $G_{r\ min}$ values
$D_{pw}$	pitch diameter: $D_{pw} = K \cdot D_{w\ max} + (cc_{\min}/\pi) = E_{\min} - D_{w\ max}$ $= F_{\max} + G_{r\ min} + D_{w\ max}$
E	outer raceway bore diameter: $E_{\min} = D_{pw} + D_{w\ max} = (K + 1) \cdot D_{w\ max} + (cc_{\min}/\pi)$ $= F_{\max} + G_{r\ min} + 2D_{w\ max}$
F	inner raceway diameter: $F_{\max} = D_{pw} - D_{w\ max} - G_{r\ min}$ $= (K-1) \cdot D_{w\ max} + (cc_{\min}/\pi) - G_{r\ min}$ $= E_{\min} - 2D_{w\ max} - G_{r\ min}$
$D_w$	nominal needle roller diameter
$D_{we}$	needle roller diameter applicable in the calculation of load ratings: $D_{we} = D_{pw} - F_{\max} - G_{r\ min} = \frac{D_{pw} - cc_{\min}/\pi}{K}$ $= \frac{F_{\max} + G_{r\ min} - (cc_{\min}/\pi)}{(K-1)}$ $= E_{\min} - D_{pw} = \frac{E_{\min} - cc_{\min}/\pi}{(K+1)}$
$L_w$	overall needle roller length
$R_w$	end radius, rounded end needle roller
$r_s$	corner rounding, flat end needle roller
$L_{we}$	needle roller length applicable in the calculation of load ratings, for elliptical end needle rollers: $L_{we} = L_{w\ max} - (0.4 \cdot D_{we})$ for flat end needle rollers: $L_{we} = L_{w\ max} - (2 \cdot r_s\ min)$

Note: If length of contact of the needle roller with the raceway is reduced because of undercuts, chamfers, etc.  $L_{we}$  must be reduced correspondingly.

### RACEWAY DIAMETER TOLERANCE LIMITS

Table 7 lists the suggested tolerances that should be applied to the dimensions for the maximum inner raceway and the minimum outer raceway diameter after they have been calculated using the Bearing Calculation Form, Table 3.

TABLE 3 – BEARING CALCULATION FORM

Step	Source	Design Factor	Inch	
1	given	$D_w$ , roller diameter	0.1250 max.	min.
2	Table 4	K, for 30 rollers	9.56677	
3	(1) x (2)	$KD_w$	1.1958	
4	Table 5	$cc_{min}/\pi = 0.001"$	0.0010 min.	max.
5	(3) + (4)	$D_{pw}$ pitch diameter	1.1968	
6	given	$D_w$ , roller diameter	0.1250 max.	min.
7	(5) – (6)		1.0718	
8	Table 5	$G_r$ , radial clearance	0.0005 min.	max.
9	(7)– (8)	$F$ , inner raceway diameter	1.0713 max.	1.0709 min.*
10	(5) + (6)	$E$ , outer raceway diameter	1.3218 min.	1.3224 max.*

\*From Table 7.

TABLE 5 – MINIMUM CLEARANCES, NORMAL ROTATING APPLICATIONS

F Nominal Inner Raceway Diameter inch		$cc_{min}/\pi$	$G_{r min}$
>	≤	inch	inch
–	0.1181	0.001	0.0002
0.1181	0.2362	0.001	0.0003
0.2362	0.3937	0.001	0.0004
0.3937	0.7087	0.001	0.0004
0.7087	1.1811	0.001	0.0005
1.1811	1.9685	0.002	0.0006
1.9685	3.1496	0.002	0.0007
3.1496	4.7244	0.002	0.0009

TABLE 6 – MINIMUM CLEARANCES, MISCELLANEOUS APPLICATIONS

Application	$cc_{min}/\pi$	$G_{r min}$
universal joint	1/3 • normal	1/2 • normal
transmission pilot	normal	3 • normal
constant mesh gear	0.2 • roller dia.	normal
transmission planet	normal	normal
crank pin for two	5 • normal	7 • normal

TABLE 4 –

K Values	
Z	K
6	2.00000
7	2.30476
8	2.61313
9	2.92380
10	3.23607
11	3.54947
12	3.86370
13	4.17858
14	4.49396
15	4.80973
16	5.12583
17	5.44219
18	5.75877
19	6.07553
20	6.39245
21	6.70951
22	7.02667
23	7.34394
24	7.66130
25	7.97873
26	8.29623
27	8.61379
28	8.93140
29	9.24907
30	9.56677
31	9.88452
32	10.20230
33	10.52011
34	10.83795
35	11.15582
36	11.47371
37	11.79163
38	12.10957
39	12.42752
40	12.74549
41	13.06348
42	13.38149
43	13.69951
44	14.01754
45	14.33559
46	14.65364
47	14.97171
48	15.28979
49	15.60788
50	15.92597
51	16.24408
52	16.56219
53	16.88031
54	17.19843
55	17.51657
56	17.83471
57	18.15285
58	18.47100
59	18.78916
60	19.10732



**TABLE 7 – SUGGESTED RACEWAY DIAMETER TOLERANCES**

F Nominal Inner Raceway Diameter inch		Tolerance Limits (ISO h5) inch	
>	≤	High	Low
0.1181	0.2362	0	-0.0002
0.2362	0.3937	0	-0.0002
0.3937	0.7087	0	-0.0003
0.7087	1.1811	0	-0.0004
1.1811	1.9685	0	-0.0004
1.9685	3.1496	0	-0.0005
3.1496	4.7244	0	-0.0006

E Nominal Outer Raceway Diameter inch		Tolerance Limits (ISO H6) inch	
>	≤	Low	High
0.1181	0.2362	0	+0.0003
0.2362	0.3937	0	+0.0004
0.3937	0.7087	0	+0.0004
0.7087	1.1811	0	+0.0005
1.1811	1.9685	0	+0.0006
1.9685	3.1496	0	+0.0007
3.1496	4.7244	0	+0.0009

## KEYSTONED ROLLER ASSEMBLIES

Retention of the rollers in the outer raceway by key-stoning can be helpful in assembly operations. The following formula may be used to check the bearing design to be sure that a given number of rollers, Z, will keystone.

$$Y \cdot D_{w \min} > E_{\max} = \text{keystone condition}$$

That is, the product of the keystone constant Y, given below, and the minimum roller diameter  $D_{w \min}$ , must be greater than the maximum outer race bore,  $E_{\max}$ .

Roller complements with 14 or more rollers usually will not keystone unless steps are taken to reduce the circumferential clearance. It is suggested that your Timken representative be consulted when designing a keystone roller complement with 14 or more rollers.

**TABLE 8 – KEYSTONE CONSTANT**

Z	Y	Z	Y	Z	Y
8	3.67633	12	4.88797	16	6.13885
9	3.97094	13	5.19892	17	6.45365
10	4.27277	14	5.51128	18	6.76893
11	4.57895	15	5.82467	19	7.08461

## LOAD RATING AND LIFE CALCULATIONS FOR FULL COMPLEMENTS OF NEEDLE ROLLERS

Before selecting the quantity and size of needle rollers to be used in a needle roller complement, it is usually necessary to calculate the load rating required using the applied load, speed and desired life. For a review of bearing size selection, see the engineering section.

Since it is not practical to tabulate the dynamic and static load ratings for the great number of needle roller complements that can be assembled by using different quantities, diameters and lengths of rollers, formulae are provided for the necessary calculations.

For convenience, values of  $f_c$  and values of  $Z^{3/4}$  have been combined into single factors ( $f_c \cdot Z^{3/4}$ ). These factors for a wide range of needle roller complements are contained in Table 9.

## BASIC DYNAMIC LOAD RATINGS

The basic dynamic load rating C, for any roller bearing can be calculated from the formula:

$$C = f_c (i L_w \cos \alpha)^{7/9} Z^{3/4} D_w^{29/27}$$

where:  $f_c$  = a factor which depends on the geometry of the bearing components, the accuracy to which the various components are made, and the material. Maximum values are listed in such standards as ISO 281 and USA ANSI-ABMA Standard 11.

$i$  = number of rows of needle rollers in any one bearing.

$\alpha$  = nominal angle of contact. Since  $\alpha = 0$  for a radial needle roller bearing,  $\cos \alpha = 1$ .

Other symbols are explained in Table 2.

For single path radial needle roller bearings, where  $i = 1$  and  $\cos \alpha = 1$ , the basic dynamic load rating formula can be written as:

$$C_r = f_c Z^{3/4} L_{we}^{7/9} D_w^{29/27}$$

TABLE 9 – VALUES OF  $f_c Z^{3/4}$  FOR INCH UNITS

Z	$f_c Z^{3/4}$ lbf - inch units
6	24000
7	30200
8	35900
9	41200
10	46100
11	50700
12	55100
13	59100
14	63000
15	66600
16	70100
17	73400
18	76600
19	79700
20	82600
21	85400
22	88100
23	90800
24	93300
25	95800
26	98200
27	100600
28	102900
29	105100
30	107300
31	109500
32	111600
33	113600
34	115600
35	117600
36	119600
37	121500
38	123400
39	125200
40	127100
41	128900
42	130600
43	132400
44	134100
45	135800
46	137500
47	139200
48	140800
49	142400
50	144000
51	145600
52	147200
53	148800
54	150300
55	151800
56	153300
57	154800
58	156300
59	157800
60	159200

**Example:**

Calculate the basic dynamic load rating in lbf for a full complement of 28 elliptical end rollers, 0.1250 in. diameter and 0.750 in. length.

$$C = f_c \cdot Z^{3/4} \cdot L_{we}^{7/9} \cdot D_{we}^{29/27}$$

$$f_c Z^{3/4} \text{ from Table 9} = 102900$$

$$D_{we}^{29/27} = 0.1250^{29/27} = 0.1072$$

$$L_{we} = 0.750 - (0.4 \cdot 0.1250) = 0.700 \text{ (see Table 2)}$$

$$L_{we}^{7/9} = 0.700^{7/9} = 0.758$$

$$C = 102900 \cdot 0.1072 \cdot 0.758 = 8360 \text{ lbf}$$

When a couple load (overturning moment) is imposed on a single row of needle rollers, the resulting uneven distribution of load can seriously affect bearing life. In such cases, two rows of needle rollers are generally suggested.

Your Timken representative should be consulted before a final selection of a needle roller complement is made.

**BASIC STATIC LOAD RATING**

The basic static load rating ( $C_0$ ) for any roller bearing, including needle roller bearings, can be calculated from the following formula included in ISO 76, USA ANSI-ABMA Standard 11 and other Standards:

$$C_0 = f_0 \cdot \left(1 - \frac{D_{we} \cdot \cos \alpha}{D_{pw}}\right)^i \cdot Z \cdot L_{we} \cdot D_{we} \cdot \cos \alpha$$

where:  $f_0 = 6430$  when pound-force and inch units are used

$D_{pw}$  = pitch diameter of the needle roller complement (inch).

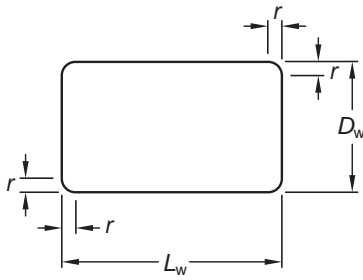
$i$  = number of rows of rollers in any one bearing.

$\alpha$  = nominal angle of contact. Since  $\alpha = 0$  for radial roller bearing,  $\cos \alpha = 1$ .

The other symbols are described in Table 2.



CYLINDRICAL ROLLERS – METRIC SERIES



Timken® Torrington® cylindrical rollers are made from bearing quality steel and hardened to 58-65 HRC or equivalent. Nominal metric cylindrical rollers are sorted into gages based on the mean deviation from nominal diameter and nominal length. The relieved ends of the cylindrical rollers, when used in bearing complements, help to reduce stress concentration at the ends of rollers, both under misalignment or ideal alignment. This results in a more uniform stress distribution along the roller-raceway contact length and optimum bearing performance.

METRIC SERIES CYLINDRICAL ROLLER DIMENSIONS

Nominally metric cylindrical rollers conforming to DIN 5402 sheet 1 are shown in Table 1. Chamfer dimension limits of these cylindrical rollers with flat ends are also shown in Table 1. The use of these chamfer limits results in the maximum possible effective contact length between roller and raceway, along with the already mentioned relieved ends, producing the maximum possible load ratings and longer life.

Each cylindrical roller gage is packed separately and the mean deviations of diameter and length gages are shown on the package (below the roller designation).

EXAMPLE OF METRIC SERIES CYLINDRICAL ROLLER DESIGNATION AND PACKAGE MARKING:

ZR0.6 x 8  
P0/M6

Nominal diameter:  $D_w = 6$  mm

Nominal length:  $L_w = 8$  mm

Mean deviation of the diameter  $\pm 0$   $\mu$ m (see Table 2)

Mean deviation of the length -6  $\mu$ m. (see Table 3)

The actual finished diameter is between 5,999 and 6,001 mm.

The actual finished length is between 7,991 and 7,997 mm.

In the marking of the cylindrical roller gage, P identifies zero (0) or plus (+), M identifies minus (-). If a shipment of cylindrical rollers of the same size comprises several boxes, each box contains cylindrical rollers of the identical gage, although the gage may vary from box to box.

TABLE 1 – DIMENSIONS OF METRIC SERIES CYLINDRICAL ROLLERS

Nominal Diameter mm	Nominal Length			Cylindrical Roller Designation	Wt. kg 100 pieces (approx.)
$D_w$	$L_w$	$r_s$ min	$r_s$ max		
3	5	0.2	0.4	ZR0.3x5	0.027
3.5	5	0.2	0.4	ZR0.3.5x5	0.037
4	4	0.2	0.4	ZR0.4x4	0.039
4	6	0.2	0.4	ZR0.4x6	0.058
4	8	0.2	0.4	ZR0.4x8	0.078
5	5	0.2	0.6	ZR0.5x5	0.075
5	8	0.2	0.6	ZR0.5x8	0.121
5.5	8	0.2	0.6	ZR0.5.5x8	0.146
6	6	0.2	0.6	ZR0.6x6	0.13
6	12	0.2	0.6	ZR0.6x12	0.261
6.5	9	0.2	0.6	ZR0.6.5x9	0.23
7	7	0.2	0.6	ZR0.7x7	0.206
7	10	0.2	0.6	ZR0.7x10	0.296
7	14	0.2	0.6	ZR0.7x14	0.417
7.5	7.5	0.2	0.6	ZR0.7.5x7.5	0.254
7.5	9	0.2	0.6	ZR0.7.5x9	0.312
7.5	11	0.2	0.6	ZR0.7.5x11	0.374
8	8	0.2	0.6	ZR0.8x8	0.308
8	12	0.2	0.6	ZR0.8x12	0.465
9	10	0.3	0.7	ZR0.9x10	0.5
9	14	0.3	0.7	ZR0.9x14	0.68
10	10	0.3	0.7	ZR0.10x10	0.6
10	11	0.3	0.7	ZR0.10x11	0.68
10	14	0.3	0.7	ZR0.10x14	0.85
11	15	0.3	0.7	ZR0.11x15	1.1
12	14	0.3	0.7	ZR0.12x14	1.23
13	20	0.4	0.8	ZR0.13x20	2.04
14	14	0.4	0.8	ZR0.14x14	1.66
14	20	0.4	0.8	ZR0.14x20	2.38

Mass in accordance with DIN 5402.



TABLE 2 – DIAMETER AND FORM ACCURACY OF METRIC SERIES CYLINDRICAL ROLLERS

Nominal Diameter $D_w$		Total Diameter Deviation		Variation of Gage	Mean Deviation of Gage DIN/ISO 1101														Circularity Deviation	
> mm	≤ mm	high $\mu\text{m}$	low $\mu\text{m}$	$\mu\text{m}$	$\mu\text{m}$														max. $\mu\text{m}$	
—	20	+7	-9	2	+6	+5	+4	+3	+2	+1	0	-1	-2	-3	-4	-5	-6	-7	-8	0.8

TABLE 3 – LENGTH GAGES OF METRIC SERIES CYLINDRICAL ROLLERS

Nominal Length $L_w$		Total Length Deviation		Variation of gage	Mean Deviation of Gage				Axial Runout DIN/ISO 1101
> mm	≤ mm	high $\mu\text{m}$	high $\mu\text{m}$	$\mu\text{m}$	$\mu\text{m}$				$\mu\text{m}$
—	48	+9	-15	6	+6	0	-6	-12	6

## INNER RINGS – METRIC SERIES

When it is impractical to meet the shaft raceway design requirements (hardness, surface finish, case depth, etc.) outlined in the engineering section of this catalog, standard inner rings may be used.

Inner rings are made of rolling bearing steel and after hardening, their bores, raceways and end surfaces are ground. Metric series inner rings may be used to provide inner raceway surfaces for metric series needle roller and cage radial assemblies, metric series needle roller bearings and metric series drawn cup needle roller bearings. The extended inner rings are suitable for use with bearings containing lip contact seals and for applications in which axial movement may be present.

### CONSTRUCTION

Metric series inner rings are available in four basic designs and differ only by the chamfers at the ends of the raceway surfaces, the lubricant access holes and the raceway profile. Inner rings of series JR have chamfers to assist in bearing installation but are without lubricating holes. Inner rings of series JR and IM have bearing installation chamfers and lubricating holes (bore diameters 5 to 50 mm). Inner rings of series JRZ.JS1 are without installation chamfers, allowing for maximum possible raceway contact. IM...RG6 inner rings have a profiled outer diameter for use in applications having a greater degree of misalignment.

The BIC and BICG Series inner rings have chamfers and oil holes and are designed to be used with the full complement, metric, needle roller bearings of Series RNA1000, RNA2000 and RNA3000. These inner rings are intended for RNA bearings of the same number; for example a BIC2020 would be used with a RNA2020.

### DIMENSIONAL ACCURACY

The tolerances of size, form, and runout for metric series inner rings meet the requirements of ISO normal tolerance class for radial bearings (see the engineering section). Most metric series inner rings are produced with outside diameter raceway tolerance in accordance with h5 which, in most cases, is suitable for combining the metric series needle roller bearings to give the

normal clearance class, and for use with drawn cup bearings. Other raceway tolerances may also be found on inner rings for combining with needle roller bearings to give one of the clearance classes, or other specially requested radial internal clearance requirement.

### MOUNTING OF INNER RINGS

Inner rings may be mounted on the shaft with either a loose transition fit or an interference fit. These fits used in conjunction with the proper fit of the bearing outer ring, will provide the correct operating clearances for most applications.

Regardless of the fit of the inner ring on the shaft, the inner ring should be axially located by shaft shoulders or other positive means. The shaft shoulder diameter adjacent to the inner ring must not exceed the inner ring outside diameter (per suggestions on page C103 of the metric series needle roller bearing section).

When metric series inner rings are to be used with the metric series needle roller bearings, appropriate shaft tolerances should be selected from Table 3 in the metric series needle roller bearing section. When metric series inner rings are to be used with drawn cup bearings the suggested shaft tolerances are given in the “Inner ring” discussion on page C39 of the “metric series drawn cup needle roller bearings” section of this catalog.

### INCH SERIES INNER RINGS

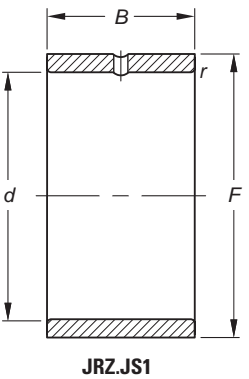
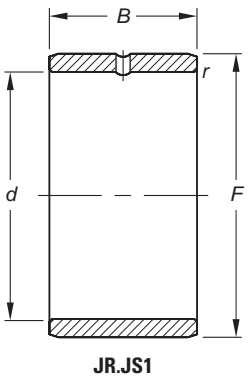
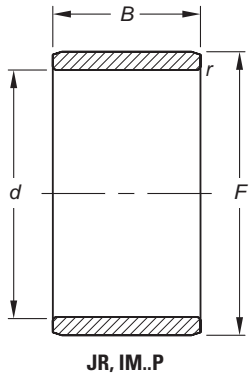
Inch series inner rings for use with inch series drawn cup bearings are tabulated on page C92 of this catalog. See catalog page C150 for inch series inner rings for use with inch series needle roller bearings.

### END WASHERS – METRIC SERIES

When the metric series needle roller and cage radial assembly used in series NAO and RNAO needle roller bearings without flanges cannot be axially located by suitable shoulders or side faces, end washers of series SNSH may be used. These end washers, which are made of spring steel, are designed to be guided in the housing bore. They are tabulated on page C353.



## INNER RINGS METRIC SERIES

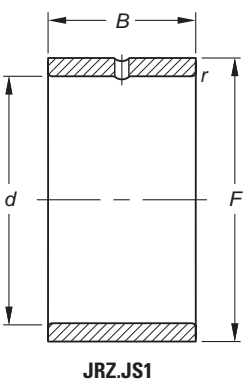
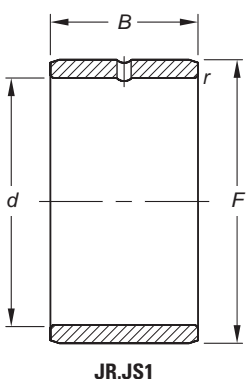
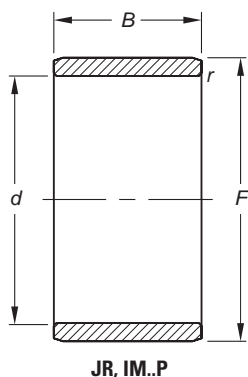


Shaft Diameter	Dimensions mm/in.				Inner Ring Designation	Wt. kg/lbs.
	mm	d	F	B		
5	5	5	8	8	JR5x8x8JS1	0.002 0.004
	5	5	8	12	JR5x8x12	0.003 0.007
	5	5	8	16	JR5x8x16	0.004 0.009
6	6	6	9	8	JR6x9x8JS1	0.002 0.004
	6	6	9	12	JR6x9x12	0.003 0.007
	6	6	9	16	JR6x9x16	0.004 0.009
6	6	6	10	10	JR6x10x10	0.004 0.009
	6	6	10	10	JR6x10x10JS1	0.004 0.009
	6	6	10	12	JRZ6x10x12JS1	0.005 0.011
7	7	7	10	10.5	JR7x10x10.5	0.003 0.007
	7	7	10	12	JR7x10x12	0.004 0.009
	7	7	10	16	JR7x10x16	0.005 0.011
8	8	8	12	10	JR8x12x10	0.005 0.011
	8	8	12	10	JR8x12x10JS1	0.005 0.011
	8	8	12	10.5	JR8x12x10.5	0.005 0.011
8	8	8	12	12	JRZ8x12x12JS1	0.006 0.013
	8	8	12	12.5	JR8x12x12.5	0.006 0.013
	8	8	12	16	IM 8 12 16 P	0.007 0.016
9	9	9	12	12	JR9x12x12	0.005 0.011
	9	9	12	16	JR9x12x16	0.006 0.013
10	10	10	13	12.5	JR10x13x12.5	0.005 0.011
	10	10	14	11	JR10x14x11JS1	0.007 0.015
	10	10	14	12	JR10x14x12	0.007 0.015
10	10	10	14	12	JR10x14x12JS1	0.007 0.015
	10	10	14	13	JR10x14x13	0.007 0.015
	10	10	14	14	JRZ10x14x14JS1	0.008 0.018
10	10	14	16	JR10x14x16	0.009 0.020	



INNER RINGS — *continued*

METRIC SERIES



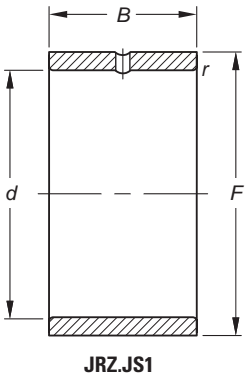
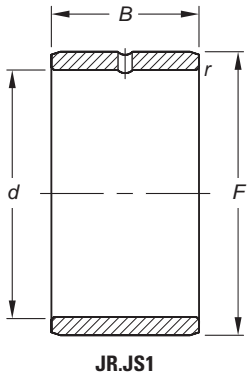
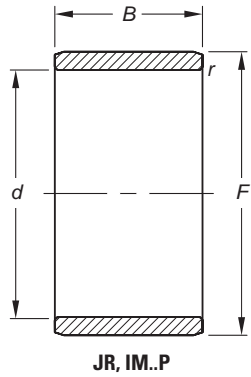
Shaft Diameter	Dimensions mm/in.				Inner Ring Designation	Wt. kg/lbs.
	mm	d	F	B		
10	10	14	20	0.3	JR10x14x20	0.012
	0.3937	0.5512	0.787	0.01		0.026
12	12	15	12.5	0.3	JR12x15x12.5	0.006
	0.4724	0.5906	0.492	0.01		0.013
	12	15	16	0.3	JR12x15x16	0.008
	0.4724	0.5906	0.630	0.01		0.018
	12	15	16.5	0.3	JR12x15x16.5	0.008
	0.4724	0.5906	0.650	0.01		0.018
	12	15	18.5	0.3	JR12x15x18.5	0.009
	0.4724	0.5906	0.728	0.01		0.020
	12	15	22.4	0.2	IM 12 15 22,4 P	0.011
	0.4724	0.5906	0.882	0.01		0.024
	12	15	22.5	0.3	JR12x15x22.5	0.011
	0.4724	0.5906	0.886	0.01		0.024
	12	16	12	0.3	JR12x16x12	0.008
	0.4724	0.6299	0.472	0.01		0.018
	12	16	12	0.3	JR12x16x12JS1	0.008
	0.4724	0.6299	0.472	0.01		0.018
	12	16	13	0.3	JR12x16x13	0.008
	0.4724	0.6299	0.512	0.01		0.018
	12	16	14	0.3	JRZ12x16x14JS1	0.010
	0.4724	0.6299	0.551	0.01		0.022
	12	16	16	0.3	JR12x16x16	0.011
	0.4724	0.6299	0.630	0.01		0.024
	12	16	20	0.3	JR12x16x20	0.014
	0.4724	0.6299	0.787	0.01		0.031
	12	16	22	0.3	JR12x16x22	0.015
	0.4724	0.6299	0.866	0.01		0.033
13	13	18	16	0.35	IM 13 18 16 P	0.015
	0.5118	0.7087	0.630	0.014		0.032
14	14	17	17	0.3	JR14x17x17	0.009
	0.5512	0.6693	0.669	0.01		0.020
15	15	18	16.5	0.3	JR15x18x16.5	0.010
	0.5906	0.7087	0.650	0.01		0.022
	15	19	16	0.3	JR15x19x16	0.013
	0.5906	0.7480	0.630	0.01		0.029
	15	19	20	0.3	JR15x19x20	0.017
	0.5906	0.7480	0.787	0.01		0.037
	15	20	12	0.3	JR15x20x12	0.012
	0.5906	0.7874	0.472	0.01		0.026
	15	20	12	0.3	JR15x20x12JS1	0.012
	0.5906	0.7874	0.472	0.01		0.026
	15	20	13	0.3	JR15x20x13	0.014
	0.5906	0.7874	0.512	0.01		0.031
	15	20	14	0.3	JRZ15x20x14JS1	0.015
	0.5906	0.7874	0.551	0.01		0.033
	15	20	16	0.3	JR15x20x16	0.017
	0.5906	0.7874	0.630	0.01		0.037
	15	20	20	0.35	IM 15 20 20 P	0.021
	0.5906	0.7874	0.787	0.014		0.045
	15	20	23	0.3	JR15x20x23	0.025
	0.5906	0.7874	0.906	0.01		0.055
	15	20	26	0.3	JR15x20x26	0.028
	0.5906	0.7874	1.024	0.01		0.062

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INNER RINGS — continued

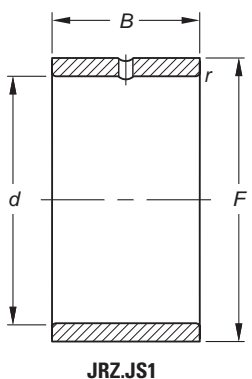
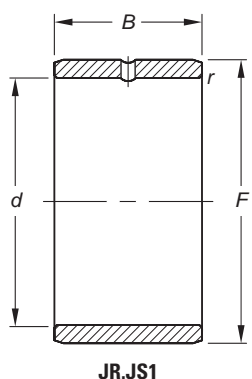
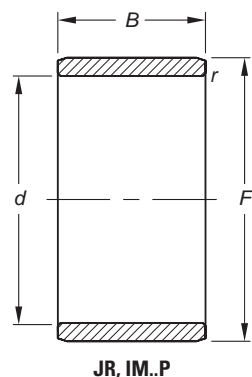
METRIC SERIES



Shaft Diameter	Dimensions mm/in.				Inner Ring Designation	Wt. kg/lbs.	
	mm	d	F	B			r <sub>s</sub> min
17	17	17	20	16.5	0.3	JR17x20x16.5	0.011 0.024
	0.6693	0.6693	0.7874	0.650	0.01		
	17	17	20	20	0.3	JR17x20x20	0.014 0.031
	0.6693	0.6693	0.7874	0.787	0.01		
	17	17	20	20.5	0.3	JR17x20x20.5	0.014 0.031
	0.6693	0.6693	0.7874	0.807	0.01		
	17	17	20	30.5	0.3	JR17x20x30.5	0.021 0.046
	0.6693	0.6693	0.7874	1.201	0.01		
	17	17	21	16	0.3	JR17x21x16	0.015 0.033
	0.6693	0.6693	0.8268	0.630	0.01		
	17	17	21	20	0.3	JR17x21x20	0.019 0.042
	0.6693	0.6693	0.8268	0.787	0.01		
	17	17	22	13	0.3	JR17x22x13	0.015 0.033
	0.6693	0.6693	0.8661	0.512	0.01		
	17	17	22	16	0.3	JR17x22x16	0.019 0.042
0.6693	0.6693	0.8661	0.630	0.01			
17	17	22	16	0.3	JR17x22x16JS1	0.019 0.042	
0.6693	0.6693	0.8661	0.630	0.01			
17	17	22	16	0.3	JRZ17x22x16JS1	0.019 0.042	
0.6693	0.6693	0.8661	0.630	0.01			
17	17	22	20	0.35	IM 17 22 20 P	0.023 0.051	
0.6693	0.6693	0.8661	0.787	0.014			
17	17	22	23	0.3	JR17x22x23	0.028 0.062	
0.6693	0.6693	0.8661	0.906	0.01			
17	17	22	26	0.3	JR17x22x26	0.031 0.068	
0.6693	0.6693	0.8661	1.024	0.01			
17	17	22	32	0.3	JR17x22x32	0.038 0.084	
0.6693	0.6693	0.8661	1.260	0.01			
20	20	20	24	16	0.3	JR20x24x16	0.018 0.040
	0.7874	0.7874	0.9449	0.630	0.01		
	20	20	24	20	0.3	JR20x24x20	0.022 0.049
	0.7874	0.7874	0.9449	0.787	0.01		
	20	20	25	16	0.3	JR20x25x16	0.022 0.049
	0.7874	0.7874	0.9843	0.630	0.01		
	20	20	25	16	0.3	JR20x25x16JS1	0.022 0.049
	0.7874	0.7874	0.9843	0.630	0.01		
	20	20	25	17	0.3	JR20x25x17	0.023 0.051
	0.7874	0.7874	0.9843	0.669	0.01		
	20	20	25	18	0.3	JRZ20x25x18JS1	0.025 0.055
	0.7874	0.7874	0.9843	0.709	0.01		
	20	20	25	20	0.3	JR20x25x20	0.028 0.062
	0.7874	0.7874	0.9843	0.787	0.01		
	20	20	25	20.5	0.3	JR20x25x20.5	0.029 0.064
0.7874	0.7874	0.9843	0.807	0.01			
20	20	25	26	0.3	JR20x25x26	0.036 0.079	
0.7874	0.7874	0.9843	1.024	0.01			
20	20	25	26.5	0.3	JR20x25x26.5	0.037 0.082	
0.7874	0.7874	0.9843	1.043	0.01			
20	20	25	30	0.3	JR20x25x30	0.042 0.093	
0.7874	0.7874	0.9843	1.181	0.01			
20	20	25	32	0.3	JR20x25x32	0.044 0.097	
0.7874	0.7874	0.9843	1.260	0.01			
20	20	25	38.5	0.3	JR20x25x38.5	0.054 0.119	
0.7874	0.7874	0.9843	1.516	0.01			

INNER RINGS — *continued*

METRIC SERIES



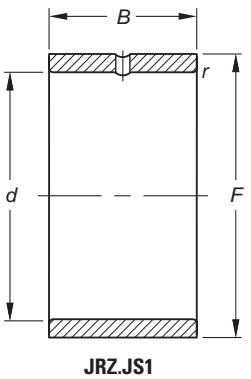
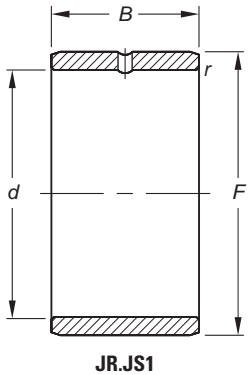
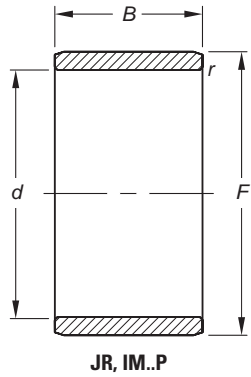
Shaft Diameter	Dimensions mm/in.				Inner Ring Designation	Wt. kg/lbs.
	mm	d	F	B		
22	22	26	16	0.3	JR22x26x16	0.019 0.042
	0.8661	1.0236	0.630	0.01		
	22	26	20	0.3	JR22x26x20	0.023 0.051
	0.8661	1.0236	0.787	0.01		
	22	28	17	0.3	JR22x28x17	0.030 0.066
	0.8661	1.1024	0.669	0.01		
22	22	28	20.5	0.3	JR22x28x20.5	0.038 0.084
	0.8661	1.1024	0.807	0.01		
22	22	28	30	0.3	JR22x28x30	0.056 0.123
	0.8661	1.1024	1.181	0.01		
23	23	28	20	0.35	IM 23 28 20 P	0.030 0.066
	0.9055	1.1024	0.787	0.014		
25	25	29	20	0.3	JR25x29x20	0.027 0.060
	0.9843	1.1417	0.787	0.01		
	25	29	30	0.3	JR25x29x30	0.040 0.088
	0.9843	1.1417	1.181	0.01		
	25	30	16	0.3	JR25x30x16	0.027 0.060
	0.9843	1.1811	0.630	0.01		
	25	30	16	0.3	JR25x30x16JS1	0.027 0.060
	0.9843	1.1811	0.630	0.01		
	25	30	17	0.3	JR25x30x17	0.028 0.062
	0.9843	1.1811	0.669	0.01		
	25	30	18	0.3	JR25x30x18JS1	0.031 0.068
	0.9843	1.1811	0.709	0.01		
	25	30	20	0.3	JR25x30x20	0.034 0.075
	0.9843	1.1811	0.787	0.01		
	25	30	20.5	0.3	JR25x30x20.5	0.035 0.077
0.9843	1.1811	0.807	0.01			
25	30	26	0.3	JR25x30x26	0.044 0.097	
0.9843	1.1811	1.024	0.01			
25	30	26.5	0.3	JR25x30x26.5	0.045 0.099	
0.9843	1.1811	1.043	0.01			
25	30	30	0.3	JR25x30x30	0.051 0.112	
0.9843	1.1811	1.181	0.01			
25	30	32	0.3	JR25x30x32	0.054 0.119	
0.9843	1.1811	1.260	0.01			
25	30	38.5	0.3	JR25x30x38.5	0.066 0.146	
0.9843	1.1811	1.516	0.01			
28	28	32	17	0.3	JR28x32x17	0.028 0.062
	1.1024	1.2598	0.669	0.01		
	28	32	20	0.3	JR28x32x20	0.030 0.066
	1.1024	1.2598	0.787	0.01		
28	28	32	30	0.3	JR28x32x30	0.044 0.097
	1.1024	1.2598	1.181	0.01		
30	30	35	16	0.3	JR30x35x16	0.031 0.068
	1.1811	1.3780	0.630	0.01		
	30	35	17	0.3	JR30x35x17	0.033 0.073
	1.1811	1.3780	0.669	0.01		
	30	35	18	0.3	JRZ30x35x18JS1	0.036 0.079
	1.1811	1.3780	0.709	0.01		
30	30	35	20	0.3	JR30x35x20	0.039 0.086
	1.1811	1.3780	0.787	0.01		
30	30	35	20	0.3	JRZ30x35x20JS1	0.039 0.086
	1.1811	1.3780	0.787	0.01		

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## INNER RINGS — continued

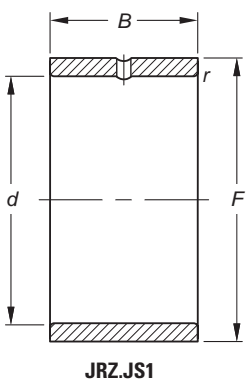
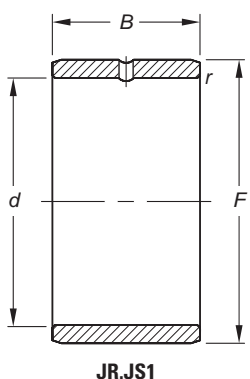
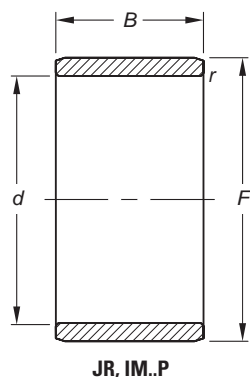
### METRIC SERIES



Shaft Diameter	Dimensions mm/in.				Inner Ring Designation	Wt. kg/lbs.
	mm	d	F	B		
30	30	35	20.5	0.3	JR30x35x20.5	0.040 0.088
	1.1811	1.3780	0.807	0.01		
	30	35	26	0.3	JR30x35x26	0.054 0.119
	1.1811	1.3780	1.024	0.01		
	30	35	30	0.3	JR30x35x30	0.057 0.126
1.1811	1.3780	1.181	0.01			
30	30	35	32	0.3	JR30x35x32	0.062 0.137
	1.1811	1.3780	1.260	0.01		
	30	38	20	0.6	JR30x38x20JS1	0.067 0.148
1.1811	1.4961	0.787	0.02			
32	32	37	20	0.3	JR32x37x20	0.043 0.095
	1.2598	1.4567	0.787	0.01		
	32	37	30	0.3	JR32x37x30	0.064 0.141
	1.2598	1.4567	1.181	0.01		
	32	40	20	0.6	JR32x40x20	0.069 0.152
1.2598	1.5748	0.787	0.02			
32	32	40	36	0.6	JR32x40x36	0.128 0.282
	1.2598	1.5748	1.417	0.02		
	35	40	17	0.3	JR35x40x17	0.040 0.088
1.3780	1.5748	0.669	0.01			
35	35	40	20	0.3	JR35x40x20	0.046 0.101
	1.3780	1.5748	0.787	0.01		
35	35	40	20.5	0.3	JR35x40x20.5	0.049 0.108
	1.3780	1.5748	0.807	0.01		
	35	40	22	0.3	JR35x40x22	0.052 0.115
	1.3780	1.5748	0.866	0.01		
	35	40	30	0.3	JR35x40x30	0.071 0.157
1.3780	1.5748	1.181	0.01			
35	35	40	34	0.3	JR35x40x34	0.080 0.176
	1.3780	1.5748	1.339	0.01		
35	35	40	40	0.3	JR35x40x40	0.094 0.207
	1.3780	1.5748	1.575	0.01		
35	35	42	20	0.6	JR35x42x20	0.065 0.143
	1.3780	1.6535	0.787	0.02		
35	35	42	20	0.6	JR35x42x20JS1	0.065 0.143
	1.3780	1.6535	0.787	0.02		
35	35	42	23	0.6	JRZ35x42x23JS1	0.074 0.163
	1.3780	1.6535	0.906	0.02		
35	35	42	36	0.6	JR35x42x36	0.122 0.269
	1.3780	1.6535	1.417	0.02		
35	35	44	22	0.6	JR35x44x22	0.097 0.214
	1.3780	1.7323	0.866	0.02		
37	37	42	20	0.35	IM 37 42 20 P	0.046 0.101
1.4567	1.6535	0.787	0.014			
38	38	43	20	0.3	JR38x43x20	0.050 0.110
	1.4961	1.6929	0.787	0.01		
38	38	43	30	0.3	JR38x43x30	0.075 0.165
	1.4961	1.6929	1.181	0.01		
40	40	45	17	0.3	JR40x45x17	0.044 0.097
	1.5748	1.7717	0.669	0.01		
	40	45	20	0.3	JR40x45x20	0.052 0.115
1.5748	1.7717	0.787	0.01			
40	40	45	20.5	0.3	JR40x45x20.5	0.054 0.119
	1.5748	1.7717	0.807	0.01		

INNER RINGS — *continued*

METRIC SERIES



Shaft Diameter	Dimensions mm/in.				Inner Ring Designation	Wt. kg/lbs.
	mm	d	F	B		
40	40	45	25	0.35	IM 40 45 25 P	0.062
	1.5748	1.7717	0.984	0.014		0.137
	40	45	30	0.3	JR40x45x30	0.078
	1.5748	1.7717	1.181	0.01		0.172
	40	45	34	0.3	JR40x45x34	0.089
	1.5748	1.7717	1.339	0.01		0.196
	40	45	40	0.3	JR40x45x40	0.115
	1.5748	1.7717	1.575	0.01		0.254
	40	48	22	0.6	JR40x48x22	0.094
	1.5748	1.8898	0.866	0.02		0.207
42	40	48	23	0.6	JRZ40x48x23JS1	0.100
	1.5748	1.8898	0.906	0.02		0.220
	40	48	40	0.6	JR40x48x40	0.173
	1.5748	1.8898	1.575	0.02		0.381
	40	50	20	1	JR40x50x20	0.110
	1.5748	1.9685	0.787	0.04		0.243
	42	47	20	0.3	JR42x47x20	0.055
	1.6535	1.8504	0.787	0.01		0.121
	42	47	30	0.3	JR42x47x30	0.083
	1.6535	1.8504	1.181	0.01		0.183
45	45	50	20	0.3	JR45x50x20	0.058
	1.7717	1.9685	0.787	0.01		0.128
	45	50	25	0.6	JR45x50x25	0.073
	1.7717	1.9685	0.984	0.02		0.161
	45	50	25.5	0.3	JR45x50x25.5	0.075
	1.7717	1.9685	1.004	0.01		0.165
	45	50	35	0.6	JR45x50x35	0.103
	1.7717	1.9685	1.378	0.02		0.227
	45	50	40	0.3	JR45x50x40	0.117
	1.7717	1.9685	1.575	0.01		0.258
50	45	52	22	0.6	JR45x52x22	0.090
	1.7717	2.0472	0.866	0.02		0.198
	45	52	23	0.6	JR45x52x23	0.096
	1.7717	2.0472	0.906	0.02		0.212
	45	52	23	0.6	JRZ45x52x23JS1	0.096
	1.7717	2.0472	0.906	0.02		0.212
	45	52	40	0.6	JR45x52x40	0.167
	1.7717	2.0472	1.575	0.02		0.368
	45	55	20	1	JR45x55x20	0.133
	1.7717	2.1654	0.787	0.04		0.293
50	45	55	20	1	JR45x55x20JS1	0.133
	1.7717	2.1654	0.787	0.04		0.293
	45	55	22	1	JR45x55x22	0.135
	1.7717	2.1654	0.866	0.04		0.298
	45	55	40	1	JR45x55x40	0.247
	1.7717	2.1654	1.575	0.04		0.545
	50	55	20	0.3	JR50x55x20	0.065
	1.9685	2.1654	0.787	0.01		0.143
50	50	55	25	0.6	JR50x55x25	0.081
	1.9685	2.1654	0.984	0.02		0.179
	50	55	35	0.65	IM 50 55 35 P	0.107
	1.9685	2.1654	1.378	0.026		0.236
50	50	55	35	0.6	JR50x55x35	0.113
	1.9685	2.1654	1.378	0.02		0.249

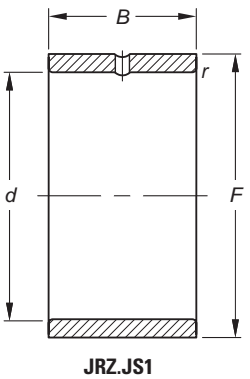
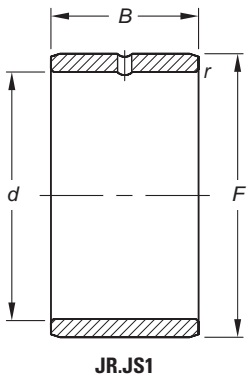
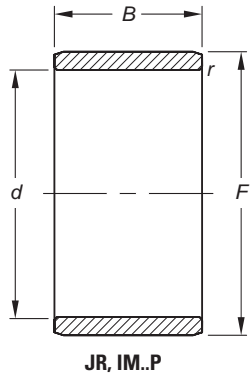
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# NEEDLE ROLLER BEARINGS

## INNER RINGS — continued

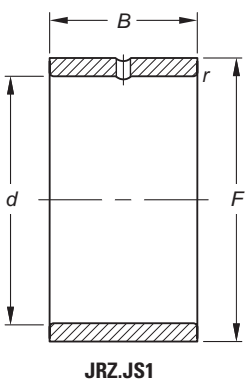
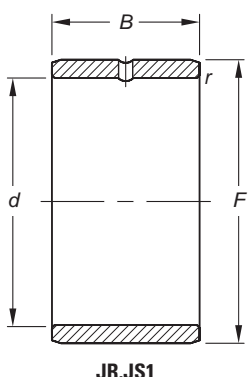
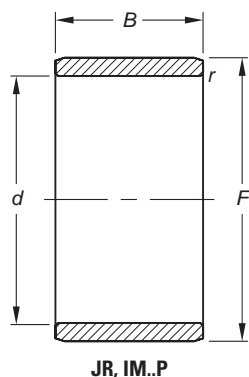
### METRIC SERIES



Shaft Diameter	Dimensions mm/in.				Inner Ring Designation	Wt. kg/lbs.	
	mm	d	F	B			r <sub>s</sub> min
50	50	55	40	0.3	JR50x55x40	0.130	
	1.9685	2.1654	1.575	0.01		0.287	
	50	58	22	0.6	JR50x58x22	0.117	
	1.9685	2.2835	0.866	0.02		0.258	
	50	58	23	0.6	JRZ50x58x23JS1	0.122	
	1.9685	2.2835	0.906	0.02		0.269	
	50	58	40	0.6	JR50x58x40	0.213	
	1.9685	2.2835	1.575	0.02		0.470	
	50	60	20	1	JR50x60x20	0.155	
	1.9685	2.3622	0.787	0.04		0.342	
	50	60	20	1	JR50x60x20JS1	0.155	
	1.9685	2.3622	0.787	0.04		0.342	
55	50	60	25	1	JR50x60x25	0.170	
	1.9685	2.3622	0.984	0.04		0.375	
	50	60	40	1	JR50x60x40	0.310	
	1.9685	2.3622	1.575	0.04		0.683	
	55	60	25	0.6	JR55x60x25	0.088	
	2.1654	2.3622	0.984	0.02		0.194	
	55	60	35	0.65	IM 55 60 35 P	0.118	
	2.1654	2.3622	1.378	0.026		0.260	
	55	60	35	0.6	JR55x60x35	0.124	
	2.1654	2.3622	1.378	0.02		0.273	
	55	63	25	1	JR55x63x25	0.141	
	2.1654	2.4803	0.984	0.04		0.311	
58	55	63	45	1	JR55x63x45	0.286	
	2.1654	2.4803	1.772	0.04		0.631	
	55	65	30	1	JR55x65x30	0.222	
	2.1654	2.5591	1.181	0.04		0.489	
	55	65	60	1	JR55x65x60	0.444	
	2.1654	2.5591	2.362	0.04		0.979	
	58	65	25	0.85	IM 58 65 25 P	0.125	
	2.2835	2.5591	0.984	0.033		0.276	
	60	60	68	25	0.6	JR60x68x25	0.153
		2.3622	2.6772	0.984	0.02		0.337
		60	68	35	0.6	JR60x68x35	0.220
		2.3622	2.6772	1.378	0.02		0.485
60		68	45	1	JR60x68x45	0.284	
2.3622		2.6772	1.772	0.04		0.626	
60		70	25	1	JR60x70x25	0.200	
2.3622		2.7559	0.984	0.04		0.441	
60		70	30	1	JR60x70x30	0.240	
2.3622		2.7559	1.181	0.04		0.529	
60		70	35	0.85	IM 60 70 35 P	0.280	
2.3622		2.7559	1.378	0.033		0.616	
65	60	70	60	1	JR60x70x60	0.480	
	2.3622	2.7559	2.362	0.04		1.058	
	65	72	25	1	JR65x72x25	0.143	
	2.5591	2.8346	0.984	0.04		0.315	
	65	72	45	1	JR65x72x45	0.266	
	2.5591	2.8346	1.772	0.04		0.586	
	65	73	25	0.6	JR65x73x25	0.170	
	2.5591	2.8740	0.984	0.02		0.375	
	65	73	35	0.6	JR65x73x35	0.240	
	2.5591	2.8740	1.378	0.02		0.529	
	65	75	28	1	JR65x75x28	0.240	
	2.5591	2.9528	1.102	0.04		0.529	

INNER RINGS — continued

METRIC SERIES



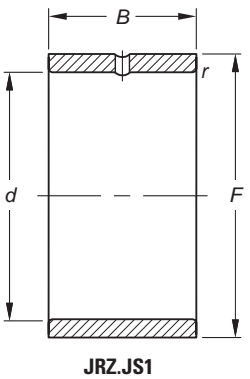
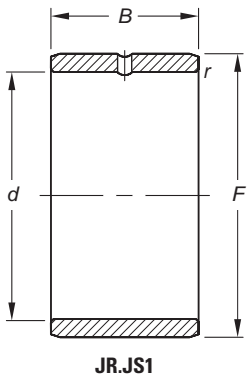
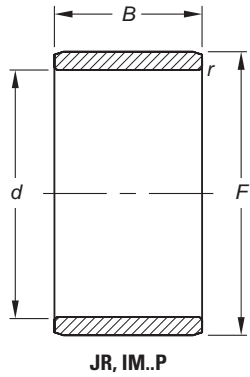
Shaft Diameter	Dimensions mm/in.				Inner Ring Designation	Wt. kg/lbs.
	mm	d	F	B		
65	65	75	30	1	JR65x75x30	0.260 0.573
	2.5591	2.9528	1.181	0.04		
	65	75	60	1	JR65x75x60	0.520 1.146
	2.5591	2.9528	2.362	0.04		
70	70	80	25	1	JR70x80x25	0.230 0.507
	2.7559	3.1496	0.984	0.04		
	70	80	30	1	JR70x80x30	0.270 0.595
	2.7559	3.1496	1.181	0.04		
	70	80	35	1	JR70x80x35	0.320 0.705
	2.7559	3.1496	1.378	0.04		
	70	80	54	1	JR70x80x54	0.500 1.102
	2.7559	3.1496	2.126	0.04		
	70	80	60	1	JR70x80x60	0.556 1.226
	2.7559	3.1496	2.362	0.04		
75	75	85	25	1	JR75x85x25	0.240 0.529
	2.9528	3.3465	0.984	0.04		
	75	85	30	1	JR75x85x30	0.289 0.637
	2.9528	3.3465	1.181	0.04		
	75	85	35	1	JR75x85x35	0.338 0.745
	2.9528	3.3465	1.378	0.04		
	75	85	54	1	JR75x85x54	0.530 1.168
	2.9528	3.3465	2.126	0.04		
80	80	90	25	1	JR80x90x25	0.260 0.573
	3.1496	3.5433	0.984	0.04		
	80	90	30	1	JR80x90x30	0.306 0.675
	3.1496	3.5433	1.181	0.04		
	80	90	35	1	JR80x90x35	0.355 0.783
	3.1496	3.5433	1.378	0.04		
	80	90	54	1	JR80x90x54	0.565 1.246
	3.1496	3.5433	2.126	0.04		
85	85	95	26	1	JR85x95x26	0.290 0.639
	3.3465	3.7402	1.024	0.04		
	85	95	30	1	JR85x95x30	0.334 0.736
	3.3465	3.7402	1.181	0.04		
	85	95	36	1	JR85x95x36	0.397 0.875
	3.3465	3.7402	1.417	0.04		
	85	100	35	1.1	JR85x100x35	0.595 1.312
	3.3465	3.9370	1.378	0.04		
	85	100	63	1.1	JR85x100x63	1.080 2.381
	3.3465	3.9370	2.480	0.04		
90	90	100	26	1	JR90x100x26	0.300 0.661
	3.5433	3.9370	1.024	0.04		
	90	100	30	1	JR90x100x30	0.350 0.772
	3.5433	3.9370	1.181	0.04		
	90	100	36	1	JR90x100x36	0.422 0.930
	3.5433	3.9370	1.417	0.04		
	90	105	32	1.1	JR90x105x32	0.580 1.279
	3.5433	4.1339	1.260	0.04		
	90	105	35	1.1	JR90x105x35	0.624 1.376
	3.5433	4.1339	1.378	0.04		
	90	105	63	1.1	JR90x105x63	1.140 2.513
	3.5433	4.1339	2.480	0.04		
95	95	105	26	1	JR95x105x26	0.310 0.683
	3.7402	4.1339	1.024	0.04		

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## INNER RINGS — continued

### METRIC SERIES

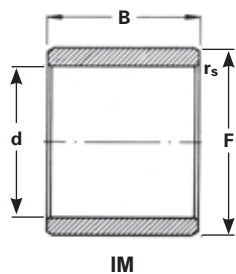


Shaft Diameter	Dimensions mm/in.				Inner Ring Designation	Wt. kg/lbs.
	mm	d	F	B		
95	95	105	36	1	JR95x105x36	0.430
	3.7402	4.1339	1.417	0.04		0.948
	95	110	35	1.1	JR95x110x35	0.653
	3.7402	4.3307	1.378	0.04		1.440
95	95	110	63	1.1	JR95x110x63	1.200
	3.7402	4.3307	2.480	0.04		2.646
	100	110	30	1.1	JR100x110x30	0.384
	3.9370	4.3307	1.181	0.04		0.847
100	100	110	40	1.1	JR100x110x40	0.510
	3.9370	4.3307	1.575	0.04		1.124
	100	115	40	1.1	JR100x115x40	0.790
	3.9370	4.5276	1.575	0.04		1.742
110	110	120	30	1	JR110x120x30	0.425
	4.3307	4.7244	1.181	0.04		0.937
	110	125	40	1.1	JR110x125x40	0.870
	4.3307	4.9213	1.575	0.04		1.918
120	120	130	30	1	JR120x130x30	0.460
	4.7244	5.1181	1.181	0.04		1.014
	120	135	45	1.1	JR120x135x45	1.060
	4.7244	5.3150	1.772	0.04		2.337
130	130	145	35	1.1	JR130x145x35	0.890
	5.1181	5.7087	1.378	0.04		1.962
	130	150	50	1.5	JR130x150x50	1.730
	5.1181	5.9055	1.969	0.06		3.814
140	140	155	35	1.1	JR140x155x35	0.955
	5.5118	6.1024	1.378	0.04		2.105
	140	160	50	1.5	JR140x160x50	1.860
	5.5118	6.2992	1.969	0.06		4.101
150	150	165	40	1.1	JR150x165x40	1.170
	5.9055	6.4961	1.575	0.04		2.579
160	160	175	40	1.1	JR160x175x40	1.240
	6.2992	6.8898	1.575	0.04		2.734
170	170	185	45	1.1	JR170x185x45	1.480
	6.6929	7.2835	1.772	0.04		3.263
180	180	195	45	1.1	JR180x195x45	1.560
	7.0866	7.6772	1.772	0.04		3.439

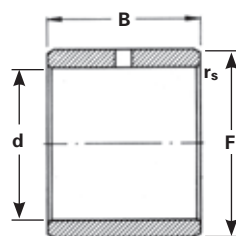


# INNER RINGS FOR FULL COMPLEMENT NEEDLE ROLLER BEARINGS

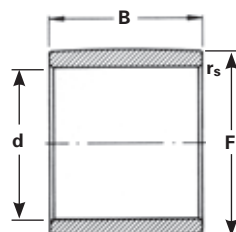
## METRIC SERIES



IM



IMC



IM...R6

Shaft Diameter	Dimensions mm/in. g5			Hole mm/in. <sup>(1)</sup>	rs min	Bearing Designation	Wt. kg/lbs.	
	mm	d	F	B				C <sub>3</sub>
8	8	12	12.4		0.3	IM 8 12 12.4	0.006	
	0.3150	0.4724	0.488		0.01		0.013	
9	9	13	12.4		0.3	IM 9 13 12.4	0.006	
	0.3543	0.5118	0.488		0.01		0.014	
10	9	13	12.4		0.3	IM 9 13 12.4 R6	0.006	
	0.3543	0.5118	0.488		0.01		0.014	
	10	14	12.4		0.3	IM 10 14 12.4	0.007	
	0.3937	0.5512	0.488		0.01		0.015	
11	10	14	16.4		0.3	IM 10 14 16.4	0.009	
	0.3937	0.5512	0.646		0.01		0.020	
	11	15	12.4		0.3	IM 11 15 12.4	0.008	
	0.4331	0.5906	0.488		0.01		0.018	
12	12	15	12.4		0.2	IM 12 15 12.4	0.006	
	0.4724	0.5906	0.488		0.01		0.013	
	12	16	12.4		0.2	IM 12 16 12.4	0.008	
	0.4724	0.6299	0.488		0.01		0.018	
13	12	16	12.4		0.3	IM 12 16 12.4 R6	0.008	
	0.4724	0.6299	0.488		0.01		0.018	
	12	16	12.4	6.2	0.3	IMC 12 16 12.4	0.008	
	0.4724	0.6297	0.488	0.24	0.01		0.018	
13	13	17	12.4		0.3	IM 13 17 12.4	0.009	
	0.5118	0.6693	0.488		0.01		0.019	
	13	18	12.4		0.35	IM 13 18 12.4	0.011	
	0.5118	0.7087	0.488		0.014		0.025	
15	13	18	12.4		0.35	IM 13 18 12.4 R6	0.011	
	0.5118	0.7087	0.488		0.014		0.025	
	13	18	16.4		0.35	IM 13 18 16.4	0.015	
	0.5118	0.7087	0.646		0.014		0.033	
15	15	20	12.4		0.35	IM 15 20 12.4	0.013	
	0.5906	0.7874	0.488		0.014		0.028	
	15	20	16.4		0.35	IM 15 20 16.4	0.017	
	0.5906	0.7874	0.646		0.014		0.037	
17	17	22	16.4		0.35	IM 17 22 16.4	0.019	
	0.6693	0.8661	0.646		0.014		0.041	
	17	22	16.4		0.35	IM 17 22 16.4 R6	0.019	
	0.6693	0.8661	0.646		0.014		0.041	
17	17	22	16.4	8.2	0.35	IMC 17 22 16.4	0.019	
	0.6693	0.8659	0.646	0.32	0.014		0.041	
	20	20	25	16.4		0.35	IM 20 25 16.4	0.022
		0.7874	0.9843	0.646		0.014		0.047
20		25	16.4		0.35	IM 20 25 16.4 R6	0.022	
0.7874		0.9843	0.646		0.014		0.047	
20	20	25	16.4	8.2	0.35	IMC 20 25 16.4	0.022	
	0.7874	0.9840	0.646	0.32	0.014		0.047	
	20	25	20.4		0.35	IM 20 25 20.4	0.027	
	0.7874	0.9843	0.803		0.014		0.060	
23	20	25	20.4	10.2	0.35	IMC 20 25 20.4	0.027	
	0.7874	0.9840	0.803	0.40	0.014		0.060	
	20	25	25.0		0.35	IM 20 25 25	0.033	
	0.7874	0.9843	0.984		0.014		0.073	
23	23	28	20.4		0.35	IM 23 28 20.4	0.031	
	0.9055	1.1024	0.803		0.014		0.067	
25	25	30	16.4		0.35	IM 25 30 16.4	0.027	
	0.9843	1.1811	0.646		0.014		0.058	
	25	30	16.4		0.35	IM 25 30 16.4 R6	0.027	
	0.9843	1.1811	0.646		0.014		0.058	

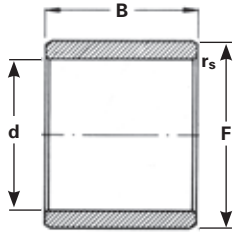
<sup>(1)</sup> single 2 mm dia. thru hole

Continued on next page.

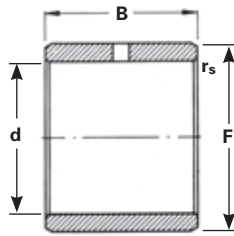


**INNER RINGS FOR FULL COMPLEMENT NEEDLE ROLLER BEARINGS — continued**

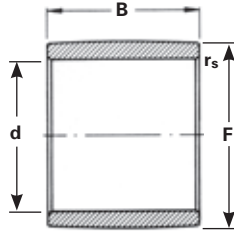
**METRIC SERIES**



**IM**



**IMC**



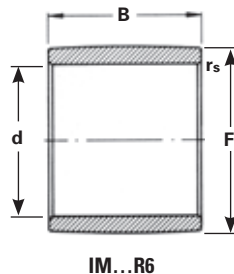
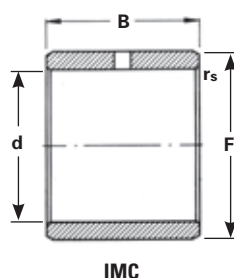
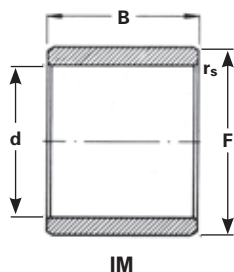
**IM...R6**

Shaft Diameter	Dimensions mm/in.			Hole mm/in. <sup>(1)</sup> Location	$r_s$ min	Bearing Designation	Wt. kg/lbs.	
	g5							
mm	d	F	B	C <sub>3</sub>				
25	25	30	16.4	8.2	0.35	IMC 25 30 16.4	0.027	
	0.9843	1.1808	0.646	0.32	0.014		0.058	
	25	30	20.4		0.35	IM 25 30 20.4	0.033	
	0.9843	1.1811	0.803		0.014		0.073	
25	25	30	20.4	10.2	0.35	IMC 25 30 20.4	0.033	
	0.9843	1.1808	0.803	0.40	0.014		0.073	
	25	30	25		0.35	IM 25 30 25	0.040	
	0.9843	1.1811	0.984		0.014		0.088	
30	30	35	16.4		0.35	IM 30 35 16.4	0.031	
	1.1811	1.3780	0.646		0.014		0.068	
	30	35	16.4		0.35	IM 30 35 16.4 R6	0.031	
	1.1811	1.3780	0.646		0.014		0.068	
	30	35	16.4	8.2	0.35	IMC 30 35 16.4	0.031	
	1.1811	1.3776	0.646	0.32	0.014		0.068	
	30	35	20.4		0.35	IM 30 35 20.4	0.039	
	1.1811	1.3780	0.803		0.014		0.086	
30	30	35	20.4		0.35	IM 30 35 20.4 R6	0.039	
	1.1811	1.3780	0.803		0.014		0.086	
	30	35	20.4	10.2	0.35	IMC 30 35 20.4	0.039	
	1.1811	1.3776	0.803	0.40	0.014		0.086	
	30	35	25.0		0.35	IM 30 35 25	0.048	
	1.1811	1.3780	0.984		0.014		0.106	
	35	35	40	16.4		0.35	IM 35 40 16.4	0.036
		1.3780	1.5748	0.646		0.014		0.079
35		40	16.4		0.35	IM 35 40 16.4 R6	0.036	
1.3780		1.5748	0.646		0.014		0.079	
35		40	20.4		0.35	IM 35 40 20.4	0.045	
1.3780		1.5748	0.803		0.014		0.099	
35		40	20.4		0.35	IM 35 40 20.4 R6	0.045	
1.3780		1.5748	0.803		0.014		0.099	
35	35	40	20.4	10.2	0.35	IMC 35 40 20.4	0.045	
	1.3780	1.5744	0.803	0.40	0.014		0.099	
	35	40	25		0.35	IM 35 40 25	0.055	
	1.3780	1.5748	0.984		0.014		0.121	
	40	40	44	16.4		0.3	IM 40 44 16.4	0.032
		1.5748	1.7323	0.646		0.01		0.071
		40	44	16.4		0.3	IM 40 44 16.4 R6	0.032
		1.5748	1.7323	0.646		0.01		0.071
40		44	16.4	8.2	0.3	IMC 40 44 16.4	0.032	
1.5748		1.7319	0.646	0.32	0.01		0.071	
40		45	20.4		0.35	IM 40 45 20.4	0.051	
1.5748		1.7717	0.803		0.014		0.112	
40	40	44	20.4	10.2	0.35	IMC 40 45 20.4	0.05	
	1.5748	1.7319	0.803	0.40	0.014		0.112	
	45	45	50	20.4		0.65	IM 45 50 20.4	0.056
		1.7717	1.9685	0.803		0.026		0.123
45		50	20.4		0.65	IM 45 50 20.4 R6	0.056	
1.7717		1.9685	0.803		0.026		0.123	
45	45	50	25		0.65	IM 45 50 25	0.069	
	1.7717	1.9685	0.984		0.026		0.152	
	45	60	25		0.65	IM 45 50 25 R6	0.069	
	1.7717	2.3622	0.984		0.026		0.152	
50	50	55	20.4		0.65	IM 50 55 20.4 R6	0.062	
	1.9685	2.1654	0.803		0.026		0.137	
	50	55	20.4		0.65	IM 50 55 20.4	0.062	
	1.9685	2.1654	0.803		0.026		0.137	

<sup>(1)</sup> single 2 mm dia. thru hole

## INNER RINGS FOR FULL COMPLEMENT NEEDLE ROLLER BEARINGS

### METRIC SERIES

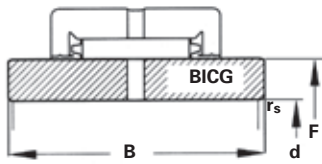
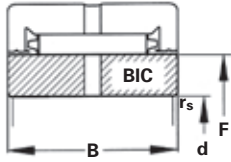


Shaft Diameter	Dimensions mm/in.				Bearing Designation	Wt. kg/lbs.
	mm	d	F	B		
17	17	20	27.5	0.2	IM 19017	0.019
	0.6693	0.7874	1.083	0.01		0.042
	17	20	32	0.2	IM 20617	0.021
20	0.6693	0.7874	1.240	0.01		0.046
	17	22	13	0.35	IM 4903 <sup>(1)</sup>	0.015
	0.6693	0.8665	0.512	0.014		0.033
20	20	25	27.5	0.35	IM 19020	0.038
	0.7874	0.9843	1.083	0.014		0.084
	20	25	32	0.35	IM 20620	0.044
25	0.7874	0.9843	1.240	0.014		0.097
	25	30	27.5	0.35	IM 19025	0.042
	0.9843	1.1811	1.083	0.014		0.093
25	25	30	32	0.35	IM 20625	0.052
	0.9843	1.1811	1.240	0.014		0.115
	30	35	17	0.35	IM 4906 <sup>(1)</sup>	0.033
30	1.1811	1.3785	0.669	0.014		0.072
	30	35	27.5	0.35	IM 19030	0.053
	1.1811	1.3780	1.083	0.014		0.117
30	30	35	32	0.35	IM 20630	0.061
	1.1811	1.3780	1.240	0.014		0.134
	35	40	27.5	0.35	IM 19035	0.063
35	1.3780	1.5748	1.083	0.014		0.139
	35	40	32	0.35	IM 20635	0.072
	1.3780	1.5748	1.240	0.014		0.159
40	40	45	27.5	0.35	IM 19040	0.069
	1.5748	1.7717	1.083	0.014		0.152
	40	45	32	0.35	IM 20640	0.080
45	1.5748	1.7717	1.240	0.014		0.176
	45	50	30.5	0.65	IM 19045	0.085
	1.7717	1.9685	1.201	0.026		0.187
45	45	50	35	0.65	IM 20645	0.096
	1.7717	1.9685	1.358	0.026		0.212
	45	52	22	0.85	IM 4909 <sup>(1)</sup>	0.087
	1.7717	2.0476	0.866	0.033		0.192

<sup>(1)</sup> Call for O.D. tolerance



EXTRA WIDE INNER RINGS  
METRIC SERIES

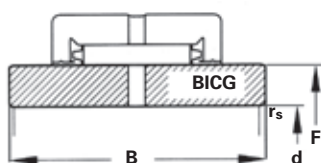
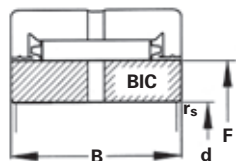


Shaft Diameter	Dimensions mm/in.				Bearing Designation	Wt. kg/lbs.
	mm	d	F	B		
12	12	12	17.6	15	BIC 1012	0.016
	0.4724	0.4724	0.6929	0.591		0.035
	12	12	17.6	20	BIP 1012	0.020
	0.4724	0.4724	0.6929	0.787		0.044
15	15	15	20.8	15	BIC 1015	0.018
	0.5906	0.5906	0.8189	0.591		0.040
	15	15	22.1	22	BIC 2015	0.035
	0.5906	0.5906	0.8701	0.866		0.077
17	17	17	23.9	15	BIC 1017	0.026
	0.6693	0.6693	0.9409	0.591		0.057
20	20	20	28.7	18	BIC 1020	0.046
	0.7874	0.7874	1.1299	0.709		0.101
	20	20	28.7	22	BIC 2020	0.056
	0.7874	0.7874	1.1299	0.866		0.123
	20	20	28.7	22	BIP 1020	0.056
	0.7874	0.7874	1.1299	0.866		0.123
25	25	25	33.5	18	BIC 1025	0.054
	0.9843	0.9843	1.3189	0.709		0.119
	25	25	33.5	22	BIC 2025	0.065
	0.9843	0.9843	1.3189	0.866		0.143
	25	25	33.5	30	BIC 22025	0.500
	0.9843	0.9843	1.3189	1.181		1.102
	25	25	33.5	32	BIG 2025	0.095
	0.9843	0.9843	1.3189	1.260		0.209
	25	25	33.5	42	BIK 2025	0.125
	0.9843	0.9843	1.3189	1.654		0.276
30	30	30	38.2	18	BIC 1030	0.060
	1.1811	1.1811	1.5039	0.709		0.132
	30	30	38.2	22	BIC 2030	0.074
	1.1811	1.1811	1.5039	0.866		0.163
	30	30	44.0	30	BIC 3030	0.188
	1.1811	1.1811	1.7323	1.181		0.414
	30	30	38.2	32	BIG 2030	0.108
	1.1811	1.1811	1.5039	1.260		0.238
	30	30	44.0	40	BIG 3030	0.247
	1.1811	1.1811	1.7323	1.575		0.545
35	35	35	44.0	18	BIC 1035	0.077
	1.3780	1.3780	1.7323	0.709		0.170
	35	35	44.0	22	BIC 2035	0.093
	1.3780	1.3780	1.7323	0.866		0.205
	35	35	44.0	32	BIG 2035	0.135
	1.3780	1.3780	1.7323	1.260		0.298
40	40	40	49.7	18	BIC 1040	0.094
	1.5748	1.5748	1.9567	0.709		0.207
	40	40	49.7	22	BIC 2040	0.115
	1.5748	1.5748	1.9567	0.866		0.254
	40	40	55.4	36	BIC 3040	0.321
	1.5748	1.5748	2.1811	1.417		0.708
	40	40	49.7	32	BiG 2040	0.170
	1.5748	1.5748	1.9567	1.260		0.375
	40	40	49.7	22	BIP 1040	0.115
	1.5748	1.5748	1.9567	0.866		0.254
45	45	45	55.4	18	BIC 1045	0.113
	1.7717	1.7717	2.1811	0.709		0.249

Continued on next page.

EXTRA WIDE INNER RINGS — *continued*

METRIC SERIES



Shaft Diameter	Dimensions mm/in.				Bearing Designation	Wt. kg/lbs.
	mm	d	F	B		
45	45	45	55.4	22	BIC 2045	0.139
	1.7717	1.7717	2.1811	0.866		0.306
	45	45	62.1	38	BIC 3045	0.422
	1.7717	1.7717	2.4449	1.496		0.930
	45	45	55.4	32	BIG 2045	0.210
	1.7717	1.7717	2.1811	1.260		0.463
50	50	50	62.1	20	BIC 1050	0.163
	1.9685	1.9685	2.4449	0.787		0.359
	50	50	62.1	24	BIC 11050	0.196
	1.9685	1.9685	2.4449	0.945		0.432
	50	50	62.1	28	BIC 2050	0.228
	1.9685	1.9685	2.4449	1.102		0.503
	50	50	68.8	38	BIC 3050	0.515
	1.9685	1.9685	2.7087	1.496		1.135
	50	50	62.1	38	BIG 2050	0.312
	1.9685	1.9685	2.4449	1.496		0.688
	50	50	62.1	28	BIP 1050	0.228
	1.9685	1.9685	2.4449	1.102		0.503
55	55	55	68.8	20	BIC 1055	0.205
	2.1654	2.1654	2.7087	0.787		0.452
	55	55	72.6	38	BIC 3055	0.525
	2.1654	2.1654	2.8583	1.496		1.157
	55	55	72.6	48	BICG 3055	0.660
	2.1654	2.1654	2.8583	1.890		1.455
	55	55	68.8	38	BIG 2055	0.390
	2.1654	2.1654	2.7087	1.496		0.860
	55	55	68.8	28	BIP 1055	0.288
	2.1654	2.1654	2.7087	1.102		0.635
60	60	60	72.6	28	BIC 2060	0.282
	2.3622	2.3622	2.8583	1.102		0.622
	60	60	78.3	38	BIC 3060	0.583
	2.3622	2.3622	3.0827	1.496		1.285
	60	60	72.6	38	BICG 2060	0.385
	2.3622	2.3622	2.8583	1.496		0.849
	60	60	72.6	38	BIG 2060	0.385
	2.3622	2.3622	2.8583	1.496		0.849
65	65	65	83.1	38	BIC 3065	0.623
	2.5591	2.5591	3.2717	1.496		1.373
	65	65	78.3	38	BIG 2065	0.437
	2.5591	2.5591	3.0827	1.496		0.963
70	70	70	88.0	38	BIC 3070	0.662
	2.7559	2.7559	3.4646	1.496		1.459
	70	70	88.0	48	BIG 3070	0.820
	2.7559	2.7559	3.4646	1.890		1.808
	70	70	88.0	58	BIK 3070	1.010
	2.7559	2.7559	3.4646	2.283		2.227
75	75	75	88.0	32	BIC 2075	0.410
	2.9528	2.9528	3.4646	1.260		0.904
	75	75	88.0	42	BIG 2075	0.538
	2.9528	2.9528	3.4646	1.654		1.186
	75	75	96.0	58	BIK 3075	1.260
	2.9528	2.9528	3.7795	2.283		2.778
80	80	80	96.0	24	BIC 1080	0.410
	3.1496	3.1496	3.7795	0.945		0.904

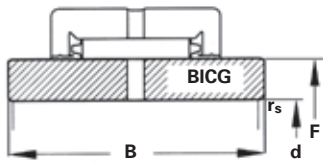
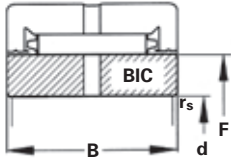
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# NEEDLE ROLLER BEARINGS

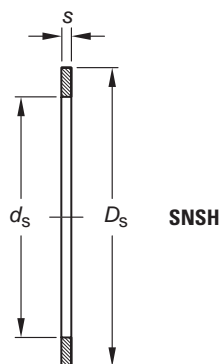
## EXTRA WIDE INNER RINGS — *continued*

### METRIC SERIES



Shaft Diameter	Dimensions mm/in.				Bearing Designation	Wt. kg/lbs.
	mm	d	F	B		
80	80	96.0	32	2	BIC 2080	0.545 1.202
	3.1496	3.7795	1.260	0.08		
	80	99.5	38	2		
80	3.1496	3.9173	1.496	0.08	BIC 3080	0.805 1.775
	80	96.0	42	2		
	3.1496	3.7795	1.654	0.08		
90	90	104.7	32	2	BIG 2080	0.714 1.574
	3.5433	4.1220	1.260	0.08		
	90	109.1	43	2		
90	3.5433	4.2953	1.693	0.08	BIC 2090	0.531 1.171
	90	109.1	53	2		
	3.5433	4.2953	2.087	0.08		
90	90	109.1	63	2	BIC 3090	0.990 2.183
	3.5433	4.2953	2.480	0.08		
	90	109.1	32	2		
95	3.7402	4.2953	1.260	0.08	BIG 3090	1.220 2.690
	95	114.7	43	2		
	3.7402	4.5157	1.693	0.08		
95	95	114.7	63	2	BIK 3090	1.480 3.263
	3.7402	4.5157	2.480	0.08		
	95	109.1	32	2		
100	3.9370	4.6929	1.693	0.08	BIC 2095	0.548 1.208
	100	119.2	43	2		
	3.9370	4.6929	1.693	0.08		
100	100	114.7	42	2	BIC 3095	1.075 2.370
	3.9370	4.5157	1.654	0.08		
	100	114.7	63	2		
105	4.1339	4.9094	2.165	0.08	BIK 3095	1.585 3.494
	105	119.2	32	2		
	4.1339	4.9094	2.165	0.08		
110	4.3307	4.9094	1.339	0.08	BIC 2105	0.615 1.356
	110	124.7	34	2		
	4.3307	4.9094	1.339	0.08		
110	4.3307	124.7	44	2	BIG 2105	1.505 3.318
	110	124.7	44	2		
	4.3307	4.9094	1.732	0.08		
125	4.9213	5.6102	1.732	0.08	BIC 2110	0.705 1.554
	125	142.5	44	2		
	4.9213	5.6102	1.732	0.08		
125	4.9213	142.5	44	2	BIG 2110	0.920 2.028
	125	142.5	44	2		
	4.9213	5.6102	1.732	0.08		
130	5.1181	6.2205	2.047	0.08	BIC 2125	1.340 2.954
	130	158.0	52	2		
					BIC 3130	2.530 5.578

**END WASHERS**  
**METRIC SERIES**



Dimensions mm/in.			End Washer Designation	Wt. kg/lbs.
$d_s$	$D_s$	S		
8.0 0.315	18 0.709	2.0 0.079	SNSH8X18X2	0.001 0.002
8.5 0.335	15 0.591	0.5 0.020	SNSH8.5X15X0.5	0.001 0.002
10.5 0.413	17 0.669	0.5 0.020	SNSH10.5X17X0.5	0.001 0.001
10.5 0.413	20 0.787	0.5 0.020	SNSH10.5X20X0.5	0.001 0.002
12.5 0.492	19 0.748	0.5 0.020	SNSH12.5X19X0.5	0.001 0.001
12.5 0.492	22 0.866	0.5 0.020	SNSH12.5X22X0.5	0.001 0.002
14.5 0.571	22 0.866	0.5 0.020	SNSH14.5X22X0.5	0.001 0.002
14.5 0.571	26 1.024	0.5 0.020	SNSH14.5X26X0.5	0.001 0.003
15.5 0.610	23 0.906	0.5 0.020	SNSH15.5X23X0.5	0.001 0.002
16.5 0.650	24 0.945	0.5 0.020	SNSH16.5X24X0.5	0.001 0.002
16.5 0.650	28 1.102	0.5 0.020	SNSH16.5X28X0.5	0.002 0.004
17.5 0.689	25 0.984	0.5 0.020	SNSH17.5X25X0.5	0.001 0.002
18.5 0.728	26 1.024	0.5 0.020	SNSH18.5X26X0.5	0.001 0.002
18.5 0.728	30 1.181	0.5 0.020	SNSH18.5X30X0.5	0.002 0.004
20.5 0.807	28 1.102	0.5 0.020	SNSH20.5X28X0.5	0.001 0.002
20.5 0.807	32 1.260	0.5 0.020	SNSH20.5X32X0.5	0.002 0.004

Dimensions mm/in.			End Washer Designation	Wt. kg/lbs.
$d_s$	$D_s$	S		
22.5 0.886	30 1.181	0.5 0.020	SNSH22.5X30X0.5	0.001 0.003
22.5 0.886	35 1.378	0.5 0.020	SNSH22.5X35X0.5	0.002 0.005
25.5 1.004	35 1.378	0.5 0.020	SNSH25.5X35X0.5	0.002 0.004
25.5 1.004	37 1.457	0.5 0.020	SNSH25.5X37X0.5	0.002 0.005
28.5 1.122	40 1.575	0.5 0.020	SNSH28.5X40X0.5	0.002 0.005
30.5 1.201	40 1.575	0.5 0.020	SNSH30.5X40X0.5	0.002 0.005
35.5 1.398	47 1.850	0.5 0.020	SNSH35.5X47X0.5	0.003 0.006
40.5 1.594	50 1.969	0.5 0.020	SNSH40.5X50X0.5	0.003 0.006
41.0 1.614	55 2.165	1.0 0.039	SNSH41X55X1	0.008 0.018
45.5 1.791	55 2.165	0.5 0.020	SNSH45.5X55X0.5	0.003 0.007
46.0 1.811	62 2.441	1.0 0.039	SNSH46X62X1	0.011 0.024
51.0 2.008	65 2.559	1.0 0.039	SNSH51X65X1	0.010 0.022
56.0 2.205	72 2.835	1.0 0.039	SNSH56X72X1	0.013 0.029
61.0 2.402	78 3.071	1.0 0.039	SNSH61X78X1	0.015 0.033
66.0 2.598	85 3.346	1.0 0.039	SNSH66X85X1	0.018 0.040



# NEEDLE ROLLER BEARINGS



## NOTES

