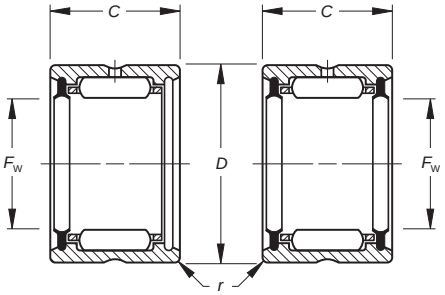
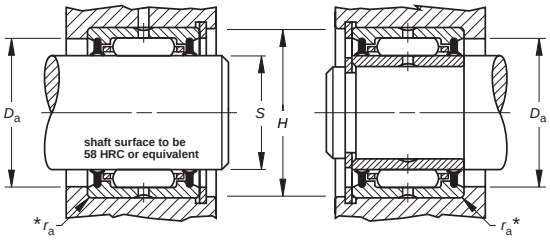




Bearing

Bearing with Inner Ring

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

*$r_{as\ max}$ is equal to the minimum bearing chamfer ($r_{s\ min}$) at unmarked end.

INNER RINGS

INCH SERIES

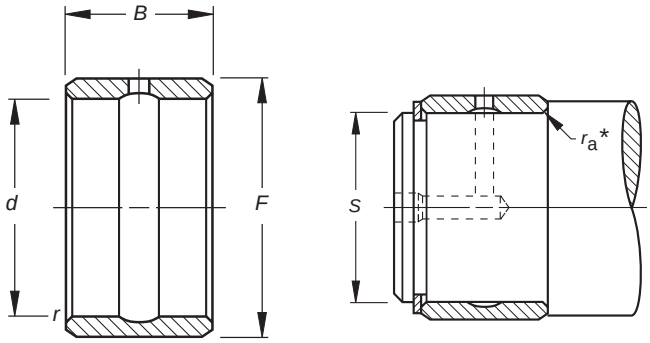
- Check for availabilty.
- Ideal choice where shaft not practical to use as inner raceway.
- Provided in inch nominal dimensions for use with inch series heavy-duty needle roller bearings.
- Designed to meet established inch tolerances.
- Selected size should be wider than matching drawn cup bearing.
- 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.

C

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
							Max.	Min.		Max.	Min.	
in.	d	F	B	$r_{s\ min}$			S			S		
3/8	9.525 0.3750	15.875 0.6250	19.05 0.750	0.64 0.025	IR-061012	0.018 0.040	9.520 0.3748	9.510 0.3744	IR-061012	9.538 0.3755	9.530 0.3752	HJ-101812
1/2	12.700 0.5000	19.050 0.7500	19.05 0.750	1.02 0.04	IR-081212	0.023 0.050	12.692 0.4997	12.682 0.4993	IR-081212	12.715 0.5006	12.708 0.5003	HJ-122012
	12.700 0.5000	19.050 0.7500	25.40 1.000	1.02 0.04	IR-081216	0.032 0.070	12.692 0.4997	12.682 0.4993	IR-081216	12.715 0.5006	12.708 0.5003	HJ-122016
5/8	15.875 0.6250	22.225 0.8750	19.05 0.750	1.02 0.04	IR-101412	0.027 0.060	15.867 0.6247	15.857 0.6243	IR-101412	15.890 0.6256	15.883 0.6253	HJ-142212
	15.875 0.6250	22.225 0.8750	25.40 1.000	1.02 0.04	IR-101416	0.036 0.080	15.867 0.6247	15.857 0.6243	IR-101416	15.890 0.6256	15.883 0.6253	HJ-142216
11/16	17.463 0.6875	22.225 0.8750	19.05 0.750	1.02 0.04	IR-111412	0.023 0.050	17.455 0.6872	17.445 0.6868	IR-111412	17.478 0.6881	17.470 0.6878	HJ-142212
3/4	19.050 0.7500	25.400 1.0000	19.05 0.750	1.02 0.04	IR-121612	0.032 0.070	19.042 0.7497	19.030 0.7492	IR-121612	19.068 0.7507	19.058 0.7503	HJ-162412
	19.050 0.7500	25.400 1.0000	25.40 1.000	1.02 0.04	IR-121616	0.041 0.090	19.042 0.7497	19.030 0.7492	IR-121616	19.068 0.7507	19.058 0.7503	HJ-162416
13/16	20.638 0.8125	25.400 1.0000	25.40 1.000	1.02 0.04	IR-131616	0.032 0.070	20.630 0.8122	20.617 0.8117	IR-131616	20.655 0.8132	20.645 0.8128	HJ-162416
7/8	22.225 0.8750	28.575 1.1250	25.40 1.000	1.02 0.04	IR-141816	0.050 0.110	22.217 0.8747	22.205 0.8742	IR-141816	22.243 0.8757	22.233 0.8753	HJ-182616
	22.225 0.8750	28.575 1.1250	31.75 1.250	1.02 0.04	IR-141820	0.059 0.130	22.217 0.8747	22.205 0.8742	IR-141820	22.243 0.8757	22.233 0.8753	HJ-182620
15/16	23.813 0.9375	28.575 1.1250	25.40 1.000	1.02 0.04	IR-151816	0.036 0.080	23.805 0.9372	23.792 0.9367	IR-151816	23.830 0.9382	23.820 0.9378	HJ-182616
	23.813 0.9375	28.575 1.1250	31.75 1.250	1.02 0.04	IR-151820	0.045 0.100	23.805 0.9372	23.792 0.9367	IR-151820	23.830 0.9382	23.820 0.9378	HJ-182620
1	25.400 1.0000	31.750 1.2500	25.40 1.000	1.02 0.04	IR-162016	0.054 0.120	25.392 0.9997	25.380 0.9992	IR-162016	25.418 1.0007	25.408 1.0003	HJ-202816
	25.400 1.0000	31.750 1.2500	31.75 1.250	1.02 0.04	IR-162020	0.068 0.150	25.392 0.9997	25.380 0.9992	IR-162020	25.418 1.0007	25.408 1.0003	HJ-202820
1 1/8	28.575 1.1250	34.925 1.3750	25.40 1.000	1.02 0.04	IR-182216	0.059 0.130	28.567 1.1247	28.555 1.1242	IR-182216	28.593 1.1257	28.583 1.1253	HJ-223016
	28.575 1.1250	34.925 1.3750	31.75 1.250	1.02 0.04	IR-182220	0.077 0.170	28.567 1.1247	28.555 1.1242	IR-182220	28.593 1.1257	28.583 1.1253	HJ-223020
1 1/16	30.163 1.1875	38.100 1.5000	31.75 1.250	1.52 0.06	IR-192420	0.100 0.220	30.155 1.1872	30.142 1.1867	IR-192420	30.180 1.1882	30.170 1.1878	HJ-243320
1 1/4	31.750 1.2500	38.100 1.5000	25.40 1.000	1.52 0.06	IR-202416	0.068 0.150	31.740 1.2496	31.725 1.2490	IR-202416	31.770 1.2508	31.760 1.2504	HJ-243316
	31.750 1.2500	38.100 1.5000	31.75 1.250	1.52 0.06	IR-202420	0.082 0.180	31.740 1.2496	31.725 1.2490	IR-202420	31.770 1.2508	31.760 1.2504	HJ-243320
1 5/16	33.338 1.3125	41.275 1.6250	25.40 1.000	1.52 0.06	IR-212616	0.086 0.190	33.327 1.3121	33.312 1.3115	IR-212616	33.358 1.3133	33.348 1.3129	HJ-263516

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

Continued on next page.

INNER RINGS – *continued*

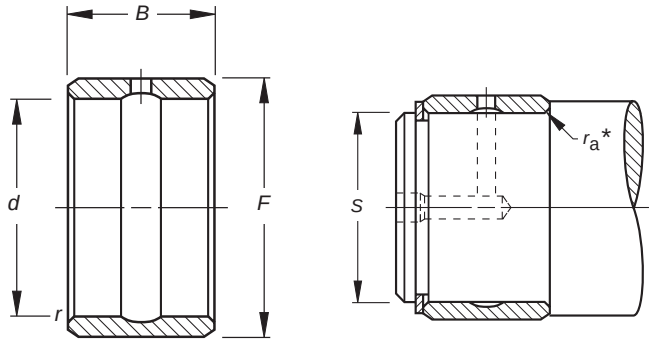
INCH SERIES

- Check for availabilty.
- 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
							Max.	Min.		Max.	Min.	
in.	d	F	B	$r_{s\ min}$			S			S		
	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

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
							Max.	Min.		Max.	Min.	
in.	d	F	B	$r_{s\ min}$			S			S		
	114.300 4.5000	139.700 5.5000	76.20 3.000	2.54 0.1	IR-728848	2.989 6.590	114.287 4.4995	114.267 4.4987	IR-728848	114.328 4.5011	114.313 4.5005	HJ-8811248
4 3/4	120.650 4.7500	146.050 5.7500	76.20 3.000	3.05 0.12	IR-769248	3.180 7.010	120.635 4.7494	120.612 4.7485	IR-769248	120.683 4.7513	120.665 4.7506	HJ-9211648
5	127.000 5.0000	152.400 6.0000	63.50 2.500	3.05 0.12	IR-809640	2.781 6.130	126.985 4.9994	126.962 4.9985	IR-809640	127.033 5.0013	127.015 5.0006	HJ-9612040
	127.000 5.0000	152.400 6.0000	76.20 3.000	3.05 0.12	IR-809648	3.325 7.330	126.985 4.9994	126.962 4.9985	IR-809648	127.033 5.0013	127.015 5.0006	HJ-9612048
5 1/2	139.700 5.5000	165.100 6.5000	63.50 2.500	3.05 0.12	IR-8810440	3.035 6.690	139.685 5.4994	139.662 5.4985	IR-8810440	139.733 5.5013	139.715 5.5006	HJ-10412840
	139.700 5.5000	165.100 6.5000	76.20 3.000	3.05 0.12	IR-8810448	3.629 8.000	139.685 5.4994	139.662 5.4985	IR-8810448	139.733 5.5013	139.715 5.5006	HJ-10412848
6	152.400 6.0000	184.150 7.2500	76.20 3.000	3.05 0.12	IR-9611648	4.935 10.880	152.385 5.9994	152.362 5.9985	IR-9611648	152.433 6.0013	152.415 6.0006	HJ-11614648
6 1/2	165.100 6.5000	196.850 7.7500	76.20 3.000	3.05 0.12	IR-10412448	5.343 11.780	165.085 6.4994	165.062 6.4985	IR-10412448	165.133 6.5013	165.115 6.5006	HJ-12415448
7	177.800 7.0000	209.550 8.2500	76.20 3.000	3.05 0.12	IR-11213248	5.389 11.880	177.785 6.9994	177.762 6.9985	IR-11213248	177.833 7.0013	177.815 7.0006	HJ-13216248
7 1/2	190.500 7.5000	222.250 8.7500	76.20 3.000	4.06 0.16	IR-12014048	6.110 13.470	190.485 7.4994	190.454 7.4982	IR-12014048	190.536 7.5014	190.515 7.5006	HJ-14017048
8	203.200 8.0000	234.950 9.2500	76.20 3.000	4.06 0.16	IR-12814848	6.518 14.370	203.185 7.9994	203.154 7.9982	IR-12814848	203.236 8.0014	203.215 8.0006	HJ-14817848

NOTES

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.

C

Yoke Type Track Rollers – Metric Nominal Dimensions

Bore diameter from 10 mm to 17 mm (for NA22)
00 = 10 mm **02** = 15 mm
01 = 12 mm **03** = 17 mm

Bore diameter > 17 mm (for NA22)
05 = 25 mm

NA22 **05** **2RS**

Prefix
- **NA22** track roller, yoke type, profiled outside diameter with inner ring, sealed
- **RNA22** track roller, yoke type, profiled outside diameter without inner ring, sealed
- **RSTO** track roller, yoke type, profiled outside diameter without inner ring, without washers
- **STO** track roller, yoke type, profiled outside diameter with inner ring, without washers
- **NATR** track roller, yoke type, profiled outside diameter with inner ring, with washers
- **NUTR** track roller, yoke type, profiled outside diameter with inner ring, with washers; two paths of full complement cylindrical rollers

Suffix
- **TN** molded cage of reinforced, engineered polymer
- **DZ** cylindrical outside diameter
- **ZZ** two washers for track rollers used for axial location
- **.2RS** lip contact seal on each side of the bearing
- **ZZ.DZ** two washers for track rollers used for axial location; cylindrical outside diameter
- **DZ.TN** cylindrical outside diameter; molded cage of reinforced, engineered polymer
- **.2RS.DZ** lip contact seal on each side of bearing; cylindrical outside diameter

STO **25** **DZ**

Bore diameter for STO, NATR, NUTR:
25 = 25 mm
45 = 45 mm

NUTR **45** **100** **DZ**

Outside diameter for NUTR
100 = 100 mm

Stud Type Track Rollers – Metric Nominal Dimensions

Prefix Modification
E Eccentric stud

Suffix
- **SK** hexagonal wrench socket in stud head
- **DZ.2RS** cylindrical outside diameter: lip contact seals on each end of bearing
- **.2RS** lip contact seal on each side of the bearing
- **DZ** cylindrical outside diameter

KR **E** **22** **.2RS**

Prefix
- **KR** track roller, stud type with cage; profiled outside diameter
- **KRV** track roller, stud type, full complement needle rollers; profiled outside diameter
- **NUKR** track roller, stud type, full complement of cylindrical rollers (2 rows) profiled outside diameter

Outside diameter
22 = 22 mm

Track Rollers / Cam Followers – Inch Nominal Dimensions

Prefix
- **CR** stud type
- **YCR** yoke type

Outside Diameter
8 = $^{8}/_{16}$ = $^{1}/_{2}$ in. **32** = $^{32}/_{16}$ = 2 in.
16 = $^{16}/_{16}$ = 1 in. **36** = $^{36}/_{16}$ = 2$^{1}/_{4}$ in.

CR **S** **B** **E** - **16**

Design Modifications
- **S** seals with internal thrust washers (CR Type only)
- **B** hex wrench socket
- **C** crowned O.D.
- **E** eccentric stud (CR Type only)

Full Complement Yoke Type Track Rollers - Metric Nominal Dimensions

Prefix
NUTR track roller, yoke type, profiled outside diameter with inner ring and washers (two paths of cylindrical rollers)
FG track roller, yoke type, profiled outside diameter standard series
FGU track roller, yoke type, profiled outside diameter light series
FGU track roller, yoke type, profiled outside diameter heavy series (larger O.D. than light series of same bore size)
FP track roller, yoke type, profiled outside diameter small series
RNA track roller, yoke type, profiled outside diameter 11000 Series (without seals)

(see tables for dimensions)

RNA 110 12 B6

NUTR 45 100 .DZ

Suffix
.DZ cylindrical outside diameter (NUTR styles only)
EE 2 polymer shields (FG styles only)
EEM 2 metal shields (FG styles only)
MM 2 metal shields (FGU styles only)

Bore diameter
45 = 45 mm

Outside diameter
100 = 100 mm

FG L 6 19 EEM

Prefix Modification
L cylindrical outside diameter

Full Complement Stud Type Track Rollers - Metric Nominal Dimensions

Prefix
NUKR track roller, stud type, profiled outside diameter (two paths of cylindrical rollers)
KRV track roller, stud type, profiled outside diameter with full complement of needle rollers
GC track roller, stud type, profiled outside diameter small series (up to 15 mm O.D.), standard series
GCU track roller, stud type, profiled outside diameter light series

Outside diameter
16 = 16 mm

KRV 16 .DZ

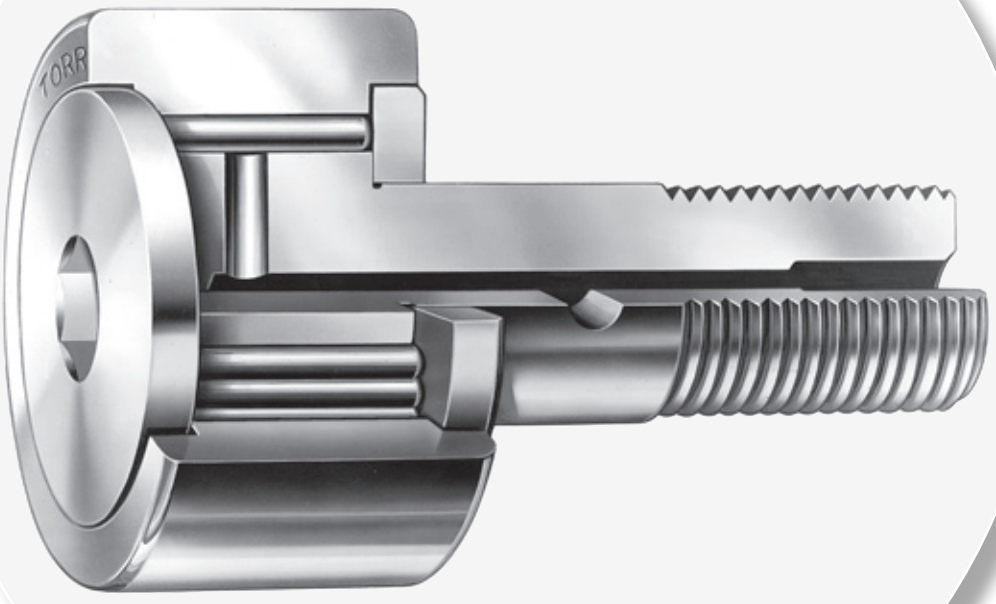
NUKR 62 .2SK

GC L 6 19 EEM

Prefix Modification
L cylindrical outside diameter
R eccentric collar

Bore diameter
45 = 45 mm

Suffix
.DZ cylindrical outside diameter (KRV styles only)
.2SK hexagonal socket in stud head (NUKR styles only)
EE 2 polymer shields (GC, GCR styles only)
EEM 2 metal shields (GC, GCR styles only)
MM 2 metal shields (GCU, GCUR styles only)


TORR

Stud Type and Yoke Type Track Rollers

C

STUD TYPE AND YOKE TYPE TRACK ROLLERS –
METRIC SERIES

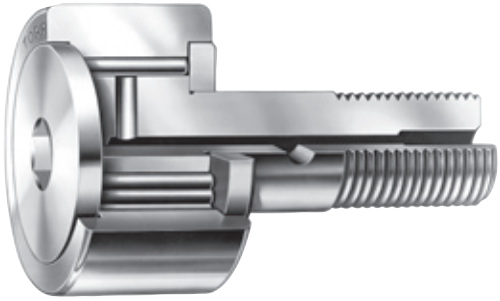
Timken track rollers listed in this catalog have been designed with outer rings of a large radial cross section to withstand heavy rolling and shock loads on track type or cam-controlled equipment. The outside diameters of the outer rings are either profiled or cylindrical. Profiled track rollers are 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)

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

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

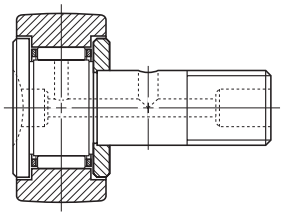
DZ.TN	cylindrical outside diameter • molded cage of reinforced engineered polymer
TN	molded cage of reinforced engineered polymer
DZ	cylindrical outside diameter
ZZ	two end washers for the outer ring
ZZ.DZ	two end washers for the outer ring • cylindrical outside diameter
.2RS	two seals
.2RS.DZ	two seals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

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

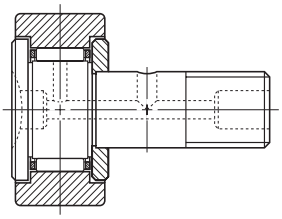
EE	polymer seals
EEM	metal shields
MM	metal shields

STUD TYPE METRIC SERIES TRACK ROLLER TYPES

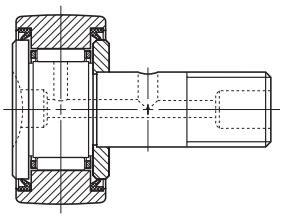
STUD TYPE TRACK ROLLERS, CAGED NEEDLE ROLLERS



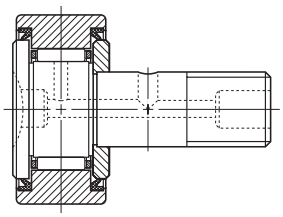
KR



KR.DZ

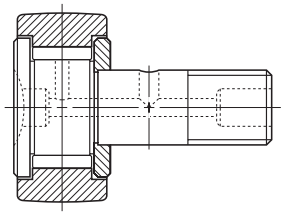


KR.2RS

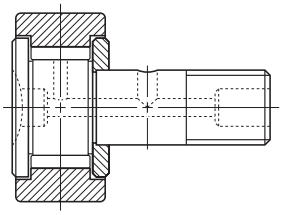


KR.DZ.2RS

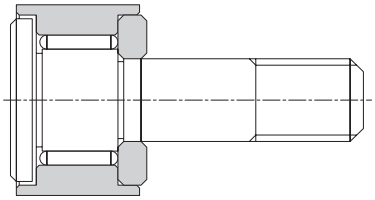
STUD TYPE TRACK ROLLERS, FULL COMPLEMENT NEEDLE ROLLERS



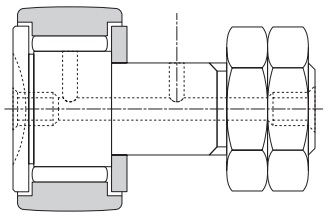
KRV



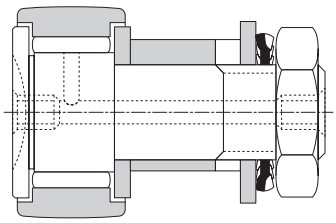
KRV.DZ



GC/GCL

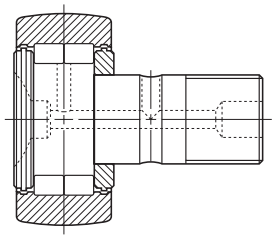


GC/GCL

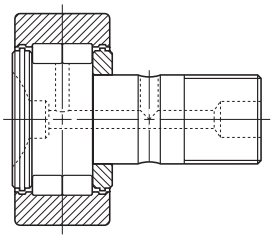


GCR/GCRL

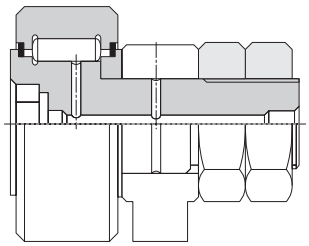
STUD TYPE TRACK ROLLERS, FULL COMPLEMENT CYLINDRICAL ROLLERS



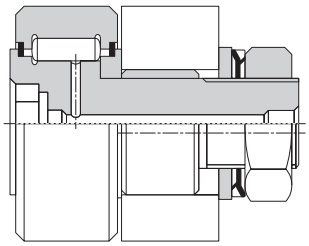
NUKR



NUKR.DZ



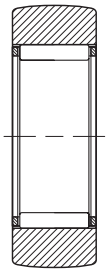
GCU/GCUL

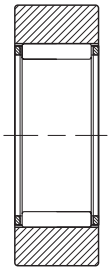


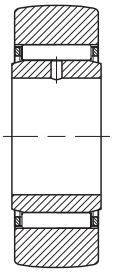
GCUR/GCURL

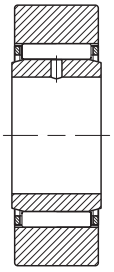
TYPES OF METRIC SERIES YOKE TYPE TRACK ROLLERS

YOKE TYPE TRACK ROLLERS WITHOUT END WASHERS

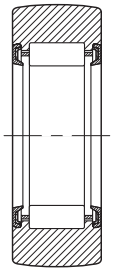

RSTO

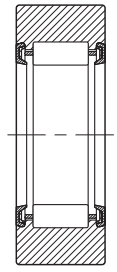

RSTO.DZ

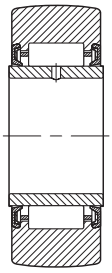

STO

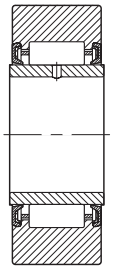

STO.DZ

SEALED YOKE TYPE TRACK ROLLERS WITHOUT END WASHERS.

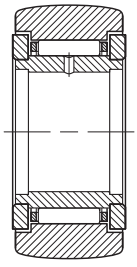

RNA22.2RS

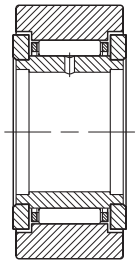

RNA22.2RS.DZ

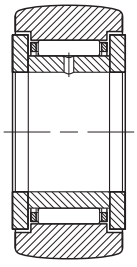

NA22.2RS

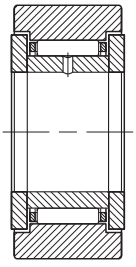

NA22.2RS.DZ

YOKE TYPE TRACK ROLLERS WITH END WASHERS

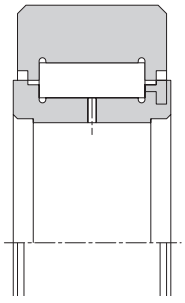

NATR

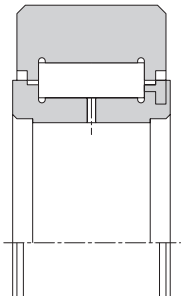

NATR.DZ


STO.ZZ

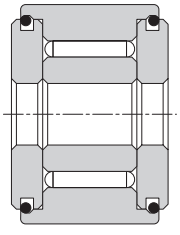

STO.ZZ.DZ

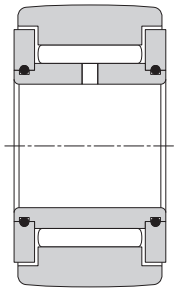
YOKE TYPE TRACK ROLLERS WITH FULL COMPLEMENT OF CYLINDRICAL ROLLERS


FGU/FGUL Light


FGU/FGUL Heavy

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


FP/FPL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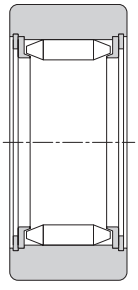
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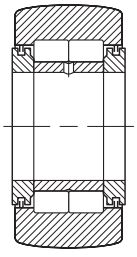
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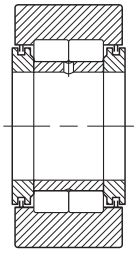
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CONSTRUCTION

STUD TYPE TRACK ROLLERS

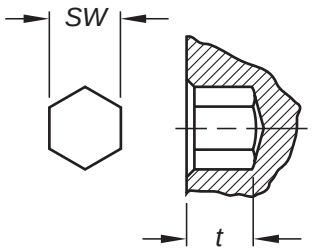
The metric series stud type track roller is a non-separable unit, consisting of a large radial cross-section outer ring, needle roller and cage radial assembly or a full complement of needle or cylindrical rollers, a stud and a retaining washer securely fastened to the stud.

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
	16	3	2.5
19	26	4	2.5
30	35	6	4
40	52	8	5
62	72	12	7
80	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.

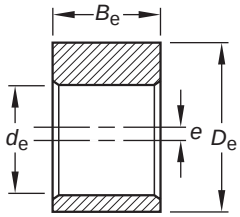


TABLE 2 –
ECCENTRIC BUSHING DIMENSIONS –
METRIC SERIES (EXCEPT GCR, GCUR SERIES)

Stud Type Outside >	Track Roller Diameter mm ≤	Dimensions			
		d_e	D_e	B_e	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.	de	De	Bw	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 desings 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.

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 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.

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

Stud Diameter mm		μm		Stud Length mm		
>	≤	high	low		high	low
d_1		Δd_{1S}		B_2	ΔB_2	
3	6	0	-12			
6	10	0	-15	all		
10	18	0	-18	lengths	0	-1
18	30	0	-21			
30	50	0	-25			
50	80	0	-30			
80	100	0	-35			

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_a 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	high	low	high	low	max.
D		Δ_{Dmp}				Δ_{Cs}		K_{ea}
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
d		Δ_{dmp}		Δ_{Bs}	
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 ($F_{r\ perm}$) 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, $F_{r\ perm}$ 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 $F_{0r\ perm}$ that may be applied to a stud type or yoke type metric series track roller. The values of $F_{0r\ perm}$ 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 $F_{0r\ perm}$ values must not be exceeded**. The static factor f_s can be calculated using the following formula:

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

where

$F_{0r\ perm}$ = 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.

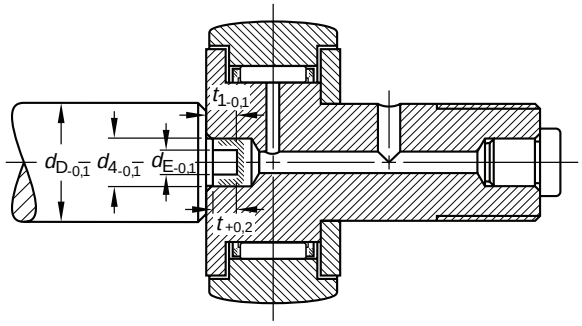
TABLE 6 –
SUGGESTED VALUES FOR STATIC FACTORS F_S FOR METRIC SERIES TRACK ROLLERS

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.

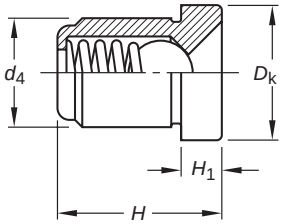


TABLE 7 – METRIC SERIES GREASE FITTINGS, SERIES VENN

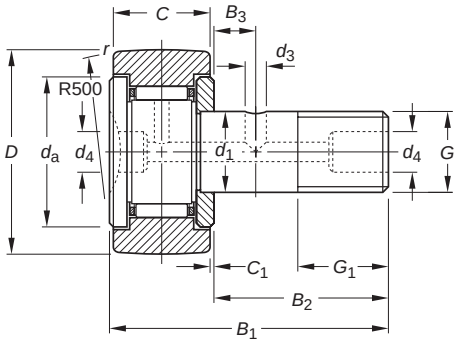
Designation	Dimensions mm				Wt. g approx.
	d_4	D_K	H	H_1	
VENN 4	4	6	6	1.5	0.4
VENN 6	6	8	7	2	1.6
VENN 8	8	10	12	3	4.7

TABLE 8 – INSTALLATION TOOL FOR METRIC SERIES PLUG

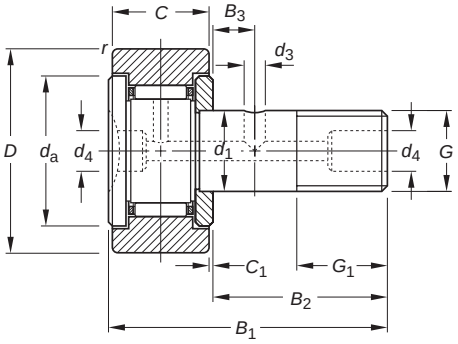
Stud Type Track Roller Outside Diameter mm		Dimensions				
>	≤	d_4	d_D	d_E	t	t_1
16	26	3.9	10	2.7	3.7	4.5
30	40	5.9	12	4.7	4.7	7
47	90	7.9	15	6.7	6.7	10

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

METRIC SERIES

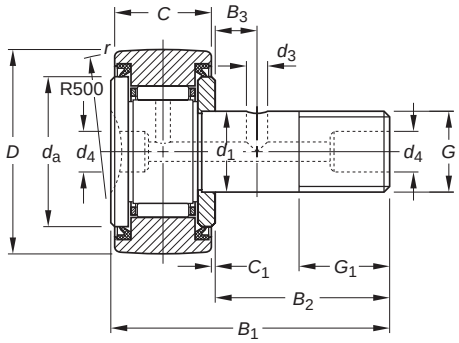


KR



KR.DZ

Outer Dia.	Dimensions mm/in.										Thread	
mm	d_1	h_7	C	$r_{s\,min}$	B_1	B_2	B_3	G_1	d_4	d_3	G	C_1
16	6 0.2362	16 0.6299	11 0.433	0.3 0.012	28.2 1.110	16 0.630		8 0.315	4 0.157		M6x1	0.6 0.024
	6 0.2362	16 0.6299	11 0.433	0.3 0.012	28.2 1.110	16 0.630		8 0.315	4 0.157		M6x1	0.6 0.024
19	8 0.3150	19 0.7480	11 0.433	0.3 0.012	32.2 1.268	20 0.787		10 0.394	4 0.157		M8x1.25	0.6 0.024
	8 0.3150	19 0.7480	11 0.433	0.3 0.012	32.2 1.268	20 0.787		10 0.394	4 0.157		M8x1.25	0.6 0.024
22	10 0.3937	22 0.8661	12 0.472	0.3 0.012	36.0 1.417	23 0.906		12 0.472	4 0.157		M10x1	0.6 0.024
	10 0.3937	22 0.8661	12 0.472	0.3 0.012	36.2 1.425	23 0.906		12 0.472	4 0.157		M10x1	0.6 0.024
26	10 0.3937	26 1.0236	12 0.472	0.3 0.012	36.0 1.417	23 0.906		12 0.472	4 0.157		M10x1	0.6 0.024
	10 0.3937	26 1.0236	12 0.472	0.3 0.012	36.2 1.425	23 0.906		12 0.472	4 0.157		M10x1	0.6 0.024
30	12 0.4724	30 1.1811	14 0.551	0.6 0.024	40.0 1.575	25 0.984	6 0.236	13 0.512	6 0.236	3 0.118	M12x1.5	0.6 0.024
	12 0.4724	30 1.1811	14 0.551	0.6 0.024	40.2 1.583	25 0.984	6 0.236	13 0.512	6 0.236	3 0.118	M12x1.5	0.6 0.024
32	12 0.4724	32 1.2598	14 0.551	0.6 0.024	40.0 1.575	25 0.984	6 0.236	13 0.512	6 0.236	3 0.118	M12x1.5	0.6 0.024
	12 0.4724	32 1.2598	14 0.551	0.6 0.024	40.2 1.583	25 0.984	6 0.236	13 0.512	6 0.236	3 0.118	M12x1.5	0.6 0.024

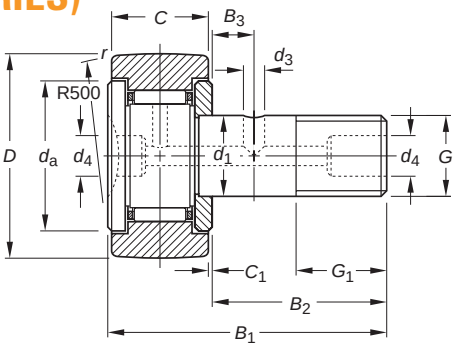


KR.2RS

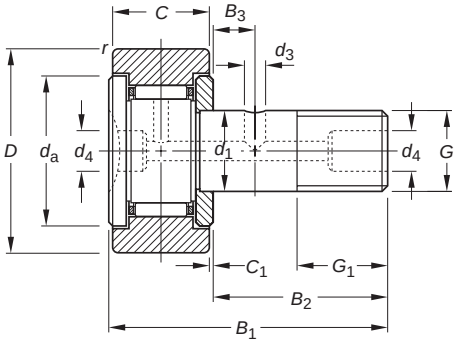
	Bearing Designation	Load Ratings kN/lbf. Dynamic	Static	As a Track Roller Dynamic		Static	Tightening Torque Nm/in.-lbs.	Limiting Speed Grease	Wt. kg/lbs.
d_a		C	C_0	C_w	$F_{r\ perm}$	$F_{0r\ perm}$		RPM	
11 0.433	**KR16**	**3.60** 810	**3.58** 800	**2.97** 670	**2.85** 640	**3.58** 800	**7** 62.0	**17000**	**0.019** 0.042
11 0.433	**KR16.DZ**	**3.60** 810	**3.58** 800	**2.97** 670	**2.85** 640	**3.58** 800	**7** 62.0	**17000**	**0.019** 0.042
13 0.512	**KR19**	**4.18** 940	**4.65** 1050	**3.28** 740	**3.29** 740	**4.22** 950	**16** 142	**13000**	**0.031** 0.068
13 0.512	**KR19.DZ**	**4.18** 940	**4.65** 1050	**3.28** 740	**3.29** 740	**4.22** 950	**16** 142	**13000**	**0.031** 0.068
15 0.591	**KR22**	**5.35** 1200	**6.79** 1530	**3.94** 890	**4.04** 910	**5.45** 1230	**28** 248	**10000**	**0.046** 0.101
15 0.591	**KR22.DZ**	**5.35** 1200	**6.79** 1530	**3.94** 890	**4.04** 910	**5.45** 1230	**28** 248	**10000**	**0.046** 0.101
15 0.591	**KR26**	**5.35** 1200	**6.79** 1530	**4.55** 1020	**6.78** 1520	**7.24** 1630	**28** 248	**10000**	**0.059** 0.130
15 0.591	**KR26.DZ**	**5.35** 1200	**6.79** 1530	**4.55** 1020	**6.78** 1520	**7.24** 1630	**28** 248	**10000**	**0.059** 0.130
21 0.827	**KR30**	**7.89** 1770	**9.79** 2200	**6.32** 1420	**7.74** 1740	**9.31** 2090	**45** 398	**8200**	**0.087** 0.192
21 0.827	**KR30.DZ**	**7.89** 1770	**9.79** 2200	**6.32** 1420	**7.74** 1740	**9.31** 2090	**45** 398	**8200**	**0.087** 0.192
21 0.827	**KR32**	**7.89** 1770	**9.79** 2200	**6.65** 1490	**9.62** 2160	**10.3** 2320	**45** 398	**8200**	**0.095** 0.209
21 0.827	**KR32.DZ**	**7.89** 1770	**9.79** 2200	**6.65** 1490	**9.62** 2160	**10.3** 2320	**45** 398	**8200**	**0.098** 0.216

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

METRIC SERIES

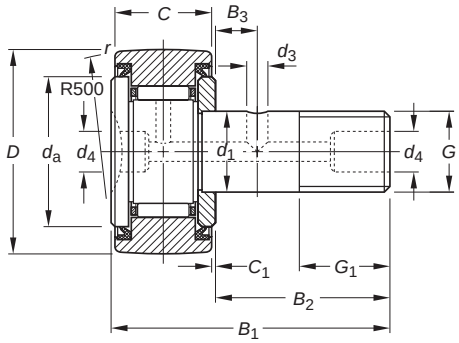


KR



KR.DZ

Outer Dia.	Dimensions mm/in.										Thread	
mm	d_1	h_7	C	$r_{s\ min}$	B_1	B_2	B_3	G_1	d_4	d_3	G	C_1
16	6 0.2362	16 0.6299	11 0.433	0.3 0.012	28.2 1.110	16 0.630		8 0.315	4 0.157		M6x1	0.6 0.024
	6 0.2362	16 0.6299	11 0.433	0.3 0.012	28.2 1.110	16 0.630		8 0.315	4 0.157		M6x1	0.6 0.024
19	8 0.3150	19 0.7480	11 0.433	0.3 0.012	32.2 1.268	20 0.787		10 0.394	4 0.157		M8x1.25	0.6 0.024
	8 0.3150	19 0.7480	11 0.433	0.3 0.012	32.2 1.268	20 0.787		10 0.394	4 0.157		M8x1.25	0.6 0.024
22	10 0.3937	22 0.8661	12 0.472	0.3 0.012	36.2 1.425	23 0.906		12 0.472	4 0.157		M10x1	0.6 0.024
	10 0.3937	22 0.8661	12 0.472	0.3 0.012	36.2 1.425	23 0.906		12 0.472	4 0.157		M10x1	0.6 0.024
26	10 0.3937	26 1.0236	12 0.472	0.3 0.012	36.2 1.425	23 0.906		12 0.472	4 0.157		M10x1	0.6 0.024
	10 0.3937	26 1.0236	12 0.472	0.3 0.012	36.2 1.425	23 0.906		12 0.472	4 0.157		M10x1	0.6 0.024
30	12 0.4724	30 1.1811	14 0.551	0.6 0.024	40.2 1.583	25 0.984	6 0.236	13 0.512	6 0.236	3 0.118	M12x1.5	0.6 0.024
	12 0.4724	30 1.1811	14 0.551	0.6 0.024	40.2 1.583	25 0.984	6 0.236	13 0.512	6 0.236	3 0.118	M12x1.5	0.6 0.024
32	12 0.4724	32 1.2598	14 0.551	0.6 0.024	40.2 1.583	25 0.984	6 0.236	13 0.512	6 0.236	3 0.118	M12x1.5	0.6 0.024
	12 0.4724	32 1.2598	14 0.551	0.6 0.024	40.2 1.583	25 0.984	6 0.236	13 0.512	6 0.236	3 0.118	M12x1.5	0.6 0.024

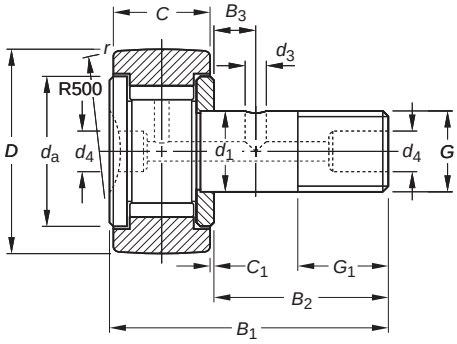


KR.2RS

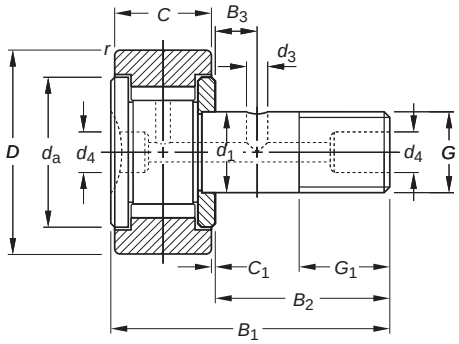
		Load Ratings kN/lbf.					Tightening Torque Nm/in.-lbs.	Limiting Speed Grease	Wt. kg/lbs.
	Bearing Designation	Dynamic	Static	As a Track Roller Dynamic		Static			
d_a		C	C_o	C_w	$F_{r\ perm}$	$F_{0r\ perm}$		RPM	
11 0.433	**KR16.2RS**	**3.60** 810	**3.58** 800	**2.97** 670	**2.85** 640	**3.58** 800	**7.0** 61.96	**17000**	**0.019** 0.042
11 0.433	**KR16.DZ.2RS**	**3.60** 810	**3.58** 800	**2.97** 670	**2.85** 640	**3.58** 800	**7.0** 61.96	**17000**	**0.01** 0.042
13 0.512	**KR19.2RS**	**4.18** 940	**4.65** 1050	**3.28** 740	**3.29** 740	**4.22** 950	**16** 141.61	**13000**	**0.031** 0.068
13 0.512	**KR19.DZ.2RS**	**4.18** 940	**4.65** 1050	**3.28** 740	**3.29** 740	**4.22** 950	**16** 141.61	**13000**	**0.031** 0.068
15 0.591	**KR22.2RS**	**5.35** 1200	**6.79** 1530	**3.94** 890	**4.04** 910	**5.45** 1230	**28** 247.82	**10000**	**0.046** 0.101
15 0.591	**KR22.DZ.2RS**	**5.35** 1200	**6.79** 1530	**3.94** 890	**4.04** 910	**5.45** 1230	**28** 247.82	**10000**	**0.046** 0.101
15 0.591	**KR26.2RS**	**5.35** 1200	**6.79** 1530	**4.55** 1020	**6.78** 1520	**7.24** 1630	**28** 247.82	**10000**	**0.059** 0.130
15 0.591	**KR26.DZ.2RS**	**5.35** 1200	**6.79** 1530	**4.55** 1020	**6.78** 1520	**7.24** 1630	**28** 247.82	**10000**	**0.059** 0.130
21 0.827	**KR30.2RS**	**7.89** 1770	**9.79** 2200	**6.32** 1420	**7.74** 1740	**9.31** 2090	**45** 398.28	**8200**	**0.087** 0.192
21 0.827	**KR30.DZ.2RS**	**7.89** 1770	**9.79** 2200	**6.32** 1420	**7.74** 1740	**9.31** 2090	**45** 398.28	**8200**	**0.087** 0.192
21 0.827	**KR32.2RS**	**7.89** 1770	**9.79** 2200	**6.65** 1490	**9.62** 2160	**10.3** 2320	**45** 398.28	**8200**	**0.098** 0.216
21 0.827	**KR32.DZ.2RS**	**7 .89** 1770	**9.79** 2200	**6.65** 1490	**9.62** 2160	**10.3** 2320	**45** 398.28	**8200**	**0.098** 0.216

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

METRIC SERIES

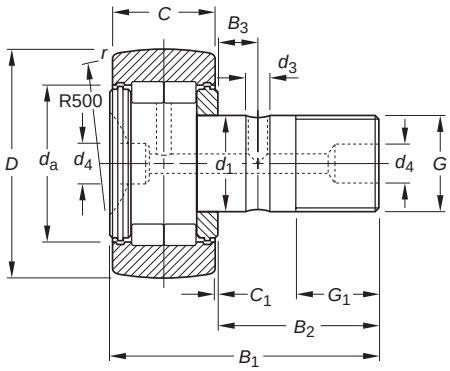


KRV

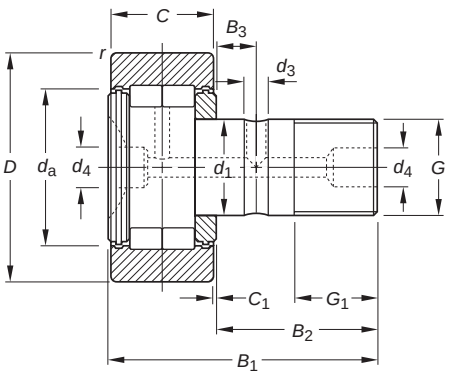


KRV.DZ

Outer Dia.	Dimensions mm/in.										Thread	
mm	d_1	D, h_7	C	$r_{s\ min}$	B_1	B_2	B_3	G_1	d_4	d_3	G	C_1
16	6 0.2362	16 0.6299	11 0.433	0.3 0.012	28.2 1.110	16 0.630		8 0.315	4 0.157		M6x1	0.6 0.024
	6 0.2362	16 0.6299	11 0.433	0.3 0.012	28.2 1.110	16 0.630		8 0.315	4 0.157		M6x1	0.6 0.024
19	8 0.3150	19 0.7480	11 0.433	0.3 0.012	32.2 1.268	20 0.787		10 0.394	4 0.157		M8x1.25	0.6 0.024
	8 0.3150	19 0.7480	11 0.433	0.3 0.012	32.2 1.268	20 0.787		10 0.394	4 0.157		M8x1.25	0.6 0.024
22	10 0.3937	22 0.8661	12 0.472	0.3 0.012	36.2 1.425	23 0.906		12 0.472	4 0.157		M10x1	0.6 0.024
	10 0.3937	22 0.8661	12 0.472	0.3 0.012	36.2 1.425	23 0.906		12 0.472	4 0.157		M10x1	0.6 0.024
26	10 0.3937	26 1.0236	12 0.472	0.3 0.012	36.2 1.425	23 0.906		12 0.472	4 0.157		M10x1	0.6 0.024
	10 0.3937	26 1.0236	12 0.472	0.3 0.012	36.2 1.425	23 0.906		12 0.472	4 0.157		M10x1	0.6 0.024
30	12 0.4724	30 1.1811	14 0.551	0.6 0.024	40.2 1.583	25 0.984	6 0.236	13 0.512	6 0.236	3 0.118	M12x1.5	0.6 0.024
	12 0.4724	30 1.1811	14 0.551	0.6 0.024	40.2 1.583	25 0.984	6 0.236	13 0.512	6 0.236	3 0.118	M12x1.5	0.6 0.024
32	12 0.4724	32 1.2598	14 0.551	0.6 0.024	40.2 1.583	25 0.984	6 0.236	13 0.512	6 0.236	3 0.118	M12x1.5	0.6 0.024
	12 0.4724	32 1.2598	14 0.551	0.6 0.024	40.2 1.583	25 0.984	6 0.236	13 0.512	6 0.236	3 0.118	M12x1.5	0.6 0.024
35	16 0.6299	35 1.3780	18 0.709	0.6 0.024	52 2.047	32.5 1.280	8 0.315	17 0.669	6 0.236	3 0.118	M16x1.5	0.8 0.031
40	18 0.7087	40 1.5748	20 0.787	1 0.039	58 2.283	36.5 1.437	8 0.315	19 0.748	6 0.236	3 0.118	M18x1.5	0.8 0.031
47	20 0.7874	47 1.8504	24 0.945	1 0.039	66 2.598	40.5 1.594	9 0.354	21 0.827	6 0.236	4 0.157	M20x1.5	0.8 0.031
52	20 0.7874	52 2.0472	24 0.945	1 0.039	66 2.598	40.5 1.594	9 0.354	21 0.827	6 0.236	4 0.157	M20x1.5	0.8 0.031
62	24 0.9449	62 2.4409	29 1.142	1 0.039	80 3.150	49.5 1.949	11 0.433	25 0.984	8 0.315	4 0.157	M24x1.5	0.8 0.031
72	24 0.9449	72 2.8346	29 1.142	1.1 0.043	80 3.150	49.5 1.949	11 0.433	25 0.984	8 0.315	4 0.157	M24x1.5	0.8 0.031
80	30 1.1811	80 3.1496	35 1.378	1.1 0.043	100 3.937	63 2.480	15 0.591	32 1.260	8 0.315	4 0.157	M30x1.5	1.0 0.039
90	30 1.1811	90 3.5433	35 1.378	1.1 0.043	100 3.937	63 2.480	15 0.591	32 1.260	8 0.315	4 0.157	M30x1.5	1.0 0.039



NUKR



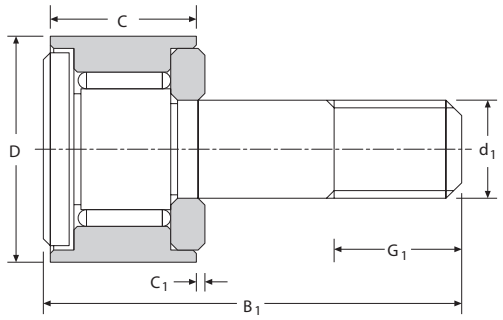
NUKR.DZ

		Load Ratings kN/lbf.					Tightening Torque Nm/in.-lbs.	Limiting Speed Grease	Wt. kg/lbs.
	Bearing Designation	Dynamic	Static	As a Track Roller Dynamic		Static			
d_a		C	C_0	C_w	$F_{r\ perm}$	$F_{0r\ perm}$		RPM	
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** 1 708	**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** 1 708	**2600**	**1.040** 2.293
52 2.047	**NUKR80.2SK**	**95.4** 21400	**130** 29200	**69.7** 15700	**63.2** 14200	**101** 22700	**390** 3 452	**2900**	**1.550** 3.417
52 2.047	**NUKR90.2SK**	**95.4** 21400	**130** 29200	**77.8** 17500	**97.8** 22000	**128** 28800	**390** 3 452	**2900**	**2.020** 4.453

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

METRIC SERIES

GC: convex outer ring
GCL: cylindrical outer ring



GC Series

C

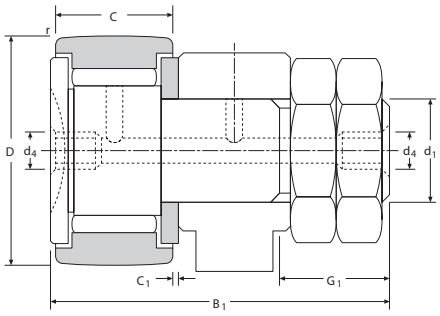
Outer Dia.	Dimensions mm/in.							Profiled Designation
mm	D	d_1	C	C_1	$r_{s\ min}$	B_1	G_1	
10	10	4	8	0.25	0.2	19.5	6	GC 10
	0.3937	0.1575	0.315	0.010	0.008	0.768	0.236	
11	11	4	8	0.25	0.2	19.5	6	GC 11
	0.4331	0.1575	0.315	0.010	0.008	0.768	0.236	
12	12	5	9	0.25	0.2	22.5	7	GC 12
	0.4724	0.1969	0.354	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. Dynamic		Static	Limiting Speed Grease	Wt. kg/lbs.
		C_1	$F_{r\ perm}$	F_0	RPM	
GCL 10	**0.9**	**2.13**	**0.52**	**0.96**	**14000**	**0.006**
	7.97	479	117	216		0.014
GCL 11	**0.9**	**2.48**	**0.52**	**0.96**	**14000**	**0.007**
	7.97	558	117	216		0.016
GCL 12	**1.8**	**2.98**	**0.90**	**1.68**	**11000**	**0.011**
	15.93	670	202	378		0.024
GCL 13	**1.8**	**3.35**	**0.90**	**1.68**	**11000**	**0.011**
	15.93	753	202	378		0.024
GCL 14	**3.0**	**3.5**	**1.48**	**2.75**	**10000**	**0.016**
	26.55	787	333	618		0.035
GCL 15	**3.0**	**3.75**	**1.48**	**2.75**	**10000**	**0.018**
	26.55	843	333	618		0.039

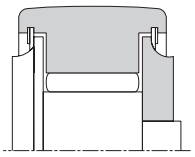
FULL COMPLEMENT, STANDARD SERIES, WITH OR WITHOUT SEALS, STUD TYPE (GC SERIES)

METRIC SERIES

GC: convex outer ring
GCL: cylindrical outer ring



GC/GCL



GC...EE, GC...EM

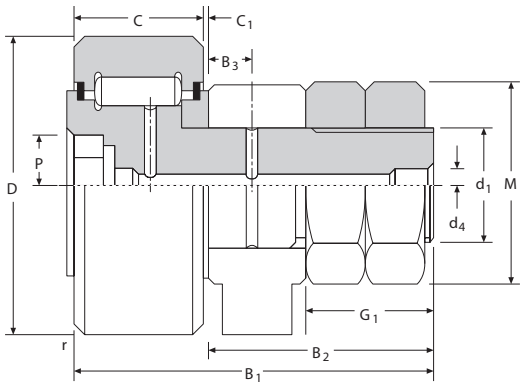
Outer Dia.	Dimensions mm/in.							Profiled Designation
mm	D	d_1	C	C_1	$r_{s\ min}$	B_1	G_1	
16	16	6	11	0.60	0.3	28.3	8	GC 16
	0.6299	0.2362	0.433	0.024	0.012	1.114	0.315	
19	19	8	11	0.60	0.3	32.3	10	GC 19
	0.748	0.315	0.433	0.024	0.012	1.272	0.394	
22	22	10	12	0.60	0.3	36.3	12	GC 22
	0.8661	0.3937	0.472	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[4]
	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. Dynamic		Static	Limiting Speed Grease	mm wrench	mm/in.	Wt. kg/lbs.
	C	$F_{r\ perm}$	F_0	RPM			
3	**5.05**	**1.18**	**2.2**	**9300**	**N/A**	**4**	**0.021**
26.6	1140	265	495			0.157	0.046
8	**5.75**	**2.83**	**5.2**	**7600**	**N/A**	**4**	**0.034**
70.8	1290	636	1170			0.157	0.075
20	**6.3**	**4.9**	**8.1**	**6300**	**N/A**	**4**	**0.058**
177	1420	1100	1820			0.157	0.128
20	**6.9**	**5.2**	**9.2**	**6300**	**N/A**	**4**	**0.067**
177	1550	1170	2070			0.157	0.148
20	**8.9**	**5.2**	**9.6**	**5500**	**N/A**	**4**	**0.072**
177	2000	1170	2160			0.157	0.159
20	**9.6**	**5.2**	**9.6**	**5500**	**N/A**	**4**	**0.08**
177	2160	1170	2160			0.157	0.176
26	**12.9**	**7.7**	**14.3**	**4800**	**8**	**4**	**0.115**
230	2900	1730	3210			0.157	0.254
26	**13.8**	**7.7**	**14.3**	**4800**	**8**	**4**	**0.12**
230	3100	1730	3210			0.157	0.265
64	**19.2**	**11.4**	**24**	**3850**	**10**	**6**	**0.208**
566	4320	2560	5400			0.236	0.459
120	**28.3**	**21.4**	**40**	**2700**	**14**	**6**	**0.477**
1060	6360	4810	8990			0.236	1.052
120	**34**	**21.4**	**40**	**2700**	**14**	**6**	**0.542**
1060	7640	4810	8990			0.236	1.195
220	**42**	**31**	**57.5**	**2330**	**12**	**6**	**0.944**
1950	9440	6970	12900			0.236	2.081
220	**44**	**31**	**57.5**	**2330**	**12**	**6**	**1.165**
1950	9890	6970	12900			0.236	2.568
450	**60**	**50**	**93**	**1700**	**14**	**8**	**1.915**
3980	13500	11200	20900			0.315	4.222
450	**64**	**50**	**93**	**1700**	**14**	**8**	**2.096**
3980	14400	11200	20900			0.315	4.621
450	**64**	**50**	**93**	**1700**	**14**	**8**	**2.096**
3980	14400	11200	20900			0.315	4.621
450	**65**	**50**	**93**	**1700**	**14**	**8**	**2.287**
3980	14600	11200	20900			0.315	5.042

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

METRIC SERIES

GCU: convex outer ring
GCUL: cylindrical outer ring



GCU, GCUL

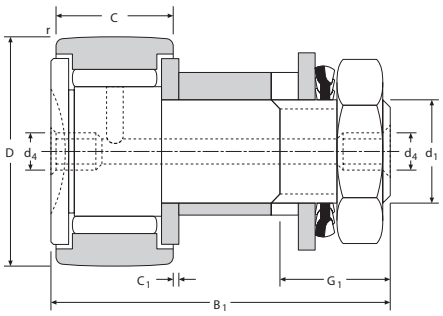
Outside Dia.	Dimensions mm/in.							Profiled Designation	Cylindrical Designation
mm	D	d_1	C	C_1	B_1	G_1	r_{smin}		
35	35 1.3780	16 0.6299	18 0.709	0.85 0.033	52.3 2.059	17 0.669	0.6 0.024	GCU 35 MM	GCUL 35 MM
40	40 1.5748	18 0.7087	20 0.787	0.85 0.033	58.3 2.295	19 0.748	1.0 0.039	GCU 40	
	40 1.5748	18 0.7087	20 0.787	0.85 0.033	58.3 2.295	19 0.748	1.0 0.039	GCU 40 MM	GCUL 40 MM
47	47 1.8504	20 0.7874	24 0.945	0.85 0.033	66.3 2.610	21 0.827	1.0 0.039	GCU 47 MM	GCUL 47 MM
52	52 2.0472	20 0.7874	24 0.945	0.85 0.033	66.3 2.610	21 0.827	1.0 0.039		GCUL 52
	52 2.0472	20 0.7874	24 0.945	0.85 0.033	66.3 2.610	21 0.827	1.0 0.039	GCU 52 MM	GCUL 52 MM
62	62 2.4409	24 0.9449	29 1.142	0.85 0.033	80.3 3.161	25 0.984	1.0 0.039	GCU 62 MM	
72	72 2.8346	24 0.9449	29 1.142	0.85 0.033	80.3 3.161	25 0.984	1.1 0.043		GCUL 72 MM
80	80 3.1496	30 1.1811	35 1.378	1.10 0.043	100.3 3.949	32 1.260	1.1 0.043	GCU 80 MM	
90	90 3.5433	30 1.1811	35 1.378	1.10 0.043	100.3 3.949	32 1.260	1.1 0.043		GCUL 90
	90 3.5433	30 1.1811	35 1.378	1.10 0.043	100.3 3.949	32 1.260	1.1 0.043	GCU 90 MM	
100	100 3.9370	36 1.4173	40 1.575	1.10 0.043	117.3 4.618	38 1.496	2.0 0.079	GCU 100	
	100 3.9370	36 1.4173	40 1.575	1.10 0.043	117.3 4.618	38 1.496	2.0 0.079	GCU 100 MM	
110	110 4.3307	36 1.4173	40 1.575	1.10 0.043	117.3 4.618	38 1.496	2.0 0.079	GCU 110 MM	GCUL 110 MM
120	120 4.7244	42 1.6535	46 1.811	1.10 0.043	136.3 5.366	44 1.732	2.0 0.079	GCU 120 MM	
130	130 5.1181	42 1.6535	46 1.811	1.10 0.043	136.3 5.366	44 1.732	2.0 0.079		GCUL 130
	130 5.1181	42 1.6535	46 1.811	1.10 0.043	136.3 5.366	44 1.732	2.0 0.079	GCU 130 MM	

Tightening Torque Nm/in.-lbs.	Load Ratings kN/lbf. Dynamic C	Dynamic $F_{r\,perm}$	Static F_{01}	Limiting Speed Grease RPM	mm wrench	mm/in. B_3	mm/in. d_4	Wt. kg/lbs.
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

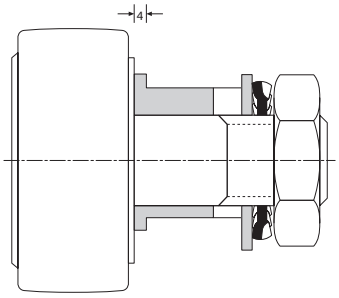
FULL COMPLEMENT, ECCENTRIC, STUD TYPE (GCR SERIES)

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_1	C	C_1	B_1	G_1	$r_{a\ min}$		
16	16 0.6299	6 0.2362	11 0.433	0.60 0.024	28.3 1.114	8 0.315	0.3 0.012	GCR 16	
	16 0.6299	6 0.2362	11 0.433	0.60 0.024	28.3 1.114	8 0.315	0.3 0.012	GCR 16 EE	GCRL 16 EE
	16 0.6299	6 0.2362	11 0.433	0.60 0.024	28.3 1.114	8 0.315	0.3 0.012	GCR 16 EEM	GCRL 16 EEM
19	19 0.748	8 0.315	11 0.433	0.60 0.024	32.3 1.272	10 0.394	0.3 0.012	GCR 19	
	19 0.748	8 0.315	11 0.433	0.60 0.024	32.3 1.272	10 0.394	0.3 0.012	GCR 19 EE	GCRL 19 EE
	19 0.748	8 0.315	11 0.433	0.60 0.024	32.3 1.272	10 0.394	0.3 0.012	GCR 19 EEM	
22	22 0.8661	10 0.3937	12 0.472	0.60 0.024	36.3 1.429	12 0.472	0.3 0.012	GCR 22 EE	GCRL 22 EE
	22 0.8661	10 0.3937	12 0.472	0.60 0.024	36.3 1.429	12 0.472	0.3 0.012	GCR 22 EEM	GCRL 22 EEM
24	24 0.9449	10 0.3937	12 0.472	0.60 0.024	36.3 1.429	12 0.472	0.3 0.012	GCR 24	
	24 0.9449	10 0.3937	12 0.472	0.60 0.024	36.3 1.429	12 0.472	0.3 0.012	GCR 24 EE	GCRL 24 EE
	24 0.9449	10 0.3937	12 0.472	0.60 0.024	36.3 1.429	12 0.472	0.3 0.012	GCR 24 EEM	GCRL 24 EEM
26	26 1.0236	10 0.3937	12 0.472	0.60 0.024	36.3 1.429	12 0.472	0.3 0.012	GCR 26	
	26 1.0236	10 0.3937	12 0.472	0.60 0.024	36.3 1.429	12 0.472	0.3 0.012	GCR 26 EE	GCRL 26 EE
28	28 1.1024	10 0.3937	12 0.472	0.60 0.024	36.3 1.429	12 0.472	0.3 0.012	GCR 28 EE	
	28 1.1024	10 0.3937	12 0.472	0.60 0.024	36.3 1.429	12 0.472	0.3 0.012	GCR 28 EEM	GCRL 28 EEM
30	30 1.1811	12 0.4724	14 0.551	0.60 0.024	40.3 1.587	13 0.512	0.6 0.024	GCR 30 EE	GCRL 30 EE
	30 1.1811	12 0.4724	14 0.551	0.60 0.024	40.3 1.587	13 0.512	0.6 0.024	GCR 30 EEM	GCRL 30 EEM
32	32 1.2598	12 0.4724	14 0.551	0.60 0.024	40.3 1.587	13 0.512	0.6 0.024	GCR 32	
	32 1.2598	12 0.4724	14 0.551	0.60 0.024	40.3 1.587	13 0.512	0.6 0.024	GCR 32 EE	GCRL 32 EE
	32 1.2598	12 0.4724	14 0.551	0.60 0.024	40.3 1.587	13 0.512	0.6 0.024	GCR 32 EEM	
35	35 1.378	16 0.6299	18 0.709	0.80 0.031	52.3 2.059	17 0.669	0.6 0.024	GCR 35	
	35 1.378	16 0.6299	18 0.709	0.80 0.031	52.3 2.059	17 0.669	0.6 0.024	GCR 35 EE	GCRL 35 EE
	35 1.378	16 0.6299	18 0.709	0.80 0.031	52.3 2.059	17 0.669	0.6 0.024	GCR 35 EEM	GCRL 35 EEM

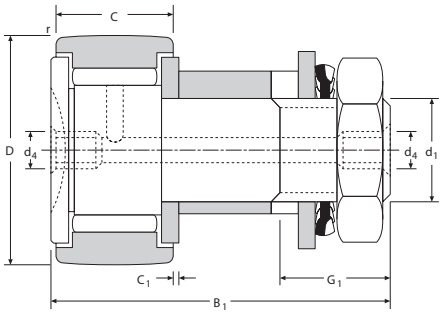
Tightening Torque Nm/in.-lbs.	Load Ratings kN/lbf. Dynamic		Static	Limiting Speed Grease	mm/in.	Wt. kg/lbs.
	C_0	$F_{r\ perm}$	F_0	RPM	d_4	
2 17.7	**5.05** 1140	**1.18** 265	**2.20** 495	**9300**	**4** 0.157	**0.024** 0.053
2 17.7	**5.05** 1140	**1.18** 265	**2.20** 495	**9300**	**4** 0.157	**0.024** 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.

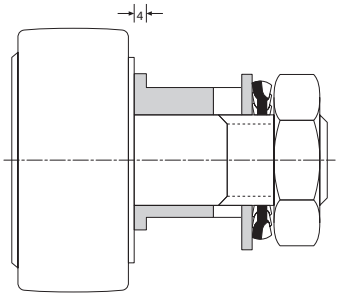
FULL COMPLEMENT, ECCENTRIC, STUD TYPE (GCR SERIES) – *continued*

METRIC SERIES

GCR: convex outer ring
GCRL: cylindrical outer ring



GCR 16-52



GCR 62-90

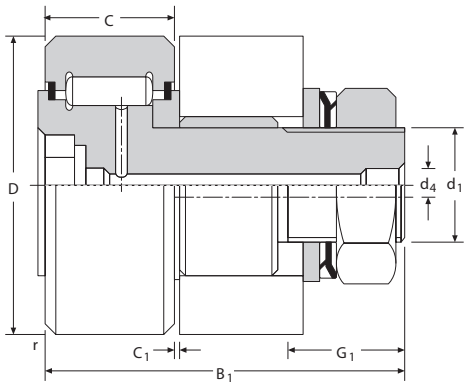
Outer Dia.	Dimensions mm/in.							Profiled Designation	Cylindrical Designation
mm	D	d_1	C	C_1	B_1	G_1	$r_{a\ min}$		
40	40 1.5748	18 0.7087	20 0.787	0.80 0.709	58.3 2.295	19 0.748	1 0.039	GCR 40	GCRL 40
	40 1.5748	18 0.7087	20 0.787	0.80 0.709	58.3 2.295	19 0.748	1 0.039	GCR 40 EE	GCRL 40 EE
	40 1.5748	18 0.7087	20 0.787	0.80 0.709	58.3 2.295	19 0.748	1 0.039	GCR 40 EEM	GCRL 40 EEM
47	47 1.8504	20 0.7874	24 0.945	0.80 0.709	66.3 2.61	21 0.827	1 0.039	GCR 47 EE	
	47 1.8504	20 0.7874	24 0.945	0.80 0.709	66.3 2.61	21 0.827	1 0.039	GCR 47 EEM	GCRL 47 EEM
52	52 2.0472	20 0.7874	24 0.945	0.80 0.709	66.3 2.61	21 0.827	1 0.039	GCR 52	
	52 2.0472	20 0.7874	24 0.945	0.80 0.709	66.3 2.61	21 0.827	1 0.039	GCR 52 EE	GCRL 52 EE
	52 2.0472	20 0.7874	24 0.945	0.80 0.709	66.3 2.61	21 0.827	1 0.039	GCR 52 EEM	GCRL 52 EEM
62	62 2.4409	24 0.9449	29 1.142	0.80 0.709	80.3 3.161	25 0.984	1 0.039	GCR 62	
	62 2.4409	24 0.9449	29 1.142	0.80 0.709	80.3 3.161	25 0.984	1 0.039	GCR 62 EE	
	62 2.4409	24 0.9449	29 1.142	0.80 0.709	80.3 3.161	25 0.984	1 0.039	GCR 62 EEM	GCRL 62 EEM
72	72 2.8346	24 0.9449	29 1.142	0.80 0.709	80.3 3.161	25 0.984	1 0.039	GCR 72 EE	GCRL 72 EE
	72 2.8346	24 0.9449	29 1.142	0.80 0.709	80.3 3.161	25 0.984	1 0.039		GCRL 72 EEM
80	80 3.1496	30 1.1811	35 1.378	1.00 0.039	100.3 3.949	32 1.26	1 0.039	GCR 80	
	80 3.1496	30 1.1811	35 1.378	1.00 0.039	100.3 3.949	32 1.26	1 0.039	GCR 80 EE	GCRL 80 EE
	80 3.1496	30 1.1811	35 1.378	1.00 0.039	100.3 3.949	32 1.26	1 0.039	GCR 80 EEM	GCRL 80 EEM
90	90 3.5433	30 1.1811	35 1.378	1.00 0.039	100.3 3.949	32 1.26	1 0.039	GCR 90	GCRL 90
	90 3.5433	30 1.1811	35 1.378	1.00 0.039	100.3 3.949	32 1.26	1 0.039	GCR 90 EE	
	90 3.5433	30 1.1811	35 1.378	1.00 0.039	100.3 3.949	32 1.26	1 0.039	GCR 90 EEM	

Tightening Torque Nm/in.-lbs.	Load Ratings kN/lbf. Dynamic		Static	Limiting Speed Grease	mm/in.	Wt. kg/lbs.
	C_0	$F_{r\ perm}$	F_0	RPM	d_4	
75 664	**20.0** 4500	**14.2** 3190	**12.3** 2770	**3150**	**6** 0.236	**0.321** 0.708
75 664	**20.0** 4500	**14.2** 3190	**12.3** 2770	**3150**	**6** 0.236	**0.321** 0.708
75 664	**20.0** 4500	**14.2** 3190	**12.3** 2770	**3150**	**6** 0.236	**0.321** 0.708
100 885	**28.3** 6360	**21.4** 4810	**23.7** 5330	**2700**	**6** 0.236	**0.500** 1.102
100 885	**28.3** 6360	**21.4** 4810	**23.7** 5330	**2700**	**6** 0.236	**0.500** 1.102
100 885	**34.0** 7640	**21.4** 4810	**23.7** 5330	**2700**	**6** 0.236	**0.568** 1.252
100 885	**34.0** 7640	**21.4** 4810	**23.7** 5330	**2700**	**6** 0.236	**0.568** 1.252
100 885	**34.0** 7640	**21.4** 4810	**23.7** 5330	**2700**	**6** 0.236	**0.568** 1.252
180 1590	**42.0** 9440	**31.0** 6970	**28.8** 6470	**2330**	**8** 0.315	**1.035** 2.282
180 1590	**42.0** 9440	**31.0** 6970	**28.8** 6470	**2330**	**8** 0.315	**1.035** 2.282
180 1590	**42.0** 9440	**31.0** 6970	**28.8** 6470	**2330**	**8** 0.315	**1.035** 2.282
180 1590	**44.0** 9890	**31.0** 6970	**28.8** 6470	**2330**	**8** 0.315	**1.278** 2.818
180 1590	**44.0** 9890	**31.0** 6970	**28.8** 6470	**2330**	**8** 0.315	**1.278** 2.818
370 3270	**60.0** 13500	**50.0** 11200	**54.0** 12100	**1700**	**8** 0.315	**2.074** 4.572
370 3270	**60.0** 13500	**50.0** 11200	**54.0** 12100	**1700**	**8** 0.315	**2.074** 4.572
370 3270	**60.0** 13500	**50.0** 11200	**54.0** 12100	**1700**	**8** 0.315	**2.074** 4.572
370 3270	**65.0** 14600	**50.0** 11200	**54.0** 12100	**1700**	**8** 0.315	**2.435** 5.368
370 3270	**65.0** 14600	**50.0** 11200	**54.0** 12100	**1700**	**8** 0.315	**2.435** 5.368
370 3270	**65.0** 14600	**50.0** 11200	**54.0** 12100	**1700**	**8** 0.315	**2.435** 5.368

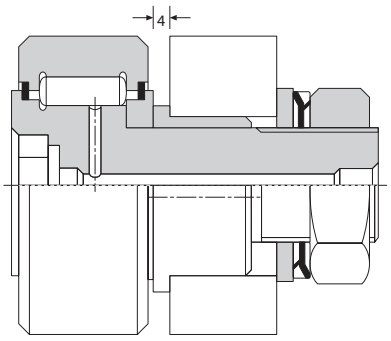
FULL COMPLEMENT ECCENTRIC, WITH METAL SEALS, STUD TYPE (GCUR...MM SERIES)

METRIC SERIES

GCUR: convex outer ring
GCURL: cylindrical outer ring



GCUR 35-52



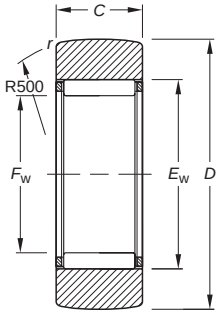
GCUR 62-130

Outside Dia.	Dimensions mm/in.							Profiled Designation	Cylindrical Designation
mm	D	d_1	C	C_1	B_1	G_1	r_{smin}		
35	35 1.3780	16 0.6299	18 0.709	0.85 0.033	52.3 2.059	17 0.669	0.6 0.024	GCUR 35	
40	40 1.5748	18 0.7087	20 0.787	0.85 0.033	58.3 2.295	19 0.748	1.0 0.039	GCUR 40	
	40 1.5748	18 0.7087	20 0.787	0.85 0.033	58.3 2.295	19 0.748	1.0 0.039		GCURL 40 MM
52	52 2.0472	20 0.7874	24 0.945	0.85 0.033	66.3 2.610	21 0.827	1.0 0.039	GCUR 52 MM	
62	62 2.4409	24 0.9449	29 1.142	0.85 0.033	80.3 3.161	25 0.984	1.0 0.039	GCUR 62	
	62 2.4409	24 0.9449	29 1.142	0.85 0.033	80.3 3.161	25 0.984	1.0 0.039	GCUR 62 MM	
72	72 2.8346	24 0.9449	29 1.142	0.85 0.033	80.3 3.161	25 0.984	1.1 0.043	GCUR 72	
	72 2.8346	24 0.9449	29 1.142	0.85 0.033	80.3 3.161	25 0.984	1.1 0.043	GCUR 72 MM	
80	80 3.1496	30 1.1811	35 1.378	1.10 0.014	100.3 3.949	32 1.260	1.1 0.043	GCUR 80	
	80 3.1496	30 1.1811	35 1.378	1.10 0.043	100.3 3.949	32 1.260	1.1 0.043	GCUR 80 MM	
90	90 3.5433	30 1.1811	35 1.378	1.10 0.043	100.3 3.949	32 1.260	1.1 0.043	GCUR 90	
100	100 3.9370	36 1.4173	40 1.575	1.10 0.043	117.3 4.618	38 1.496	2.0 0.079	GCUR 100	
	100 3.9370	36 1.4173	40 1.575	1.10 0.043	117.3 4.618	38 1.496	2.0 0.079	GCUR 100 MM	
110	110 4.3307	36 1.4173	40 1.575	1.10 0.043	117.3 4.618	38 1.496	2.0 0.079	GCUR 110 MM	
120	120 4.7244	42 1.6535	46 1.811	1.10 0.043	136.3 5.366	44 1.732	2.0 0.079	GCUR 120 MM	
130	130 5.1181	42 1.6535	46 1.811	1.10 0.043	136.3 5.366	44 1.732	2.0 0.079	GCUR 130	
	130 5.1181	42 1.6535	46 1.811	1.10 0.043	136.3 5.366	44 1.732	2.0 0.079	GCUR 130 MM	

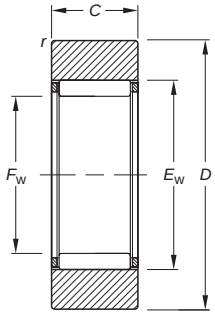
Tightening Torque Nm/in.-lbs.	Load Ratings kN/lbf. Dynamic		Static	Limiting Speed Grease	mm wrench	mm/in.	Wt. kg/lbs.
	C	$F_{r\ perm}$	F_{01}	RPM		d_4	
55 487	**17.0** 3820	**7.8** 1750	**10.0** 2250	**5700**	**10**	**6** 0.236	**0.215** 0.474
75 664	**20.0** 4500	**10.9** 2450	**10.9** 2450	**5200**	**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

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

METRIC SERIES



RSTO



RSTO.DZ

C

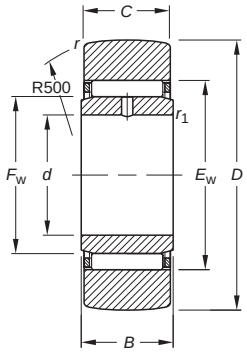
Outer Dia.	Dimensions						Bearing Designation	Load Ratings kN/lbf. As a Bearing Dynamic	As a Bearing Static	As a Track Roller Dynamic		As a Track Roller Static	Limiting Speed Grease	Wt. kg/lbs.
mm	D	B	C	F_w	E_w	r_s		C	C_o	C_w	$F_{r\ perm}$	$F_{Or\ perm}$	RPM	
16	16 0.6299	8 0.315	7.8 0.307	7 0.2756	10 0.394	0.3 0.012	RSTO5A.TN	2.74 616	2.44 549	2.49 560	2.97 668	2.44 549	19000	0.009 0.020
	16 0.6299	8 0.315	7.8 0.307	7 0.2756	10 0.394	0.3 0.012	RSTO5ADZ.TN	2.74 616	2.44 549	2.49 560	2.97 668	2.44 549	19000	0.009 0.020
19	19 0.7480	10 0.394	9.8 0.386	10 0.3937	13 0.512	0.3 0.012	RSTO6	5.40 1210	6.43 1450	4.15 933	4.04 908	5.63 1270	13000	0.014 0.031
	19 0.7480	10 0.394	9.8 0.386	10 0.3937	13 0.512	0.3 0.012	RSTO6DZ	5.40 1210	6.43 1450	4.15 933	4.04 908	5.63 1270	13000	0.014 0.031
	19 0.7480	10 0.394	9.8 0.386	10 0.3937	13 0.512	0.3 0.012	RSTO6TN	5.40 1210	6.43 1450	4.15 933	4.04 908	5.63 1270	13000	0.014 0.031
24	24 0.9449	10 0.394	9.8 0.386	12 0.4724	15 0.591	0.3 0.012	RSTO8	5.85 1320	7.51 1690	4.79 1080	6.67 1500	7.44 1670	10000	0.023 0.051
	24 0.9449	10 0.394	9.8 0.386	12 0.4724	15 0.591	0.3 0.012	RSTO8DZ	5.85 1320	7.51 1690	4.79 1080	6.67 1500	7.44 1670	10000	0.023 0.051
30	30 1.1811	12 0.472	11.8 0.465	14 0.5512	20 0.787	0.3 0.012	RSTO10	10.40 2340	10.6 2380	8.62 1940	7.69 1730	10.6 2380	9400	0.044 0.097
	30 1.1811	12 0.472	11.8 0.465	14 0.5512	20 0.787	0.3 0.012	RSTO10DZ	10.40 2340	10.6 2380	8.62 1940	7.69 1730	10.6 2380	9400	0.044 0.097
32	32 1.2598	12 0.472	11.8 0.465	16 0.6299	22 0.866	0.3 0.012	RSTO12	11.20 2520	11.9 2680	8.80 1980	7.65 1720	10.9 2450	8100	0.049 0.108
	32 1.2598	12 0.472	11.8 0.465	16 0.6299	22 0.866	0.3 0.012	RSTO12DZ	11.20 2520	11.9 2680	8.80 1980	7.65 1720	10.9 2450	8100	0.049 0.108
35	35 1.3780	12 0.472	11.8 0.465	20 0.7874	26 1.024	0.3 0.012	RSTO15	12.90 2900	15.3 3440	9.13 2050	6.95 1560	11.2 2520	6300	0.052 0.115
	35 1.3780	12 0.472	11.8 0.465	20 0.7874	26 1.024	0.3 0.012	RSTO15DZ	12.90 2900	15.3 3440	9.13 2050	6.95 1560	11.2 2520	6300	0.052 0.115

Continued on next page.

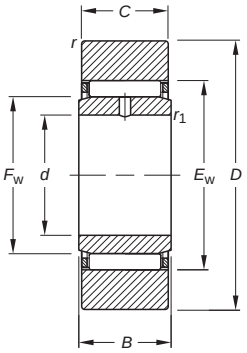
Outer Dia.	Dimensions						Bearing Designation	Load Ratings kN/lbf. As a Bearing		As a Track Roller			Limiting Speed Grease	Wt. kg/lbs.
								Dynamic	Static	Dynamic		Static		
mm	D	B	C	F_w	E_w	r_s		C	C_o	C_w	$F_{r\ perm}$	$F_{Or\ perm}$	RPM	
40	40 1.5748	16 0.630	15.8 0.622	22 0.8661	29 1.142	0.3 0.012	RST017	19.00 4270	23.3 5240	13.8 3100	11.4 2560	18.2 4090	5800	0.095 0.209
	40 1.5748	16 0.630	15.8 0.622	22 0.8661	29 1.142	0.3 0.012	RST017DZ	19.00 4270	23.3 5240	13.8 3100	11.4 2560	18.2 4090	5800	0.095 0.209
47	47 1.8504	16 0.630	15.8 0.622	25 0.9843	32 1.260	0.3 0.012	RST020	20.00 4500	25.3 5690	15.3 3440	16.5 3710	22.2 4990	5000	0.134 0.295
	47 1.8504	16 0.630	15.8 0.622	25 0.9843	32 1.260	0.3 0.012	RST020DZ	20.00 4500	25.3 5690	15.3 3440	16.5 3710	22.2 4990	5000	0.134 0.295
52	52 2.0472	16 0.630	15.8 0.622	30 1.1811	37 1.457	0.3 0.012	RST025	22.40 5040	31.0 6970	16.0 3600	16.9 3800	23.7 5330	4100	0.155 0.342
	52 2.0472	16 0.630	15.8 0.622	30 1.1811	37 1.457	0.3 0.012	RST025DZ	22.30 5010	31.0 6970	16.0 3600	16.9 3800	23.7 5330	4100	0.155 0.342
62	62 2.4409	20 0.787	19.8 0.780	38 1.4961	46 1.811	0.6 0.024	RST030	33.30 7490	51.0 11470	22.3 5010	23.2 5220	34.2 7690	3200	0.258 0.569
	62 2.4409	20 0.787	19.8 0.780	38 1.4961	46 1.811	0.6 0.024	RST030DZ	33.30 7490	51.0 11470	22.3 5010	23.2 5220	34.2 7690	3200	0.258 0.569
72	72 2.8346	20 0.787	19.8 0.780	42 1.6535	50 1.969	0.6 0.024	RST035	35.20 7910	56.6 12720	25.2 5670	33.3 7490	43.0 9670	2900	0.37 0.816
	72 2.8346	20 0.787	19.8 0.780	42 1.6535	50 1.969	0.6 0.024	RST035DZ	35.20 7910	56.6 12720	25.2 5670	33.3 7490	43.0 9670	2900	0.370 0.816
80	80 3.1496	20 0.787	19.8 0.780	50 1.9685	58 2.283	0.6 0.024	RST040	38.80 8720	67.8 15240	25.9 5820	34.7 7800	45.0 10120	2400	0.430 0.948
	80 3.1496	20 0.787	19.8 0.780	50 1.9685	58 2.283	0.6 0.024	RST040DZ	38.80 8720	67.8 15240	25.9 5820	34.7 7800	45.0 10120	2400	0.430 0.948
85	85 3.3465	20 0.787	19.8 0.780	55 2.1654	63 2.480	0.6 0.024	RST045	40.30 9060	73.5 16520	26.0 5850	35.8 8050	45.5 10230	2200	0.447 0.985
90	90 3.5433	20 0.787	19.8 0.780	60 2.3622	68 2.677	0.6 0.024	RST050	41.80 9400	79.2 17800	26.0 5850	37.1 8340	45.8 10300	2000	0.495 1.091

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. As a Bearing Dynamic	Static	As a Track Roller Dynamic		Static	Limiting Speed Grease	Wt. kg/lbs.
mm	D	d	B	C	F_w	E_w	r_s	r_{ls}		C	C_o	C_w	$F_{r\ perm}$	$F_{Or\ perm}$	RPM	
19	19 0.7480	6 0.2362	10 0.394	9.8 0.386	10 0.3937	13 0.5118	0.3 0.012	0.3 0.012	STO6	5.40 1210	6.43 1450	4.15 933	4.04 908	5.63 1270	9400	0.018 0.040
	19 0.7480	6 0.2362	10 0.394	9.8 0.386	10 0.3937	13 0.5118	0.3 0.012	0.3 0.012	STO6DZ	5.40 1210	6.43 1450	4.15 933	4.04 908	5.63 1270	9400	0.018 0.040
24	24 0.9449	8 0.3150	10 0.394	9.8 0.386	12 0.4724	15 0.5906	0.3 0.012	0.3 0.012	STO8	5.85 1320	7.51 1690	4.79 1080	6.67 1500	7.44 1670	8100	0.028 0.062
	24 0.9449	8 0.3150	10 0.394	9.8 0.386	12 0.4724	15 0.5906	0.3 0.012	0.3 0.012	STO8DZ	5.85 1320	7.51 1690	4.79 1080	6.67 1500	7.44 1670	8100	0.028 0.062
30	30 1.1811	10 0.3937	12 0.472	11.8 0.465	14 0.5512	20 0.7874	0.3 0.012	0.3 0.012	STO10	10.4 2340	10.6 2380	8.62 1940	7.69 1730	10.6 2380	6300	0.065 0.143
	30 1.1811	10 0.3937	12 0.472	11.8 0.465	14 0.5512	20 0.7874	0.3 0.012	0.3 0.012	STO10DZ	10.4 2340	10.6 2380	8.62 1940	7.69 1730	10.6 2380	6300	0.065 0.143
32	32 1.2598	12 0.4724	12 0.472	11.8 0.465	16 0.6299	22 0.8661	0.3 0.012	0.3 0.012	STO12	11.2 2520	11.9 2680	8.80 1980	7.65 1720	10.9 2450	5800	0.114 0.251
	32 1.2598	12 0.4724	12 0.472	11.8 0.465	16 0.6299	22 0.8661	0.3 0.012	0.3 0.012	STO12DZ	11.2 2520	11.9 2680	8.80 1980	7.65 1720	10.9 2450	5800	0.114 0.251
35	35 1.3780	15 0.5906	12 0.472	11.8 0.465	20 0.7874	26 1.0236	0.3 0.012	0.3 0.012	STO15	12.9 2900	15.3 3440	9.13 2050	6.95 1560	11.2 2520	5000	0.160 0.353
	35 1.3780	15 0.5906	12 0.472	11.8 0.465	20 0.7874	26 1.0236	0.3 0.012	0.3 0.012	STO15DZ	12.9 2900	15.3 3440	9.13 2050	6.95 1560	11.2 2520	5000	0.156 0.344
40	40 1.5748	17 0.6693	16 0.630	15.8 0.622	22 0.8661	29 1.1417	0.3 0.012	0.3 0.012	STO17	19.1 4290	23.3 5240	13.8 3100	11.4 2560	18.2 4090	4100	0.114 0.251
	40 1.5748	17 0.6693	16 0.630	15.8 0.622	22 0.8661	29 1.1417	0.3 0.012	0.3 0.012	STO17DZ	19.1 4290	23.3 5240	13.8 3100	11.4 2560	18.2 4090	4100	0.114 0.251
47	47 1.8504	20 0.7874	16 0.630	15.8 0.622	25 0.9843	32 1.2598	0.3 0.012	0.3 0.012	STO20	19.8 4450	25.3 5690	15.3 3440	16.5 3710	22.2 4990	3200	0.325 0.717
	47 1.8504	20 0.7874	16 0.630	15.8 0.622	25 0.9843	32 1.2598	0.3 0.012	0.3 0.012	STO20DZ	20.0 4500	25.3 5690	15.3 3440	16.5 3710	22.2 4990	3200	0.156 0.344

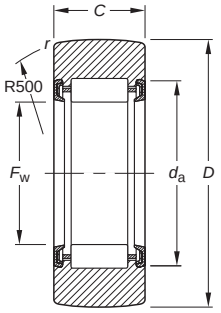
Continued on next page.

C

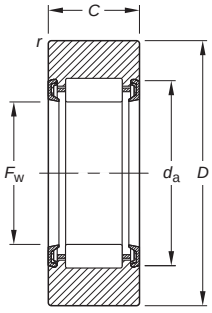
Outer Dia.	Dimensions								Bearing Designation	Load Ratings kN/lbf. As a Bearing Dynamic		As a Track Roller Dynamic		Static	Limiting Speed Grease	Wt. kg/lbs.
mm	D	d	B	C	F_w	E_w	r_s	r_{ls}		C	C_o	C_w	$F_{r\ perm}$	$F_{0r\ perm}$	RPM	
52	52 2.0472	25 0.9843	16 0.630	15.8 0.622	30 1.1811	37 1.4567	0.3 0.012	0.3 0.012	STO25	22.4 5040	31.0 6970	16.0 3600	16.9 3800	23.7 5330	2900	0.435 0.959
	52 2.0472	25 0.9843	16 0.630	15.8 0.622	30 1.1811	37 1.4567	0.3 0.012	0.3 0.012	STO25DZ	22.4 5040	31.0 6970	16.0 3600	16.9 3800	23.7 5330	2900	0.435 0.959
62	62 2.4409	30 1.1811	20 0.787	19.8 0.780	38 1.4961	46 1.8110	0.6 0.024	0.6 0.024	STO30	33.3 7490	51.0 11470	22.3 5010	23.2 5220	34.2 7690	2400	0.325 0.717
	62 2.4409	30 1.1811	20 0.787	19.8 0.780	38 1.4961	46 1.8110	0.6 0.024	0.6 0.024	STO30DZ	33.3 7490	51.0 11470	22.3 5010	23.2 5220	34.2 7690	2400	0.325 0.717
72	72 2.8346	35 1.3780	20 0.787	19.8 0.780	42 1.6535	50 1.9685	0.6 0.024	0.6 0.024	STO35	35.2 7910	56.6 12720	25.2 5670	33.3 7490	43.0 9670	2200	0.435 0.959
	72 2.8346	35 1.3780	20 0.787	19.8 0.780	42 1.6535	50 1.9685	0.6 0.024	0.6 0.024	STO35DZ	35.2 7910	56.6 12720	25.2 5670	33.3 7490	43.0 9670	2200	0.435 0.959
80	80 3.1496	40 1.5748	20 0.787	19.8 0.780	50 1.9685	58 2.2835	0.6 0.024	1.0 0.039	STO40	38.8 8720	67.8 15240	25.9 5820	34.7 7800	45.0 10120	2000	0.540 1.190
	80 3.1496	40 1.5748	20 0.787	19.8 0.780	50 1.9685	58 2.2835	0.6 0.024	1.0 0.039	STO40DZ	38.8 8720	67.8 15240	25.9 5820	34.7 7800	45.0 10120	2000	0.540 1.190
85	85 3.3465	45 1.7717	20 0.787	19.8 0.780	55 2.1654	63 2.4803	0.6 0.024	1.0 0.039	STO45	40.3 9060	73.5 16520	26.0 5850	35.8 8050	45.5 10230	13000	0.580 1.279
	85 3.3465	45 1.7717	20 0.787	19.8 0.780	55 2.1654	63 2.4803	0.6 0.024	1.0 0.039	STO45DZ	40.3 9060	73.5 16520	26.0 5850	35.8 8050	45.5 10230	13000	0.580 1.279
90	90 3.5433	50 1.9685	20 0.787	19.8 0.780	60 2.3622	68 2.6772	0.6 0.024	1.0 0.039	STO50	41.8 9400	79.2 17800	26.0 5850	37.1 8340	45.8 10300	10000	0.650 1.433
	90 3.5433	50 1.9685	20 0.787	19.8 0.780	60 2.3622	68 2.6772	0.6 0.024	1.0 0.039	STO50DZ	41.8 9400	79.2 17800	26.0 5850	37.1 8340	45.8 10300	10000	0.650 1.433

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

METRIC SERIES



RNA22.2RS



RNA22.2RS.DZ

C

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

Continued on next page.

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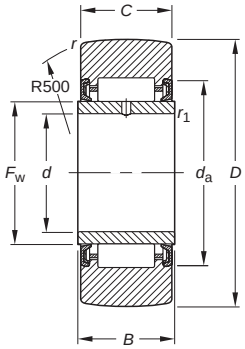
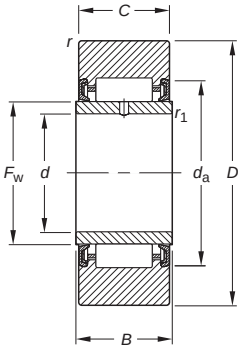
Outer Dia.	Dimensions					Bearing Designation	Load Ratings kN/lbf. As a Bearing Dynamic	As a Bearing Static	As a Track Roller Dynamic		As a Track Roller Static	Limiting Speed Grease	Wt. kg/lbs.
mm	D	C	F_w	E_w	r_s		C	C_o	C_w	$F_{r\ perm}$	$F_{Or\ perm}$	RPM	
52	52 2.0472	17.8 0.701	30 1.1811	40 1.575	1.0 0.039	RNA2205.2RS	21.6 4860	24.3 5460	15.5 3480	11.3 2540	17.7 3980	4300	0.171 0.377
	52 2.0472	17.8 0.701	30 1.1811	40 1.575	1.0 0.039	RNA2205.2RS.DZ	21.6 4860	24.3 5460	15.5 3480	11.3 2540	17.7 3980	4300	0.171 0.377
62	62 2.4409	19.8 0.780	35 1.3780	47 1.850	1.0 0.039	RNA2206.2RS	29.0 6520	32.8 7370	21.2 4770	15.8 3550	24.8 5580	3700	0.285 0.628
	62 2.4409	19.8 0.780	35 1.3780	47 1.850	1.0 0.039	RNA2206.2RS.DZ	29.7 6680	32.8 7370	21.2 4770	15.8 3550	24.8 5580	3700	0.285 0.628
72	72 2.8346	22.8 0.898	42 1.6535	54 2.126	1.1 0.043	RNA2207.2RS	40.5 9100	52.5 11800	28.6 6430	24.2 5440	37.9 8520	3000	0.490 1.080
	72 2.8346	22.8 0.898	42 1.6535	54 2.126	1.1 0.043	RNA2207.2RS.DZ	40.5 9100	52.5 11800	28.6 6430	24.2 5440	37.9 8520	3000	0.420 0.926
80	80 3.1496	22.8 0.898	48 1.8898	60 2.362	1.1 0.043	RNA2208.2RS	44.0 9890	60.0 13490	30.4 6830	27.8 6250	42.0 9440	2600	0.515 1.135
	80 3.1496	22.8 0.898	48 1.8898	60 2.362	1.1 0.043	RNA2208.2RS.DZ	44.3 9960	60.0 13490	30.4 6830	27.8 6250	42.0 9440	2600	0.515 1.135
85	85 3.3465	22.8 0.898	52 2.0472	64 2.520	1.1 0.043	RNA2209.2RS	45.6 10250	63.9 14370	30.9 6950	29.7 6680	43.7 9820	2400	0.565 1.246
	85 3.3465	22.8 0.898	52 2.0472	64 2.520	1.1 0.043	RNA2209.2RS.DZ	45.6 10250	63.9 14370	30.9 6950	29.7 6680	43.7 9820	2400	0.565 1.246
90	90 3.5433	22.8 0.898	58 2.2835	70 2.756	1.1 0.043	RNA2210.2RS	48.5 10900	71.3 16030	31.0 6970	29.4 6610	43.4 9760	2100	0.590 1.301
	90 3.5433	22.8 0.898	58 2.2835	70 2.756	1.1 0.043	RNA2210.2RS.DZ	48.5 10900	71.3 16030	31.0 6970	29.4 6610	43.4 9760	2100	0.590 1.301

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. As a Bearing Dynamic		As a Track Roller Dynamic			Speed Grease	Wt. kg/lbs.
											Static			Static		
mm	D	d	B	C	F_w	E_w	r_s	r_{1s}		C	C_o	C_w	$F_{r\ perm}$	$F_{Or\ perm}$	RPM	
19	19 0.7480	6 0.2362	12 0.472	11.8 0.465	10 0.3937	14 0.5512	0.3 0.012	0.3 0.012	NA22/6.2RS	4.70 1060	5.43 1220	4.13 928	3.06 688	4.59 1030	13000	0.018 0.040
	19 0.7480	6 0.2362	12 0.472	11.8 0.465	10 0.3937	14 0.5512	0.3 0.012	0.3 0.012	NA22/6.2RS.DZ	4.70 1060	4.55 1020	4.13 928	3.06 688	4.59 1030	13000	0.018 0.040
24	24 0.9449	8 0.3150	12 0.472	11.8 0.465	12 0.4724	18 0.7087	0.3 0.012	0.3 0.012	NA22/8.2RS	6.70 1510	6.08 1370	5.31 1190	3.37 758	5.22 1170	11000	0.031 0.068
	24 0.9449	8 0.3150	12 0.472	11.8 0.465	12 0.4724	18 0.7087	0.3 0.012	0.3 0.012	NA22/8.2RS.DZ	6.70 1510	6.08 1370	5.31 1190	3.37 758	5.22 1170	11000	0.031 0.068
30	30 1.1811	10 0.3937	14 0.551	13.8 0.543	14 0.5512	20 0.7874	0.6 0.024	0.3 0.012	NA2200.2RS	8.50 1910	9.45 2120	8.03 1810	7.85 1760	9.45 2120	9400	0.057 0.126
	30 1.1811	10 0.3937	14 0.551	13.8 0.543	14 0.5512	20 0.7874	0.6 0.024	0.3 0.012	NA2200.2RS.DZ	8.50 1910	9.45 2120	8.03 1810	7.85 1760	9.45 2120	9400	0.057 0.126
32	32 1.2598	12 0.4724	14 0.551	13.8 0.543	16 0.6299	22 0.8661	0.6 0.024	0.3 0.012	NA2201.2RS	9.00 2020	10.5 2360	8.20 1840	7.78 1750	10.1 2270	8100	0.063 0.139
	32 1.2598	12 0.4724	14 0.551	13.8 0.543	16 0.6299	22 0.8661	0.6 0.024	0.3 0.012	NA2201.2RS.DZ	9.00 2020	10.5 2360	8.20 1840	7.78 1750	10.1 2270	8100	0.063 0.139
35	35 1.3780	15 0.5906	14 0.551	13.8 0.543	20 0.7874	27 1.0630	0.6 0.024	0.3 0.012	NA2202.2RS	12.2 2740	14.5 3260	9.24 2080	6.00 1350	10.2 2290	6300	0.070 0.154
	35 1.3780	15 0.5906	14 0.551	13.8 0.543	20 0.7874	27 1.0630	0.6 0.024	0.3 0.012	NA2202.2RS.DZ	12.2 2740	14.5 3260	9.24 2080	6.00 1350	10.2 2290	6300	0.070 0.154
40	40 1.5748	17 0.6693	16 0.630	15.8 0.622	22 0.8661	30 1.1811	1.0 0.039	0.3 0.012	NA2203.2RS	16.3 3660	17.8 4000	11.9 2680	8.50 1910	13.7 3080	5900	0.107 0.236
	40 1.5748	17 0.6693	16 0.630	15.8 0.622	22 0.8661	30 1.1811	1.0 0.039	0.3 0.012	NA2203.2RS.DZ	16.3 3660	17.8 4000	11.9 2680	8.50 1910	13.7 3080	5900	0.107 0.236
47	47 1.8504	20 0.7874	18 0.709	17.8 0.701	25 0.9843	35 1.3780	1.0 0.039	0.3 0.012	NA2204.2RS	19.6 4410	20.2 4540	14.8 3330	11.0 2470	16.7 3750	5200	0.175 0.386
	47 1.8504	20 0.7874	18 0.709	17.8 0.701	25 0.9843	35 1.3780	1.0 0.039	0.3 0.012	NA2204.2RS.DZ	19.6 4410	20.2 4540	14.8 3330	11.0 2470	16.7 3750	5200	0.175 0.386

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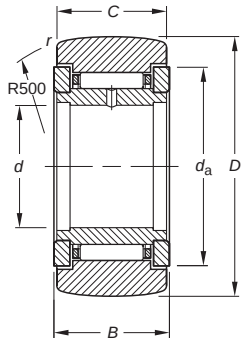
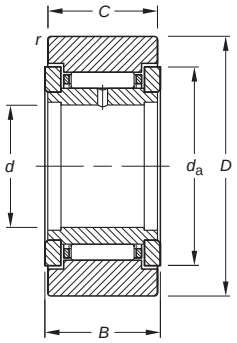
Outer Dia.	Dimensions								Bearing Designation	Load Ratings kN/lbf. As a Bearing Dynamic	As a Bearing Static	As a Track Roller Dynamic	As a Track Roller Static		Speed Grease	Wt. kg/lbs.
mm	D	d	B	C	F_w	E_w	r_s	r_{1s}		C	C_o	C_w	$F_{r\ perm}$	$F_{0r\ perm}$	RPM	
52	52 2.0472	25 0.9843	18 0.709	17.8 0.701	30 1.1811	40 1.5748	1.0 0.039	0.3 0.012	NA2205.2RS	21.6 4860	24.3 5460	15.5 3480	11.3 2540	17.7 3980	4300	0.202 0.445
	52 2.0472	25 0.9843	18 0.709	17.8 0.701	30 1.1811	40 1.5748	1.0 0.039	0.3 0.012	NA2205.2RS.DZ	21.6 4860	24.3 5460	15.5 3480	11.3 2540	17.7 3980	4300	0.202 0.445
62	62 2.4409	30 1.1811	20 0.787	19.8 0.780	35 1.3780	47 1.8504	1.0 0.039	0.3 0.012	NA2206.2RS	29.0 6520	32.8 7370	21.2 4770	15.8 3550	24.8 5580	3700	0.324 0.714
	62 2.4409	30 1.1811	20 0.787	19.8 0.780	35 1.3780	47 1.8504	1.0 0.039	0.3 0.012	NA2206.2RS.DZ	29.0 6520	32.8 7370	21.2 4770	15.8 3550	24.8 5580	3700	0.324 0.714
72	72 2.8346	35 1.3780	23 0.906	22.8 0.898	42 1.6535	54 2.1260	1.1 0.043	0.6 0.024	NA2207.2RS	40.5 9100	52.5 11800	28.6 6430	24.2 5440	37.9 8520	3000	0.490 1.080
	72 2.8346	35 1.3780	23 0.906	22.8 0.898	42 1.6535	54 2.1260	1.1 0.043	0.6 0.024	NA2207.2RS.DZ	40.5 9100	52.5 11800	28.6 6430	24.2 5440	37.9 8520	3000	0.490 1.080
80	80 3.1496	40 1.5748	23 0.906	22.8 0.898	48 1.8898	60 2.3622	1.1 0.043	0.6 0.024	NA2208.2RS	44.0 9890	60.0 13500	30.4 6830	27.8 6250	42.0 9440	2600	0.615 1.356
	80 3.1496	40 1.5748	23 0.906	22.8 0.898	48 1.8898	60 2.3622	1.1 0.043	0.6 0.024	NA2208.2RS.DZ	44.0 9890	60.0 13500	30.4 6830	27.8 6250	42.0 9440	2600	0.615 1.356
85	85 3.3465	45 1.7717	23 0.906	22.8 0.898	52 2.0472	64 2.5197	1.1 0.043	0.6 0.024	NA2209.2RS	45.0 10100	63.9 14400	30.9 6950	29.7 6680	43.7 9820	2400	0.661 1.457
	85 3.3465	45 1.7717	23 0.906	22.8 0.898	52 2.0472	64 2.5197	1.1 0.043	0.6 0.024	NA2209.2RS.DZ	45.0 10100	63.9 14400	30.9 6950	29.7 6680	43.7 9820	2400	0.661 1.457
90	90 3.5433	50 1.9685	23 0.906	22.8 0.898	58 2.2835	70 2.7559	1.1 0.043	0.6 0.024	NA2210.2RS	48.0 10800	71.3 16000	31.0 6970	29.4 6610	43.4 9760	2100	0.712 1.570
	90 3.5433	50 1.9685	23 0.906	22.8 0.898	58 2.2835	70 2.7559	1.1 0.043	0.6 0.024	NA2210.2RS.DZ	48.0 10800	71.3 16000	31.0 6970	29.4 6610	43.4 9760	2100	0.712 1.570

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

METRIC SERIES



NATR



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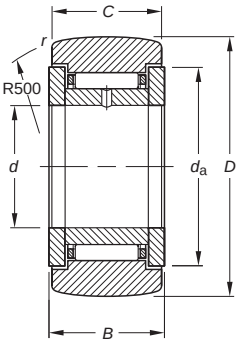

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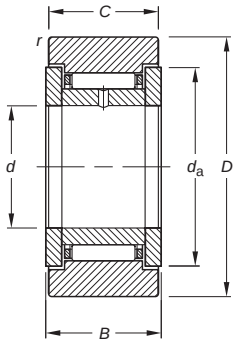


STO.ZZ.DZ

Outer Dia.	Dimensions						Bearing Designation	Load Ratings kN/lbf. As a Bearing Dynamic	As a Bearing Static	As a Track Roller Dynamic	As a Track Roller Static		Limiting Speed Grease	Wt. kg/lbs.
mm	D	d	B	C	d_a	r_s		C	C_o	C_w	$F_{r\ perm}$	$F_{Or\ perm}$	RPM	
16	16 0.6299	5 0.1969	12 0.472	11.0 0.433	13 0.512	0.3 0.012	NATR5	4.62 1040	5.19 1170	3.34 751	2.62 589	4.01 901	13000	0.017 0.037
	16 0.6299	5 0.1969	12 0.472	11.0 0.433	13 0.512	0.3 0.012	NATR5DZ	4.62 1040	5.19 1170	3.34 751	2.62 589	4.01 901	13000	0.017 0.037
19	19 0.7480	6 0.2362	12 0.472	11.0 0.433	16 0.630	0.3 0.012	NATR6	4.84 1090	5.66 1270	3.84 863	4.28 962	5.28 1190	12000	0.022 0.049
	19 0.7480	6 0.2362	12 0.472	11.0 0.433	16 0.630	0.3 0.012	NATR6DZ	5.84 1310	6.66 1500	3.84 863	4.28 962	5.28 1190	12000	0.022 0.049
	19 0.7480	6 0.2362	14 0.551	13.8 0.543	15 0.591	0.3 0.012	STO6ZZ	5.37 1210	6.47 1450	4.31 969	5.23 1180	6.17 1390	12000	0.024 0.053
	19 0.7480	6 0.2362	14 0.551	13.8 0.543	15 0.591	0.3 0.012	STO6ZZ.DZ	5.37 1210	6.47 1450	4.31 969	5.23 1180	6.17 1390	12000	0.024 0.053
24	24 0.9449	8 0.3150	14 0.551	13.8 0.543	18 0.709	0.3 0.012	STO8ZZ	5.82 1310	7.54 1700	4.97 1120	7.54 1700	8.14 1830	9900	0.040 0.088
	24 0.9449	8 0.3150	14 0.551	13.8 0.543	18 0.709	0.3 0.012	STO8ZZ.DZ	5.82 1310	7.54 1700	4.97 1120	7.54 1700	8.14 1830	9900	0.040 0.088
	24 0.9449	8 0.3150	15 0.591	14.0 0.551	20 0.787	0.3 0.012	NATR8	8.39 1890	8.67 1950	6.66 1500	5.79 1300	8.08 1820	10000	0.043 0.095
	24 0.9449	8 0.3150	15 0.591	14.0 0.551	20 0.787	0.3 0.012	NATR8DZ	9.39 2110	9.67 2170	6.66 1500	5.79 1300	8.08 1820	10000	0.043 0.095
30	30 1.1811	10 0.3937	15 0.591	14.0 0.551	24 0.945	0.6 0.024	NATR10	9.57 2150	9.45 2120	8.15 1830	8.58 1930	10.1 2270	9400	0.068 0.150
	30 1.1811	10 0.3937	15 0.591	14.0 0.551	24 0.945	0.6 0.024	NATR10DZ	9.57 2150	9.45 2120	8.15 1830	8.58 1930	10.1 2270	9400	0.068 0.150
	30 1.1811	10 0.3937	16 0.630	15.8 0.622	23 0.906	0.3 0.012	STO10ZZ	10.4 2340	10.6 2380	8.94 2010	9.64 2170	11.4 2560	9400	0.071 0.157
	30 1.1811	10 0.3937	16 0.630	15.8 0.622	23 0.906	0.3 0.012	STO10ZZ.DZ	10.4 2340	10.6 2380	8.94 2010	9.64 2170	11.4 2560	9400	0.071 0.157
32	32 1.2598	12 0.4724	15 0.591	14.0 0.551	26 1.024	0.6 0.024	NATR12	10.2 2290	10.5 2360	8.32 1870	8.50 1910	10.4 2340	8100	0.075 0.165
	32 1.2598	12 0.4724	15 0.591	14.0 0.551	26 1.024	0.6 0.024	NATR12DZ	10.2 2290	10.5 2360	8.32 1870	8.50 1910	10.4 2340	8100	0.075 0.165
	32 1.2598	12 0.4724	16 0.630	15.8 0.622	25 0.984	0.3 0.012	STO12ZZ	11.2 2520	11.9 2680	9.13 2050	9.54 2140	11.7 2630	8100	0.078 0.172
	32 1.2598	12 0.4724	16 0.630	15.8 0.622	25 0.984	0.3 0.012	STO12ZZ.DZ	11.2 2520	11.9 2680	9.13 2050	9.54 2140	11.7 2630	8100	0.078 0.172

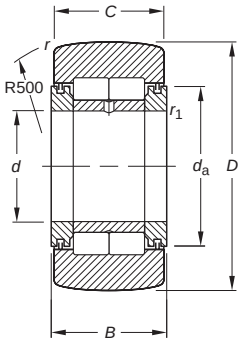
Continued on next page.

C

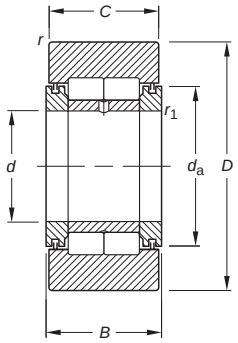
Outer Dia.	Dimensions						Bearing Designation	Load Ratings kN/lbf. As a Bearing Dynamic	As a Bearing Static	As a Track Roller Dynamic		As a Track Roller Static	Limiting Speed Grease	Wt. kg/lbs.
mm	D	d	B	C	d_a	r_s		C	C_o	C_w	$F_{r\ perm}$	$F_{Or\ perm}$	RPM	
35	35 1.3780	15 0.5906	16 0.630	15.8 0.622	30 1.181	0.3 0.012	STO15ZZ	12.9 2900	15.3 3440	9.47 2130	8.52 1920	12.1 2720	6300	0.089 0.196
	35 1.3780	15 0.5906	16 0.630	15.8 0.622	30 1.181	0.3 0.012	STO15ZZ.DZ	12.9 2900	15.3 3440	9.47 2130	8.52 1920	12.1 2720	6300	0.089 0.196
40	40 1.5748	17 0.6693	20 0.787	19.8 0.780	33 1.299	0.3 0.012	STO17ZZ	19.0 4270	23.3 5240	14.2 3190	13.4 3010	19.3 4340	5600	0.145 0.320
	40 1.5748	17 0.6693	20 0.787	19.8 0.780	33 1.299	0.3 0.012	STO17ZZ.DZ	19.0 4270	23.3 5240	14.2 3190	13.4 3010	19.3 4340	5600	0.145 0.320
47	47 1.8504	20 0.7874	20 0.787	19.8 0.780	37 1.457	0.3 0.012	STO20ZZ	20.0 4500	25.4 5710	15.7 3530	19.5 4380	23.5 5280	4900	0.200 0.441
	47 1.8504	20 0.7874	20 0.787	19.8 0.780	37 1.457	0.3 0.012	STO20ZZ.DZ	20.0 4500	25.4 5710	15.7 3530	19.5 4380	23.5 5280	4900	0.200 0.441
52	52 2.0472	25 0.9843	20 0.787	19.8 0.780	42 1.654	0.3 0.012	STO25ZZ	22.4 5040	31.1 6990	16.4 3690	19.8 4450	25.1 5640	4100	0.240 0.529
	52 2.0472	25 0.9843	20 0.787	19.8 0.780	42 1.654	0.3 0.012	STO25ZZ.DZ	22.4 5040	31.1 6990	16.4 3690	19.8 4450	25.1 5640	4100	0.240 0.529
62	62 2.4409	30 1.1811	25 0.984	24.8 0.976	52 2.047	0.6 0.024	STO30ZZ	33.3 7490	51.0 11500	23.0 5170	26.9 6050	36.2 8140	3200	0.412 0.908
	62 2.4409	30 1.1811	25 0.984	24.8 0.976	52 2.047	0.6 0.024	STO30ZZ.DZ	33.3 7490	51.0 11500	23.0 5170	26.9 6050	36.2 8140	3200	0.412 0.908
72	72 2.8346	35 1.3780	25 0.984	24.8 0.976	56 2.205	0.6 0.024	STO35ZZ	35.2 7910	56.6 12700	25.9 5820	39.2 8810	45.5 10200	2900	0.555 1.224
	72 2.8346	35 1.3780	25 0.984	24.8 0.976	56 2.205	0.6 0.024	STO35ZZ.DZ	35.2 7910	56.6 12700	25.9 5820	39.2 8810	45.5 10200	2900	0.555 1.224
80	80 3.1496	40 1.5748	26 1.024	25.8 1.016	64 2.520	0.6 0.024	STO40ZZ	38.8 8720	67.8 15200	26.8 6020	41.5 9330	48.1 10800	2400	0.700 1.543
	80 3.1496	40 1.5748	26 1.024	25.8 1.016	64 2.520	0.6 0.024	STO40ZZ.DZ	38.8 8720	67.8 15200	26.8 6020	41.5 9330	48.1 10800	2400	0.700 1.543
85	85 3.3465	45 1.7717	26 1.024	25.8 1.016	69 2.717	0.6 0.024	STO45ZZ	40.3 9060	73.5 16500	26.9 6050	42.4 9530	48.6 10900	2200	0.770 1.698
	85 3.3465	45 1.7717	26 1.024	25.8 1.016	69 2.717	0.6 0.024	STO45ZZ.DZ	40.3 9060	73.5 16500	26.9 6050	42.4 9530	48.6 10900	2200	0.770 1.698

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

METRIC SERIES



NUTR



NUTR.DZ

Outer Dia.	Dimensions							Bearing Designation	Load Ratings kN/lbf. As a Bearing Dynamic	As a Bearing Static	As a Track Roller Dynamic	As a Track Roller Dynamic	As a Track Roller Static	Limiting Speed Grease	Wt. kg/lbs.
mm	D	d	B	C	d_a	r_s	r_{ls}		C	C_o	C_w	$F_{r\ perm}$	$F_{Or\ perm}$	RPM	
35	35 1.3780	15 0.5906	19 0.748	18 0.709	24 0.945	0.6 0.024	0.3 0.012	NUTR15	24.7 5550	29.3 6590	16.2 3640	10.1 2270	16.1 3620	6100	0.105 0.231
	35 1.3780	15 0.5906	19 0.748	18 0.709	24 0.945	0.6 0.024	0.3 0.012	NUTR15DZ	22.8 5130	29.4 6610	16.2 3640	10.1 2270	16.1 3620	6100	0.105 0.231
40	40 1.5748	17 0.6693	21 0.827	20 0.787	27 1.063	1.0 0.039	0.3 0.012	NUTR17	26.6 5980	33.4 7510	18.7 4200	15.0 3370	23.9 5370	5300	0.154 0.340
	40 1.5748	17 0.6693	21 0.827	20 0.787	27 1.063	1.0 0.039	0.3 0.012	NUTR17DZ	24.5 5510	33.3 7490	18.7 4200	15.0 3370	23.9 5370	5300	0.154 0.340
42	42 1.6535	15 0.5906	19 0.748	18 0.709	24 0.945	0.6 0.024	0.3 0.012	NUTR1542	22.8 5130	29.4 6610	20.0 4500	21.2 4770	28.4 6380	6100	0.166 0.366
	42 1.6535	15 0.5906	19 0.748	18 0.709	24 0.945	0.6 0.024	0.3 0.012	NUTR1542DZ	22.8 5130	29.4 6610	20.0 4500	21.2 4770	28.4 6380	6100	0.166 0.366
47	47 1.8504	17 0.6693	21 0.827	20 0.787	27 1.063	1.0 0.039	0.3 0.012	NUTR1747	24.5 5510	33.3 7490	22.0 4950	28.1 6320	33.6 7550	5300	0.230 0.507
	47 1.8504	17 0.6693	21 0.827	20 0.787	27 1.063	1.0 0.039	0.3 0.012	NUTR1747DZ	24.5 5510	33.3 7490	22.0 4950	28.1 6320	33.6 7550	5300	0.230 0.507
	47 1.8504	20 0.7874	25 0.984	24 0.945	32 1.260	1.0 0.039	0.3 0.012	NUTR20	39.0 8770	53.2 12000	28.1 6320	20.5 4610	32.7 7350	4500	0.254 0.560
	47 1.8504	20 0.7874	25 0.984	24 0.945	32 1.260	1.0 0.039	0.3 0.012	NUTR20DZ	39.0 8770	53.2 12000	28.1 6320	20.5 4610	32.7 7350	4500	0.254 0.560
52	52 2.0472	20 0.7874	25 0.984	24 0.945	32 1.260	1.0 0.039	0.3 0.012	NUTR2052	39.0 8770	53.2 12000	31.6 7100	31.0 6970	45.9 10300	4500	0.326 0.719
	52 2.0472	20 0.7874	25 0.984	24 0.945	32 1.260	1.0 0.039	0.3 0.012	NUTR2052DZ	39.0 8770	53.2 12000	31.6 7100	31.0 6970	45.9 10300	4500	0.326 0.719
	52 2.0472	25 0.9843	25 0.984	24 0.945	37 1.457	1.0 0.039	0.3 0.012	NUTR25	43.0 9670	63.1 14200	29.6 6650	22.2 4990	35.4 7960	3700	0.291 0.642
	52 2.0472	25 0.9843	25 0.984	24 0.945	37 1.457	1.0 0.039	0.3 0.012	NUTR25DZ	43.0 9670	63.1 14200	29.6 6650	22.2 4990	35.4 7960	3700	0.291 0.642
62	62 2.4409	25 0.9843	25 0.984	24 0.945	37 1.457	1.0 0.039	0.3 0.012	NUTR2562	43.0 9670	63.1 14200	36.0 8090	43.9 9870	57.8 13000	3700	0.460 1.014
	62 2.4409	25 0.9843	25 0.984	24 0.945	37 1.457	1.0 0.039	0.3 0.012	NUTR2562DZ	43.0 9670	63.1 14200	36.0 8090	43.9 9870	57.8 13000	3700	0.460 1.014
	62 2.4409	30 1.1811	29 1.142	28 1.102	44 1.732	1.0 0.039	0.3 0.012	NUTR30	60.0 13500	83.1 18700	40.8 9170	29.0 6520	46.2 10400	3200	0.480 1.058
	62 2.4409	30 1.1811	29 1.142	28 1.102	44 1.732	1.0 0.039	0.3 0.012	NUTR30DZ	60.0 13500	83.1 18700	40.8 9170	29.0 6520	46.2 10400	3200	0.480 1.058

Continued on next page.

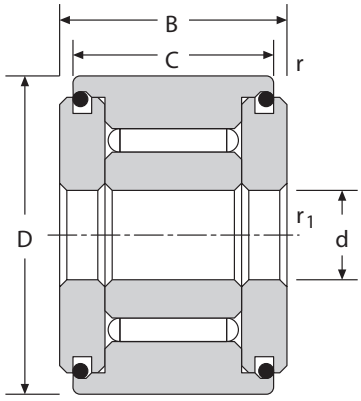
C

Outer Dia.	Dimensions							Bearing Designation	Load Ratings kN/lbf. As a Bearing Dynamic	As a Bearing Static	As a Track Roller Dynamic		As a Track Roller Static	Limiting Speed Grease	Wt. kg/lbs.
mm	D	d	B	C	d_a	r_s	r_{1s}		C	C_o	C_w	$F_{r\ perm}$	$F_{0r\ perm}$	RPM	
72	72 2.8346	30 1.1811	29 1.142	28 1.102	44 1.732	1.0 0.039	0.3 0.012	NUTR3072	60.0 13500	83.1 18700	48.6 10900	53.2 12000	74.2 16700	3200	0.711 1.567
	72 2.8346	30 1.1811	29 1.142	28 1.102	44 1.732	1.0 0.039	0.3 0.012	NUTR3072DZ	60.0 13500	83.1 18700	48.6 10900	53.2 12000	74.2 16700	3200	0.711 1.567
	72 2.8346	35 1.3780	29 1.142	28 1.102	50 1.969	1.1 0.043	0.6 0.024	NUTR35	65.5 14700	97.8 22000	45.9 10300	38.7 8700	61.7 13900	2600	0.655 1.444
	72 2.8346	35 1.3780	29 1.142	28 1.102	50 1.969	1.1 0.043	0.6 0.024	NUTR35DZ	65.5 14700	97.8 22000	45.9 10300	38.7 8700	61.7 13900	2600	0.655 1.444
80	80 3.1496	35 1.3780	29 1.142	28 1.102	50 1.969	1.1 0.043	0.6 0.024	NUTR3580	65.5 14700	97.8 22000	51.7 11600	58.7 13200	81.9 18400	2600	0.865 1.907
	80 3.1496	35 1.3780	29 1.142	28 1.102	50 1.969	1.1 0.043	0.6 0.024	NUTR3580DZ	65.5 14700	97.8 22000	51.7 11600	58.7 13200	81.9 18400	2600	0.865 1.907
	80 3.1496	40 1.5748	32 1.260	30 1.181	55 2.165	1.1 0.043	0.6 0.024	NUTR40	88.0 19800	132 29700	60.6 13600	48.0 10800	76.5 17200	2500	0.848 1.870
	80 3.1496	40 1.5748	32 1.260	30 1.181	55 2.165	1.1 0.043	0.6 0.024	NUTR40DZ	88.0 19800	132 29700	60.6 13600	48.0 10800	76.5 17200	2500	0.848 1.870
85	85 3.3465	45 1.7717	32 1.260	30 1.181	60 2.362	1.1 0.043	0.6 0.024	NUTR45	93.0 20900	146 32800	62.0 13900	50.2 11300	80.0 18000	2200	0.917 2.022
	85 3.3465	45 1.7717	32 1.260	30 1.181	60 2.362	1.1 0.043	0.6 0.024	NUTR45DZ	93.0 20900	146 32800	62.0 13900	50.2 11300	80.0 18000	2200	0.917 2.022
90	90 3.5433	40 1.5748	32 1.260	30 1.181	55 2.165	1.1 0.043	0.6 0.024	NUTR4090	88.0 19800	132 29700	69.1 15500	75.4 17000	111 25000	2500	1.162 2.562
	90 3.5433	40 1.5748	32 1.260	30 1.181	55 2.165	1.1 0.043	0.6 0.024	NUTR4090DZ	88.0 19800	132 29700	69.1 15500	75.4 17000	111 25000	2500	1.162 2.562
	90 3.5433	50 1.9685	32 1.260	30 1.181	65 2.559	1.1 0.043	0.6 0.024	NUTR50	98.0 22000	160 36000	63.3 14200	52.9 11900	84.3 19000	2000	0.988 2.178
	90 3.5433	50 1.9685	32 1.260	30 1.181	65 2.559	1.1 0.043	0.6 0.024	NUTR50DZ	98.0 22000	160 36000	63.3 14200	52.9 11900	84.3 19000	2000	0.988 2.178
100	100 3.9370	45 1.7717	32 1.260	30 1.181	60 2.362	1.1 0.043	0.6 0.024	NUTR45100	93.0 20900	146 32800	74.3 16700	92.2 20700	127 28600	2200	1.412 3.113
	100 3.9370	45 1.7717	32 1.260	30 1.181	60 2.362	1.1 0.043	0.6 0.024	NUTR45100DZ	93.0 20900	146 32800	74.3 16700	92.2 20700	127 28600	2200	1.412 3.113
110	110 4.3307	50 1.9685	32 1.260	30 1.181	65 2.559	1.1 0.043	0.6 0.024	NUTR50110	98.0 22000	160 36000	79.0 17800	110 24700	141 31700	2000	1.727 3.807
	110 4.3307	50 1.9685	32 1.260	30 1.181	65 2.559	1.1 0.043	0.6 0.024	NUTR50110DZ	98.0 22000	160 36000	79.0 17800	110 24700	141 31700	2000	1.727 3.807

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

METRIC SERIES

FP: convex outer ring
FPL: cylindrical outer ring



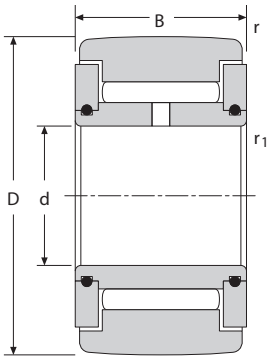
FP, FPL

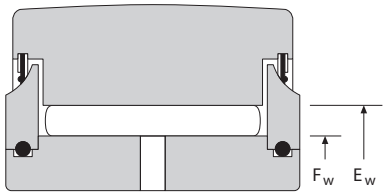
Outside Dia.	Dimensions mm/in.						Designation Profiled Track Roller	Designation Cylindrical Track Roller	Load Ratings kN/lbf. Dynamic		Static	Limiting Speed Grease	Wt. kg/lbs.
mm	D	d	C	B	r_{smin}	r_{1smin}			C	$F_{r\ perm}$	$F_{0r\ perm}$	RPM	
10	10 0.3937	3 0.1181	8 0.315	8.7 0.343	0.2 0.008	0.15 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

C

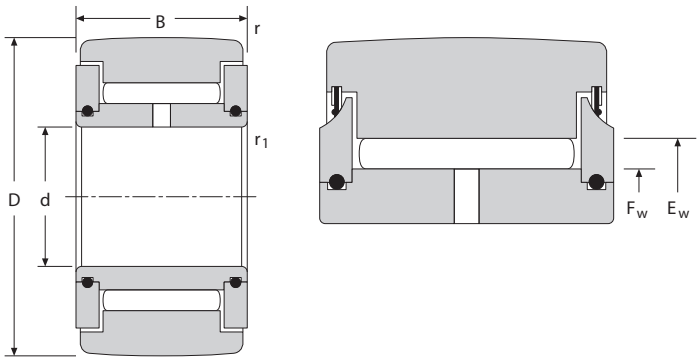
Outside Dia.	Dimensions mm/in.							Designation		Load Ratings kN/lbf.			Limiting Speed	Wt. kg/lbs.
								Profiled Track Roller	Cylindrical Track Roller	Dynamic		Static	Grease	
mm	D	d	B	F_w	E_w	r_{smin}	r_{1smin}			C	$F_{r\,perm}$	$F_{0r\,perm}$	RPM	
16	16 0.6299	5 0.1969	12 0.472	7.7 0.3031	10.7 0.4213	0.3 0.012	0.3 0.012	FG 5 16	FGL 5 16	5.05 1140	3.25 730	5.40 1210	9300	0.016 0.035
	16 0.6299	5 0.1969	12 0.472	7.7 0.3031	10.7 0.4213	0.3 0.012	0.3 0.012	FG 5 16 EE	FGL 5 16 EE	5.05 1140	3.25 730	5.40 1210	9300	0.016 0.035
	16 0.6299	5 0.1969	12 0.472	7.7 0.3031	10.7 0.4213	0.3 0.012	0.3 0.012	FG 5 16 EEM		5.05 1140	3.25 730	5.40 1210	9300	0.016 0.035
19	19 0.7480	6 0.2362	12 0.472	9.7 0.3819	12.7 0.5000	0.3 0.012	0.3 0.012	FG 6 19	FGL 6 19	5.80 1300	4.05 910	6.70 1510	7600	0.019 0.042
	19 0.7480	6 0.2362	12 0.472	9.7 0.3819	12.7 0.5000	0.3 0.012	0.3 0.012	FG 6 19 EE	FGL 6 19 EE	5.80 1300	4.05 910	6.70 1510	7600	0.019 0.042
	19 0.7480	6 0.2362	12 0.472	9.7 0.3819	12.7 0.5000	0.3 0.012	0.3 0.012	FG 6 19 EEM	FGL 6 19 EEM	5.80 1300	4.05 910	6.70 1510	7600	0.019 0.042
24	24 0.9449	8 0.3150	13 0.512	12.0 0.4724	15.0 0.5906	0.3 0.012	0.3 0.012	FG 8 24	FGL 8 24	6.90 1550	6.60 1480	9.20 2070	6300	0.037 0.082
	24 0.9449	8 0.3150	13 0.512	12.0 0.4724	15.0 0.5906	0.3 0.012	0.3 0.012	FG 8 24 EE	FGL 8 24 EE	6.90 1550	6.60 1480	9.20 2070	6300	0.037 0.082
	24 0.9449	8 0.3150	13 0.512	12.0 0.4724	15.0 0.5906	0.3 0.012	0.3 0.012	FG 8 24 EEM	FGL 8 24 EEM	6.90 1550	6.60 1480	9.20 2070	6300	0.037 0.082
	24 0.9449	8 0.3150	15 0.591	12.0 0.4724	15.0 0.5906	0.3 0.012	0.3 0.012	FG 8 24 15	FGL 8 24 15	8.70 1960	8.50 1910	12.3 2770	6300	0.044 0.097
	24 0.9449	8 0.3150	15 0.591	12.0 0.4724	15.0 0.5906	0.3 0.012	0.3 0.012	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 0.9449	8 0.3150	15 0.591	12.0 0.4724	15.0 0.5906	0.3 0.012	0.3 0.012	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 1.1811	10 0.3937	15 0.591	15.2 0.5984	20.2 0.7953	0.6 0.024	0.3 0.012	FG 10 30	FGL 10 30	12.9 2900	8.50 1910	15.5 3480	4800	0.066 0.146
	30 1.1811	10 0.3937	15 0.591	15.2 0.5984	20.2 0.7953	0.6 0.024	0.3 0.012	FG 10 30 EE	FGL 10 30 EE	12.9 2900	8.50 1910	15.5 3480	4800	0.066 0.146
	30 1.1811	10 0.3937	15 0.591	15.2 0.5984	20.2 0.7953	0.6 0.024	0.3 0.012	FG 10 30 EEM	FGL 10 30 EEM	12.9 2900	8.50 1910	15.5 3480	4800	0.066 0.146
32	32 1.2598	12 0.4724	15 0.591	17.6 0.6929	22.6 0.8898	0.6 0.024	0.3 0.012	FG 12 32	FGL 12 32	12.9 2900	8.30 1870	16.2 3640	4200	0.077 0.170
	32 1.2598	12 0.4724	15 0.591	17.6 0.6929	22.6 0.8898	0.6 0.024	0.3 0.012	FG 12 32 EE	FGL 12 32 EE	12.9 2900	8.30 1870	16.2 3640	4200	0.077 0.170
	32 1.2598	12 0.4724	15 0.591	17.6 0.6929	22.6 0.8898	0.6 0.024	0.3 0.012	FG 12 32 EEM	FGL 12 32 EEM	12.9 2900	8.30 1870	16.2 3640	4200	0.077 0.170
35	35 1.3780	15 0.5906	19 0.748	20.1 0.7929	25.2 0.9921	0.6 0.024	0.3 0.012	FG 15 35	FGL 15 35	18.0 4050	12.2 2740	25.6 5760	3750	0.103 0.227
	35 1.3780	15 0.5906	19 0.748	20.1 0.7929	25.2 0.9921	0.6 0.024	0.3 0.012	FG 15 35 EE	FGL 15 35 EE	18.0 4050	12.2 2740	25.6 5760	3750	0.103 0.227
	35 1.3780	15 0.5906	19 0.748	20.1 0.7929	25.2 0.9921	0.6 0.024	0.3 0.012	FG 15 35 EEM	FGL 15 35 EEM	18.0 4050	12.2 2740	25.6 5760	3750	0.103 0.227

Continued on next page.

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

Continued on next page.

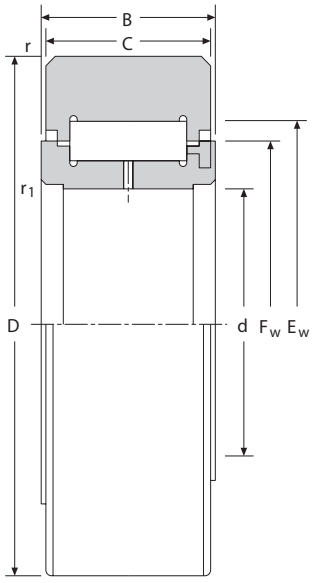
C

Outside Dia.	Dimensions mm/in.							Designation		Load Ratings kN/lbf.			Limiting Speed	Wt. kg/lbs.
								Profiled Track Roller	Cylindrical Track Roller	Dynamic		Static	Grease	
mm	D	B	C	F_w	E_w	r_{smin}	r_{1smin}			C	$F_{r\ perm}$	$F_{0r\ perm}$	RPM	
	90 3.5433	50 1.9685	32 1.260	62.1 2.4449	68.1 2.6811	1.0 0.039	0.6 0.024	FG 50 90 EE	FGL 50 90 EE	51.0 11500	74.0 16600	123 27700	1300	1.04 2.293
	90 3.5433	50 1.9685	32 1.260	62.1 2.4449	68.1 2.6811	1.0 0.039	0.6 0.024	FG 50 90 EEM	FGL 50 90 EEM	51.0 11500	74.0 16600	123 27700	1300	1.04 2.29
100	100 3.9370	55 2.1654	36 1.417	70.0 2.7559	77.0 3.0315	1.5 0.059	0.6 0.024	FG 55 100	FGL 55 100	60.0 13500	88.0 19800	142 31900	1150	1.35 2.976
	100 3.9370	55 2.1654	36 1.417	70.0 2.7559	77.0 3.0315	1.5 0.059	0.6 0.024	FG 55 100 EEM	FGL 55 100 EEM	60.0 13500	88.0 19800	142 31900	1150	1.35 2.976
110	110 4.3307	60 2.3622	36 1.417	75.0 2.9528	82.0 3.2283	1.5 0.059	0.6 0.024	FG 60 110		67.0 15100	102 22900	168 37800	1090	1.65 3.638
	110 4.3307	60 2.3622	36 1.417	75.0 2.9528	82.0 3.2283	1.5 0.059	0.6 0.024	FG 60 110 EEM	FGL 60 110 EEM	6 7.0 15100	102 22900	168 37800	1090	1.65 3.638
120	120 4.7244	65 2.5591	42 1.654	80.0 3.1496	87.0 3.4252	1.5 0.059	0.6 0.024	FG 65 120		83.0 18700	135 30300	223 50100	1020	2.35 5.181
	120 4.7244	65 2.5591	42 1.654	80.0 3.1496	87.0 3.4252	1.5 0.059	0.6 0.024	FG 65 120 EEM	FGL 65 120 EEM	83.0 18700	135 30300	223 50100	1020	2.35 5.181
125	125 4.9213	70 2.7559	42 1.654	85.0 3.3465	92.0 3.6220	1.5 0.059	0.6 0.024	FG 70 125 EEM	FGL 70 125 EEM	83.0 18700	144 32400	228 51300	960	2.50 5.512
130	130 5.1181	75 2.9528	42 1.654	90.0 3.5433	97.0 3.8189	1.5 0.059	0.6 0.024	FG 75 130 EEM		84.0 18900	155 34800	234 52600	910	2.65 5.842
140	140 5.5118	80 3.1496	48 1.890	100.0 3.9370	108.0 4.2520	2.0 0.079	1.0 0.039	FG 80 140		99.0 22300	197 44300	275 61800	820	3.40 7.496
	140 5.5118	80 3.1496	48 1.890	100.0 3.9370	108.0 4.2520	2.0 0.079	1.0 0.039	FG 80 140 EEM	FGL 80 140 EEM	99.0 22300	197 44300	275 61800	820	3.40 7.496
150	150 5.9055	85 3.3465	48 1.890	107.0 4.2126	115.0 4.5276	2.0 0.079	1.0 0.039	FG 85 150		105 23600	220 49500	300 67400	770	4.00 8.818
	150 5.9055	85 3.3465	48 1.890	107.0 4.2126	115.0 4.5276	2.0 0.079	1.0 0.039	FG 85 150 EEM		105 23600	220 49500	300 67400	770	4.00 8.818
160	160 6.2992	90 3.5433	54 2.126	115.0 4.5276	123.0 4.8425	2.0 0.079	1.0 0.039	FG 90 160 EEM		120 27000	288 64700	370 83200	710	5.30 11.7
170	170 6.6929	95 3.7402	54 2.126	120.0 4.7244	128.0 5.0394	2.0 0.079	1.0 0.039	FG 95 170 EEM		129 29000	302 67900	410 92200	690	6.00 13.2
180	180 7.0866	100 3.9370	65 2.559	126.0 4.9606	136.0 5.3543	2.0 0.079	1.5 0.059	FG 100 180		175 39300	353 79400	530 119100	650	8.05 17.8
	180 7.0866	100 3.9370	65 2.559	126.0 4.9606	136.0 5.3543	2.0 0.079	1.5 0.059	FG 100 180 EEM	FGL 100 180 EEM	175 39300	353 79400	530 119100	650	8.05 17.7
200	200 7.8740	110 4.3307	65 2.559	140.0 5.5118	150.0 5.9055	2.0 0.079	1.5 0.059	FG 110 200 EEM		189 42500	420 94400	600 134900	590	10.00 22.0
215	215 8.4646	120 4.7244	65 2.559	150.0 5.9055	160.0 6.2992	2.0 0.079	1.5 0.059	FG 120 215 EEM		199 44700	486 109300	660 148400	550	11.50 25.3
270	270 10.6299	150 5.9055	78 3.071	186.0 7.3228	198.0 7.7953	3.0 0.118	1.5 0.059	FG 150 270 EEM		290 65200	710 159600	1020 229300	440	22.00 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



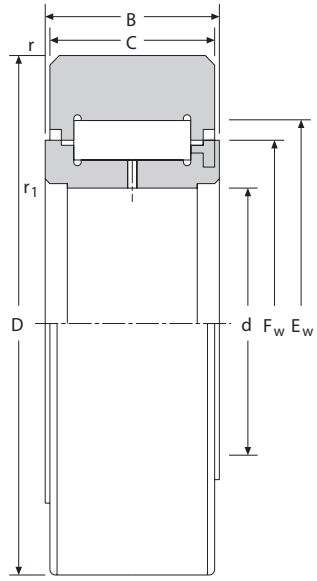
FGU, FGUL

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

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

METRIC SERIES

FGU: convex outer ring
FGUL: cylindrical outer ring



FGU, FGUL

C

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

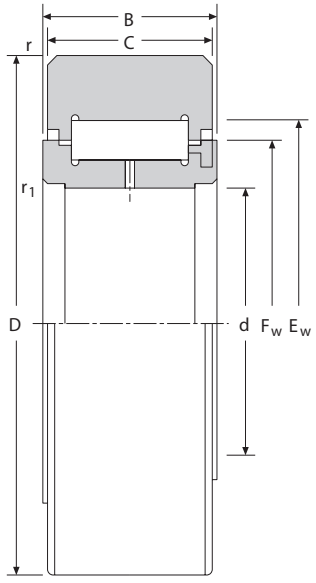
Continued on next page.

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

FGU, FGUL

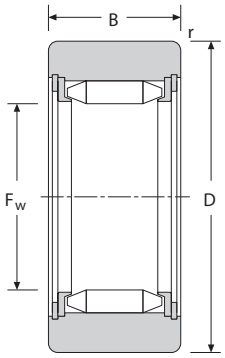


Outside Dia.	Dimensions mm/in.								Designation		Load Ratings kN/lbf.			Limiting Speed	Wt. kg/lbs.
									Profiled Track Roller	Cylindrical Track Roller	Dynamic		Static	Grease	
mm	D	d	C	B	F_w	E_w	r_{smin}	r_{1smin}			C	$F_{r\ perm}$	$F_{0r\ perm}$	RPM	
170	170 6.6929	80 3.1496	46 1.811	48 1.890	91.7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

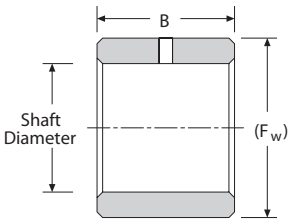
FULL COMPLEMENT, WITHOUT INNER RING, UNSEALED, YOKE TYPE (RNA...B6, RNAB, RNAL SERIES)

SEPARATE INNER RINGS (BIC SERIES)

METRIC SERIES



RNA...B6



BIC

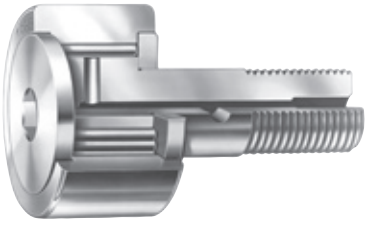
RNA...B6: Convex outer ring to maximum slope of 0.15%. Tolerance h9 on dim. D.
RNAB: Convex outer ring to maximum slope of 1.5%. Tolerance h9 on dim. D.
RNAL: Cylindrical outer ring. Tolerance h7 on dim. D.

Outside Dia.	Dimensions mm/in.						Bearing Designation Series			Load Ratings kN/lbf. Dynamic		Static	Limiting Speed Grease	Wt. kg/lbs.	Inner Ring Designation	Shaft Dia.
mm	D	d	B	F_w	E_w	r_{smin}	RNA..B6	RNAB	RNAL	C	$F_{r\ perm}$	$F_{0r\ perm}$	RPM			
19	19 0.7480	7.3 0.2874	12 0.472	7.3 0.287	12.3 0.484	0.35 0.014	RNA 11005 B6	RNAB 11005		5.10 1150	4.05 910	4.05 910	8700	0.019 0.042		
22	22 0.8661	9.7 0.3819	12 0.472	9.7 0.382	14.7 0.579	0.35 0.014	RNA 11007 B6	RNAB 11007	RNAL 11007	6.00 1350	5.10 1150	5.20 1170	7000	0.022 0.049		
28	28 1.1024	12.1 0.4764	12 0.472	12.1 0.476	17.1 0.673	0.35 0.014	RNA 11009 B6	RNAB 11009	RNAL 11009	7.40 1660	7.10 1600	7.10 1600	5800	0.028 0.062		
32	32 1.2598	17.6 0.6929	15 0.591	17.6 0.693	22.6 0.890	0.35 0.014	RNA 11012 B6	RNAB 11012	RNAL 11012	10.8 2430	9.10 2050	12.7 2860	4200	0.032 0.071	BIC 1012	12
35	35 1.3780	20.8 0.8189	15 0.591	20.8 0.819	25.8 1.016	0.65 0.026	RNA 11015 B6	RNAB 11015		10.8 2430	9.10 2050	13.4 3010	3650	0.035 0.077	BIC 1015	15
42	42 1.6535	23.9 0.9409	15 0.591	23.9 0.941	28.9 1.138	0.65 0.026	RNA 11017 B6	RNAB 11017	RNAL 11017	13.4 3010	13.9 3120	18.5 4160	3200	0.042 0.093	BIC 1017	17
47	47 1.8504	28.7 1.1299	18 0.709	28.7 1.130	34.7 1.366	0.65 0.026	RNA 11020 B6	RNAB 11020	RNAL 11020	16.8 3780	15.4 3460	23.0 5170	2700	0.047 0.104	BIC 2020	20
52	52 2.0472	33.5 1.3189	18 0.709	33.5 1.319	39.5 1.555	0.65 0.026	RNA 11025 B6	RNAB 11025		17.2 3870	16.5 3710	24.7 5550	2330	0.052 0.115	BIC 1025	25
62	62 2.4409	38.2 1.5039	22 0.866	38.2 1.504	44.2 1.740	0.65 0.026	RNA 11030 B6	RNAB 11030		28.5 6410	31.5 7080	49.5 11100	2050	0.062 0.137	BIC 2030	30
72	72 2.8346	44.0 1.7323	22 0.866	44.0 1.732	50.0 1.969	0.65 0.026	RNA 11035 B6			32.0 7190	41.0 9220	61.0 13700	1800	0.072 0.159	BIC 2035	35
80	80 3.1496	49.7 1.9567	22 0.866	49.7 1.957	55.7 2.193	0.85 0.033		RNAB 11040		34.0 7640	47.0 10600	68.0 15300	1620	0.080 0.176	BIC 2040	40
90	90 3.5433	62.1 2.4449	24 0.945	62.1 2.445	68.1 2.681	0.85 0.033	RNA 11050 B6			32.5 7310	51.0 11500	68.0 15300	1300	0.090 0.198	BIC 11050	50

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.

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 size	O.D.	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 ($F_{r\ perm}$) 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.

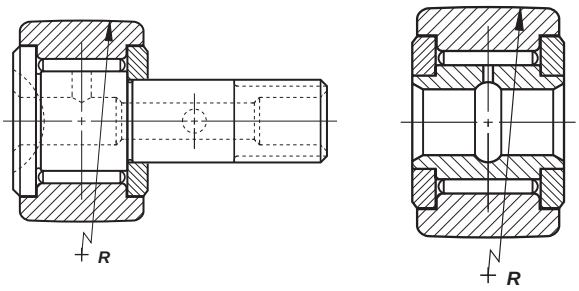
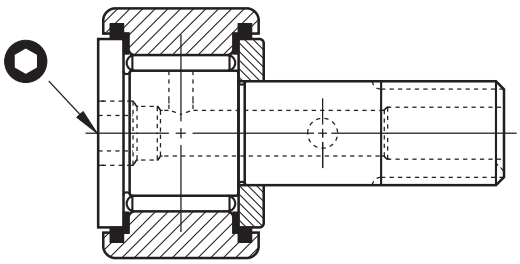


TABLE 3 – PROFILE RADIUS FOR TYPES CRC, CRSC, CRSBC, YCRC, YCRSC

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.

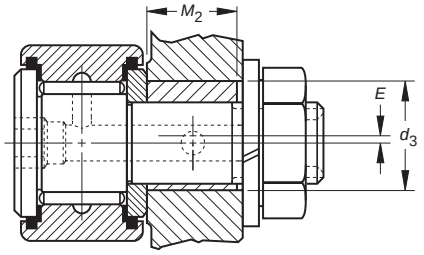


ECCENTRIC STUDS

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	Inch Bushing Width +0.000 -0.010	Eccentricity
	D_e	B_e	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 ($F_{r\,perm}$) 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, $F_{r\,perm}$ 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 $F_{0r\ perm}$ that may be applied to a stud type or yoke type track roller. The values of $F_{0r\ perm}$ 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 $F_{0r\ perm}$ values must not be exceeded. The static factor f_s can be calculated using the following formula:

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

where

$F_{0r\ perm}$ = Maximum permissible static radial load

P_{0r} = Equivalent static load
$P_{0r} = F_{0r}$ for yoke type track rollers

F_{0r} = Static radial load

f_s = Static factor whose valves 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.

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.

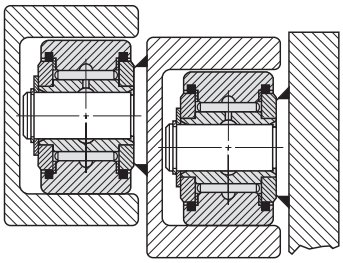
Oil is the preferred lubricant for all types. Use continuous oil lubrication or frequent grease lubrication for steady rotating conditions. Applications involving slow, intermittent oscillation are not as critical, and longer intervals between relubrication are permissible. Both stud and yoke type track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

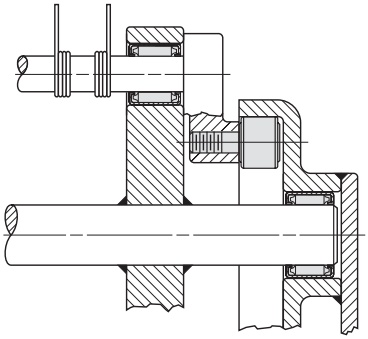
FORKLIFT TRUCK

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.



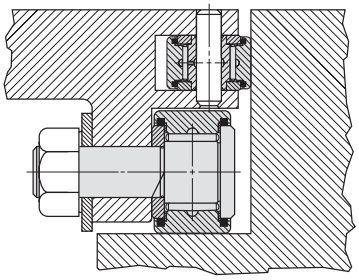
HAY BALER

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.



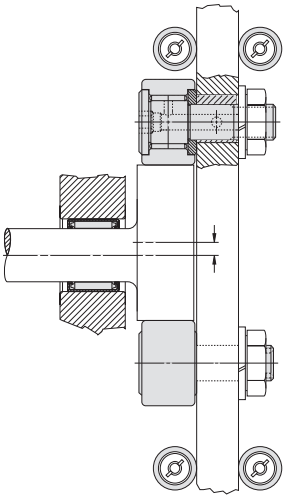
MACHINE WAY

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.

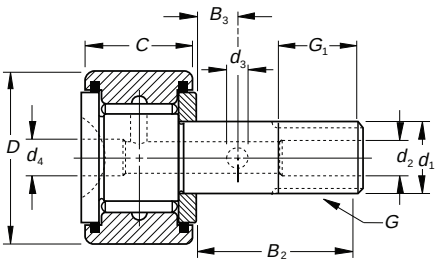


STUD TYPE TRACK ROLLERS
CR, CRS SERIES

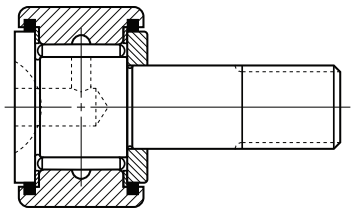
INCH SERIES

- 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.

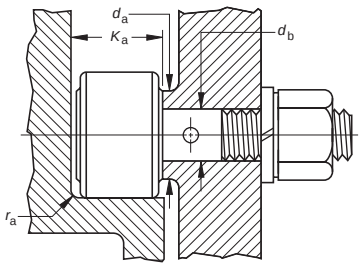
Outside Diameter	Dimensions mm/in.									Track Roller Designation	
	+0.25 -0 +0.0010 -0.0000	+0 -.025 +0.000 -0.001	+0 -.13 +0.000 -0.005	(nom.)	Min.				UNF	Without Seals	With Seals And Internal Thrust Washers
in.	d_1	D	C	B_2	B_3	G_1	d_4, d_2	d_3	G		
1/2	**4.826** 0.1900	**12.70** 0.500	**8.74** 0.344	**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.

C

Load Rating kN/lbf.					Limiting Speed	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 +.013 +0.0005 -0 -0.0000					
Dynamic	Static	Dynamic		Static	Grease		Max.	Min.	Min.		
C	C_0	C_w	$F_{r\ perm}$	$F_{0r\ perm}$	RPM	d_b	$r_{as\ max}$	K_a	d_a		
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.

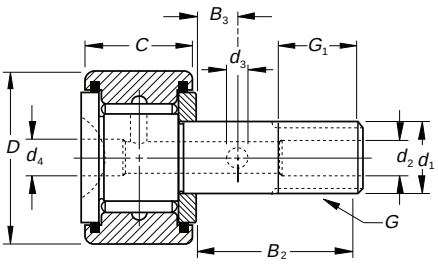
STUD TYPE TRACK ROLLERS
CR, CRS SERIES – *continued*

INCH SERIES

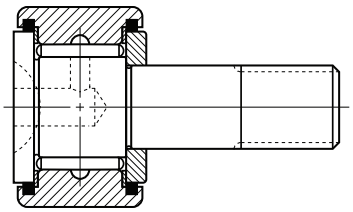
- Screwdriver slot in head facilitates mounting.
- Nonseparable, sealed unit with outer ring, full complement of needle rollers, stud seals, self-lubricating resin internal thrust washers, and stud-fastened retaining washer.
- Seals help retain lubricant and exclude foreign matter (CRS Series).
- Relubrication 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.

Outside Diameter	Dimensions mm/in.									Track Roller Designation	
	+0.25 -0 +0.0010 -0.0000	+0 -.025 +0.000 -0.001	+0 -.13 +0.000 -0.005	(nom.)	Min.				UNF	Without Seals	With Seals And Internal Thrust Washers
in.	d_1	D	C	B_2	B_3	G_1	d_4, d_2	d_3	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**

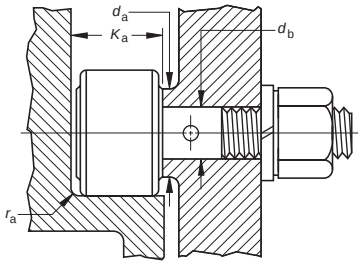
§ UNS instead of UNF threads.



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

Load Rating kN/lbf.					Limiting Speed	Mounting Dimensions mm/in.				Clamping Torque	Wt. kg/lbs. Approx.
As a Bearing		As a Track Roller				Bore Dia. for Stud +.013 +0.0005 -0 -0.0000					
Dynamic	Static	Dynamic		Static	Grease		Max.	Min.	Min.	N*m/lbf. • in.	
C	C_0	C_w	$F_{r\ perm}$	$F_{0r\ perm}$	RPM	d_b	$r_{as\ max}$	K_a	d_a		
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

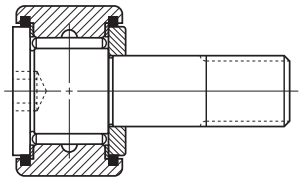
INCH SERIES

- 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.

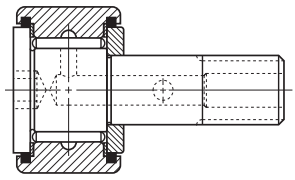
Outside Diameter	Dimensions mm/in.										Bearing Designation
	+0.25 -0 +0.0010 -0.0000	+0 -.025 +0.000 -0.001	+0 -.13 +0.000 -0.005	(nom.)		Min.				UNF	
in.	d_1	D	C	B_2	B_3	G_1	d_4	d_2	d_3	G	
1/2	**4.826** 0.1900	**12.70** 0.500	**8.74** 0.344	**12.70** 0.500	—	**6.35** 0.250	—	—	—	10-32	**CRSB-8**
	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.

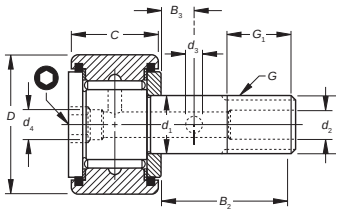
For hexagonal wrench sizes, see page C210.



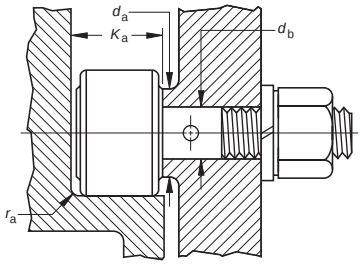
CRSB -8 to -10-1



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.

C

Load Rating kN/lbf.					Limiting Speed	Mounting Dimensions mm/in.				Clamping Torque	Wt. kg/lbs. Approx.
As a Bearing		As a Track Roller				Bore Dia. for Stud +.013 +0.0005 -0 -0.0000	Max.	Min.	Min.	N*m/lbf. • in.	
Dynamic	Static	Dynamic		Static	Grease						
C	C_0	C_w	$F_{r\ perm}$	$F_{0r\ perm}$	RPM	d_b	$r_{as\ max}$	K_a	d_a		
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** 1 350	**1.134** 2.500

Continued on next page.

STUD TYPE TRACK ROLLERS
CRSB SERIES – *continued*

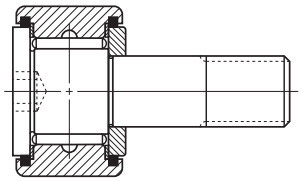
INCH SERIES

- 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.

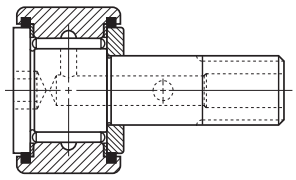
Outside Diameter	Dimensions mm/in.										Bearing Designation
	+0.25 -0 +0.0010 -0.0000	+0 -.025 +0.000 -0.001	+0 -.13 +0.000 -0.005	(nom.)		Min.				UNF	
in.	d_1	D	C	B_2	B_3	G_1	d_4	d_2	d_3	G	
2 3/4	25.400 1.0000	69.85 2.750	38.10 1.500	63.50 2.500	14.27 0.562	28.58 1.125	—	4.78 0.188	3.18 0.125	1-14§	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.

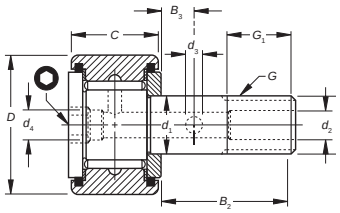
For hexagonal wrench sizes, see page C208.



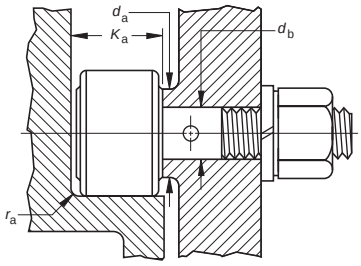
CRSB -8 to -10-1



CRSB -24 to -44



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.

C

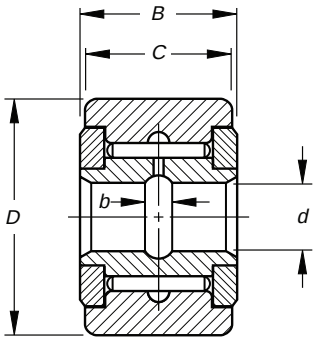
Load Rating kN/lbf.					Limiting Speed	Mounting Dimensions mm/in.				Clamping Torque	Wt. kg/lbs.
As a Bearing		As a Track Roller				Bore Dia. for Stud +.013 +0.0005 -0 -0.0000					
Dynamic	Static	Dynamic		Static	Grease		Max.	Min.	Min.	N*m/lbf. • in.	Approx.
C	C_0	C_w	$F_{r\ perm}$	$F_{0r\ perm}$	RPM	d_b	$r_{as\ max}$	K_a	d_a		
58.7 13200	**118.32** 26600	**47.2** 10600	**66.7** 15000	**113** 25500	**1400**	**25.400** 1.0000	**2.29** 0.090	**44.5** 1.75	**34.93** 1.375	**152.53** 1 350	**1.329** 2.930
74.7 16800	**178.82** 40200	**51.6** 11600	**64.0** 14400	**127** 28600	**990**	**31.750** 1.2500	**2.29** 0.090	**46.5** 1.83	**44.45** 1.750	**231.62** 2 050	**1.905** 4.200
74.7 16800	**178.82** 40200	**54.7** 12300	**80.1** 18000	**143** 32100	**990**	**31.750** 1.2500	**2.29** 0.090	**46.5** 1.83	**44.45** 1.750	**231.62** 2 050	**2.182** 4.810
110.8 24900	**226.86** 51000	**82.3** 18500	**89.8** 20200	**187** 42000	**950**	**34.925** 1.3750	**2.29** 0.090	**52.8** 2.08	**48.82** 1.922	**282.46** 2 500	**2.912** 6.420
138.3 31100	**321.16** 72200	**99.2** 22300	**121** 27200	**245** 55000	**780**	**38.100** 1.5000	**2.29** 0.090	**59.2** 2.33	**57.94** 2.281	**338.95** 3 000	**4.291** 9.460

YOKE TYPE TRACK ROLLERS
YCR, YCRS SERIES

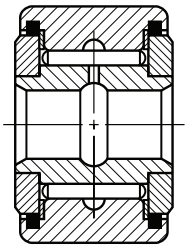
INCH SERIES

- 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 sufficicently 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.

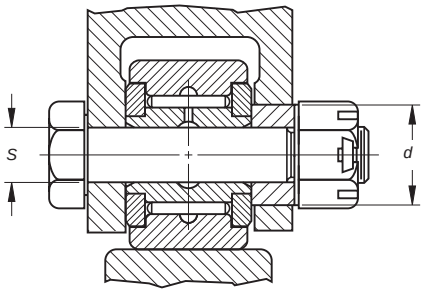
Outside Diameter	Dimensions mm/in.						Track Roller Designation	
	+0 +0.000 -0.03 -0.001	Max.	Min.	+.130 +0.0050 -0.250 -0.0100	+0 +0.000 -.13 -0.005	(nom.)	Without Seals	With Seals and Internal Thrust Washers
in.	D	d		B	C	b		
3/4	19.05 0.75	6.355 0.2502	6.34 0.2496	14.288 0.5625	12.7 0.5	3.18 0.125	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



C

Load Ratings kN/lbf.					Limiting Speed	Mounting Dimensions mm/in.				Clamping Diameter	Wt. Approx. kg/lbs.
As a Bearing		As a Track Roller				Shaft Bolt diameter Loose Fit (f7)		Tight Fit (h6)			
Dynamic	Static	Dynamic		Static	Grease	Max.	Min.	Max.	Min.		
C	C_0	C_w	$F_{r\ perm}$	$F_{0\ perm}$	RPM	S				d_a	
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

NOTES

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 trust 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

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

K.811 **04** **TVP**

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 = 17mm
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

NT cage assembly

Bore
16 = $^{16}/_{16}$ in. = 1 in.

NT **A** **16** **25**

Cage Design
A needle roller
C needle roller
H cylindrical roller

Outside Diameter
25 = $^{25}/_{16}$ in. = $1^{9}/_{16}$ in.

Thrust Washers – Inch Nominal Dimensions

TR thrust washer, inch

Bore
16 = $^{16}/_{16}$ in. =1 in.
10 = $^{10}/_{16}$ in. = $^{5}/_{8}$ in.

TR **B** **10** **18**

A, B, C, etc. washer thickness, inch
I & J bore piloted washers
ID, JD outside diameter piloted washers

Outside Diameter
18 = $^{18}/_{16}$ in. = 1 $^{1}/_{8}$ in.

Thrust Bearings, Assemblies and Washers

C

NEEDLE ROLLER AND CAGE THRUST ASSEMBLIES AND THRUST WASHERS –

METRIC SERIES

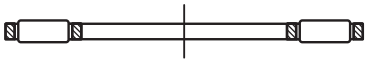
Needle roller and cage thrust assemblies are available in a variety of sizes. They all have very small cross-sections. This catalog includes the most popular, standardized and non-standard designs. If back up surface cannot be used as a raceway, hardened washers are available.

REFERENCE STANDARDS ARE:

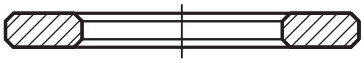
- **ISO 3031** – Rolling bearings – Needle roller and cage thrust assemblies, thrust washers – Dimensions and tolerances
- **DIN 5405 Part 2** – Rolling bearings – Needle bearings – Thrust needle roller and cage assemblies.
- **DIN 5405 Part 3** – Rolling bearings – Needle bearings – Thrust washers
- **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.

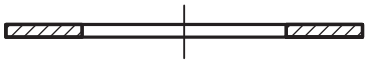
TYPES OF METRIC SERIES NEEDLE ROLLER AND CAGE THRUST ASSEMBLIES AND THRUST WASHERS



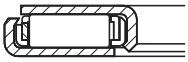
AXK, FNT
Needle roller & cage thrust assembly



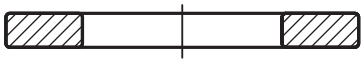
LS
Heavy thrust washer



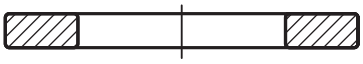
AS
Thin thrust washer



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.

The rolling elements of the AX Series thrust bearings are retained and guided in radial pockets within the cage. The cage is retained in relation to the thrust washer by means of a retaining cap. The design of a one-piece steel cage employs a special curvature that guides the rolling elements by their ends along their centerlines.

In addition, this special curvature gives the steel cage great rigidity while providing maximum lubricant space. This unitized assembly of components facilitates installation and provides a high axial load capacity while occupying only minimal space. Note that the AX Series is not interchangeable with the AXK Series or FNT Series needle roller and cage thrust assemblies.

Standard AX Series needle thrust bearings combined with a thick washer provide rotational accuracy and axial run-out to Class 6 levels according to ISO Standard 199 for ball thrust bearings. They can be supplied in High Precision "HP" quality, providing a precision grade above Class 5. AX Series needle thrust bearings with a thin washer are of minimal thickness and provide excellent economy. They should be considered whenever the degree of support and rotational accuracy requirement allow.

THRUST WASHERS

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. Some thrust washers are designed for bore piloting others may be piloted by their outside diameter.

THIN THRUST WASHERS (AS)

The metric series thin thrust washers are made of hardened spring steel. They may be out of flat due to heat treatment, but will flatten under load. Thin washers are used when the supporting or backing members cannot be adequately prepared as raceways for the needle rollers. These washers are only 1 mm (0.04 in.) thick (dimensions) and provide a very compact and cost-effective bearing arrangement. Although they are usually guided on the shaft, they may be housing-guided when required by application.

HEAVY THRUST WASHERS (LS)

These metric series thrust washers are made of bearing quality steel, hardened and precision ground on the flat raceway surfaces. Their bores and outside diameters are not ground but provide satisfactory surfaces for shaft piloting or housing piloting arrangements.

SHAFT PILOTED WASHERS (WS.811) AND HOUSING PILOTED WASHERS (GS.811)

These shaft piloted and housing piloted metric series thrust washers are primarily for use with metric series cylindrical roller thrust bearings of Series 811. They are made of bearing quality steel with, hardened and precision ground and lapped flat raceway surfaces. The tolerances of the thrust bearing bore and outside diameter shown in the engineering section apply to shaft and housing piloted washers.

THIN (CP) AND THICK (CPR) THRUST WASHERS

The washer incorporated in the AX Series thrust bearing is made from hardened bearing steel and forms one of the reaceways for the rolling elements. The opposing raceway is generally provided by a separate thrust washer of similar design supplied by Timken. When the AX Series thrust bearing is piloted by the revolving part, the thrust washer must be piloted by the stationary part and vice versa. If the revolving part and the stationary part are noticeably eccentric to each other, the thrust bearing with integral washer must, without exception, be piloted by the revolving part.

The second raceway for the rolling elements may also be formed by the face of a shoulder or an inserted washer, provided these have the correct hardness and geometric dimensions.

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_C) AND BORE DIAMETER (D_{C1}) OF SERIES FNT AND AXK NEEDLE ROLLER AND CAGE THRUST ASSEMBLIES

D_c mm		Deviations of max. outside dia. (c12) µm		D_{c1} 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				

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

	Bore Dc1 mm	Thickness Tolerance µm	Axial run-out µm		
Needle thrust bearings (thin)	≤ 60	+30 / -40(1)	20		
	60 < D_{c1} ≤ 90	+50 / -60(2)	25		
	90 < D_{c1} ≤ 120	+50 / -60(2)	30		
Needle thrust bearings (thick)	D_{c1} ≤ 60	+30 / -30(1)	20	Quality	
	60 < D_{c1} ≤ 90	+50/ -50(2)	25	HP	HSP
	90 < D_{c1} ≤ 120	+50/ -50(2)	30	2	1
Thrust washers (thin) [thick]	D_{c1} ≤ 120	+50 / -60[-50]	5*	3	1.5
	120 < D_{c1} ≤ 180	+50 / -110[-100]	7*	4	2
	180 < D_{c1} ≤ 250	+30 / -160[-150]	10*		

*HP Quality

(1) Under min. load of 150 N

(2) Under min. load of 250 N

BORE INSPECTION PROCEDURE FOR ASSEMBLY

If an inspection of the bore diameter is desired, 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 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 2 –
TOLERANCES FOR OUTSIDE DIAMETER (d_1) AND BORE DIAMETER (d) OF SERIES AS THRUST WASHERS.

d_1 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_1) AND BORE DIAMETER (d) OF SERIES LS HEAVY THRUST WASHERS.

d_1 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 µm R_a (79 µin 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.

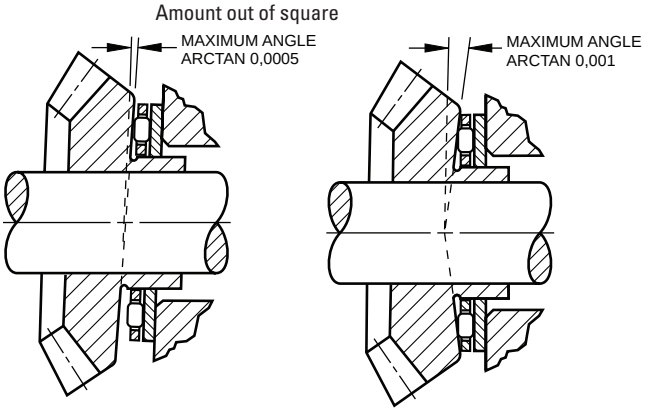
Thick series needle thrust bearings and thick thrust washers can be supported on a more restricted or discontinuous shoulder, provided that the deflection of the washer under load does not impede the smooth operation of the thrust bearing or the required axial run-out.

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,
- posess a suitable surface finish ($\leq$ 0.2 µm R_a or $\leq$ 79 µin 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.



Out of Square Surface
Figure 1

Dished or Coned Surface
Figure 2

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:

$$F_{a\ min} = C_0/2200\ [kN]$$

where

C_0 - static load rating [kN]
$F_{a\ min}$ - 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.

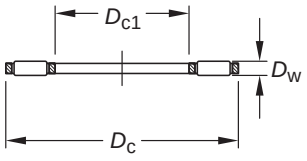
With a well-designed oil circulation, type AXJ thrust bearings permit speeds approximately twice that achieved with nomal thrust bearings.

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.

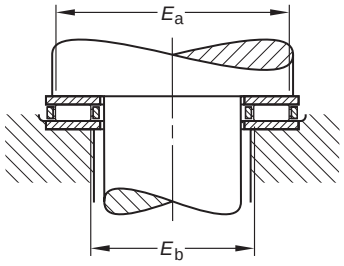
NEEDLE ROLLER AND CAGE THRUST ASSEMBLIES, THRUST WASHERS

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).

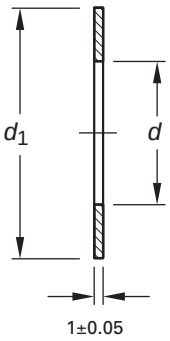


FNT, AXK



Raceway contact dimensions

Shaft Diameter	Dimensions mm/in.						Assembly Designation	Wt. kg/lbs.	Load Ratings kN/lbf.		Limiting Speed Oil
									Dynamic	Static	
mm	d_{c1}	D_c	D_w	E_b	E_a	$r_{as\ max}$			C	C_o	RPM
8	8 0.3150	21 0.8268	2 0.0787	9.6 0.378	18.6 0.732	0.3 0.012	AXK0821TN	0.001 0.002	8.34 1870	21.1 4740	20000
10	10 0.3937	24 0.9449	2 0.0787	11.0 0.433	22.5 0.886	0.3 0.012	AXK1024	0.003 0.007	9.32 2100	25.9 5820	17000
12	12 0.4724	26 1.0236	2 0.0787	13.0 0.512	24.5 0.965	0.3 0.012	AXK1226	0.004 0.009	10.8 2430	32.3 7260	15000
15	15 0.5906	28 1.1024	2 0.0787	17.0 0.669	27.0 1.063	0.3 0.012	AXK1528	0.004 0.009	11.1 2500	35.2 7910	15000
17	17 0.6693	30 1.1811	2 0.0787	22.0 0.866	34.0 1.339	0.3 0.012	AXK1730TN	0.004 0.009	11.7 2630	38.7 8700	14000
20	20 0.7874	35 1.3780	2 0.0787	22.0 0.866	34.0 1.339	0.3 0.012	AXK2035	0.001 0.001	12.8 2880	45.4 10200	12000
25	25 0.9843	42 1.6535	2 0.0787	29.0 1.142	41.0 1.614	0.6 0.024	AXK2542	0.007 0.015	14.3 3210	56.8 12800	10000
30	30 1.1811	47 1.8504	2 0.0787	35.0 1.378	46.0 1.811	0.6 0.024	AXK3047	0.009 0.020	16.0 3600	68.1 15300	9000
35	35 1.3780	52 2.0472	2 0.0787	40.0 1.575	51.0 2.008	0.6 0.024	AXK3552	0.010 0.022	17.4 3910	79.5 17900	8100
40	40 1.5748	60 2.3622	3 0.1181	45.0 1.772	58.0 2.283	0.6 0.024	AXK4060	0.016 0.035	27.1 6090	110.0 24700	7000
45	45 1.7717	65 2.5591	3 0.1181	50.0 1.969	63.0 2.480	0.6 0.024	AXK4565	0.020 0.044	29.0 6520	124.0 27900	6500
50	50 1.9685	70 2.7559	3 0.1181	55.0 2.165	68.0 2.677	0.6 0.024	AXK5070	0.020 0.044	30.8 6920	137.0 30800	6000
55	55 2.1654	78 3.0709	3 0.1181	60.0 2.362	76.0 2.992	0.6 0.024	AXK5578	0.026 0.057	39.4 8860	195.0 43800	5300
60	60 2.3622	85 3.3465	3 0.1181	65.0 2.559	83.0 3.268	0.6 0.024	AXK6085	0.035 0.077	44.5 10000	234.0 52600	4900
65	65 2.5591	90 3.5433	3 0.1181	70.0 2.756	88.0 3.465	0.6 0.024	AXK6590	0.036 0.079	46.7 10500	254 57100	4600



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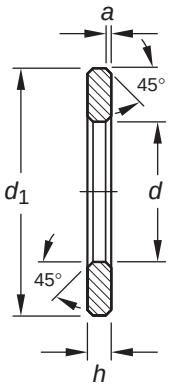

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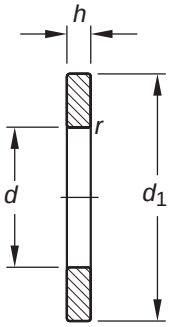

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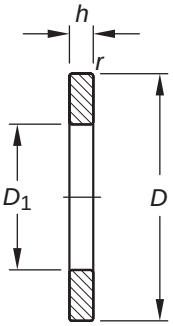


GS.811

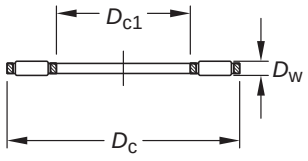
Dimensions mm/in.				Washer Desig-nation	Wt. kg/lbs.	Washer Desig-nation	mm/in. Chamfer	Wt. kg/lbs.	Washer Designation Shaft Piloted	Washer Designation Housing Piloted	Radius mm/in.	Wt. kg/lbs.
d	D, d_1	D_1	h	Thin		Heavy	a				$r_{s\ min}$	
8 0.3150	21 0.8268		2.75 0.108	AS0821	0.002 0.004	LS0821	0.30 0.012	0.004 0.009				
10 0.3937	24 0.9449		2.75 0.108	AS1024	0.003 0.007	LS1024	0.50 0.020	0.008 0.018				
12 0.4724	26 1.0236		2.75 0.108	AS1226	0.003 0.007	LS1226	0.50 0.020	0.009 0.020				
15 0.5906	28 1.1024	16 0.6299	2.75 0.108	AS1528	0.003 0.007	LS1528	0.50 0.020	0.010 0.022	WS.81102	GS.81102	0.30 0.012	0.010 0.022
17 0.6693	30 1.1811	18 0.7087	2.75 0.108	AS1730	0.003 0.007	LS1730	0.50 0.020	0.011 0.024	WS.81103	GS.81103	0.30 0.012	0.011 0.024
20 0.7874	35 1.3780	21 0.8268	2.75 0.108	AS2035	0.005 0.011	LS2035	0.50 0.020	0.014 0.031	WS.81104	GS.81104	0.30 0.012	0.014 0.031
25 0.9843	42 1.6535	26 1.0236	3.00 0.118	AS2542	0.007 0.015	LS2542	1.00 0.039	0.021 0.046	WS.81105	GS.81105	0.60 0.024	0.021 0.046
30 1.1811	47 1.8504	32 1.2598	3.00 0.118	AS3047	0.008 0.018	LS3047	1.00 0.039	0.023 0.051	WS.81106	GS.81106	0.60 0.024	0.023 0.051
35 1.3780	52 2.0472	37 1.4567	3.50 0.138	AS3552	0.009 0.020	LS3552	1.00 0.039	0.030 0.066	WS.81107	GS.81107	0.60 0.024	0.032 0.071
40 1.5748	60 2.3622	42 1.6535	3.50 0.138	AS4060	0.012 0.026	LS4060	1.00 0.039	0.041 0.090	WS.81108	GS.81108	0.60 0.024	0.043 0.095
45 1.7717	65 2.5591	47 1.8504	4.00 0.157	AS4565	0.013 0.029	LS4565	1.00 0.039	0.052 0.115	WS.81109	GS.81109	0.60 0.024	0.054 0.119
50 1.9685	70 2.7559	52 2.0472	4.00 0.157	AS5070	0.014 0.031	LS5070	1.00 0.039	0.056 0.123	WS.81110	GS.81110	0.60 0.024	0.059 0.130
55 2.1654	78 3.0709	57 2.2441	5.00 0.197	AS5578	0.018 0.040	LS5578	1.00 0.039	0.091 0.201	WS.81111	GS.81111	0.60 0.024	0.094 0.207
60 2.3622	85 3.3465	62 2.4409	4.75 0.187	AS6085	0.022 0.049	LS6085	1.50 0.059	0.102 0.225	WS.81112	GS.81112	1.00 0.039	0.106 0.234
65 2.5591	90 3.5433	67 2.6378	5.25 0.207	AS6590	0.023 0.051	LS6590	1.50 0.059	0.121 0.267	WS.81113	GS.81113	1.00 0.039	0.125 0.276

Continued on next page.

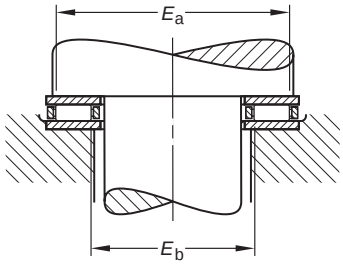
NEEDLE ROLLER AND CAGE THRUST ASSEMBLIES, THRUST WASHERS - continued

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).

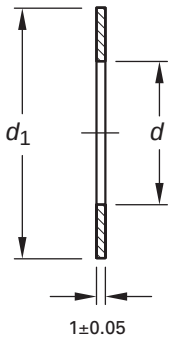


FNT, AXK



Raceway contact dimensions

Shaft Diameter	Dimensions mm/in.						Assembly Designation	Wt. kg/lbs.	Load Ratings kN/lbf.		Limiting Speed Oil
									Dynamic	Static	
mm	d_{c1}	D_c	D_w	E_b	E_a	$r_{as\ max}$			C	C_o	RPM
70	70 2.7559	95 3.7402	4 0.1575	74.0 2.913	93.0 3.661	0.6 0.024	AXK7095	0.055 0.121	53.8 12100	253 56900	4400
75	75 2.9528	100 3.9370	4 0.1575	79.0 3.110	98.0 3.858	0.6 0.024	AXK75100	0.058 0.128	55.1 12400	266 59800	4200
80	80 3.1496	105 4.1339	4 0.1575	84.0 3.307	103.0 4.055	0.6 0.024	AXK80105	0.092 0.203	56.4 12700	279 62700	4000
85	85 3.3465	110 4.3307	4 0.1575	89.0 3.504	108.0 4.252	0.6 0.024	AXK85110	0.063 0.139	57.6 12900	291 65400	3800
90	90 3.5433	120 4.7244	4 0.1575	94.0 3.701	118.0 4.646	0.6 0.024	AXK90120	0.081 0.179	72.9 16400	405 91000	3500
100	100 3.9370	135 5.3150	4 0.1575	105.0 4.134	133.0 5.236	0.6 0.024	AXK100135	0.106 0.234	90.2 20300	552 124000	3100
110	110 4.3307	145 5.7087	4 0.1575	115.0 4.528	143.0 5.630	0.6 0.024	AXK110145	0.117 0.258	93.2 21000	591 133000	2800
120	120 4.7244	155 6.1024	4 0.1575	125.0 4.921	153.0 6.024	0.6 0.024	AXK120155	0.126 0.278	98.5 22100	650 146000	2700
130	130 5.1181	170 6.6929	5 0.1969	136.0 5.354	167.0 6.575	0.6 0.024	AXK130170	0.198 0.437	132 29700	829 186000	2400
140	140 5.5118	180 7.0866	5 0.1969	146.0 5.748	177.0 6.969	0.6 0.024	AXK140180	0.221 0.487	136 30600	887 199000	2300
150	150 5.9055	190 7.4803	5 0.1969	156.0 6.142	187.0 7.362	0.6 0.024	AXK150190	0.225 0.496	141 31700	944 212000	2200
160	160 6.2992	200 7.8740	5 0.1969	166.0 6.535	197.0 7.756	0.6 0.024	AXK160200	0.249 0.549	146 32800	1000 225000	2100



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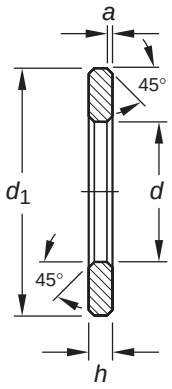

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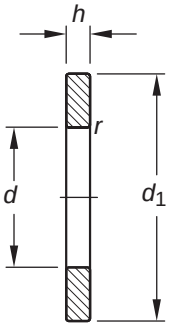

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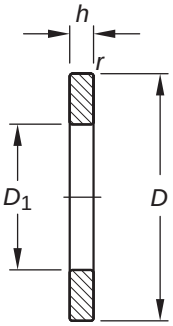


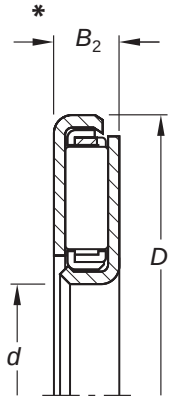
GS.811

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_1	D_1	h	Thin		Heavy	a				$r_{s\ min}$	
70 2.7559	**95** 3.7402	**72** 2.8346	**5.25** 0.207	**AS7095**	**0.025** 0.055	**LS7095**	**1.50** 0.059	**0.128** 0.282	**WS.81114**	**GS.81114**	**1.00** 0.039	**0.133** 0.293
75 2.9528	**100** 3.9370	**77** 3.0315	**5.75** 0.226	**AS75100**	**0.027** 0.060	**LS75100**	**1.50** 0.059	**0.150** 0.331	**WS.81115**	**GS.81115**	**1.00** 0.039	**0.155** 0.342
80 3.1496	**105** 4.1339	**82** 3.2283	**5.75** 0.226	**AS80105**	**0.028** 0.062	**LS80105**	**1.50** 0.059	**0.158** 0.348	**WS.81116**	**GS.81116**	**1.00** 0.039	**0.165** 0.364
85 3.3465	**110** 4.3307	**87** 3.4252	**5.75** 0.226	**AS85110**	**0.028** 0.062	**LS85110**	**1.50** 0.059	**0.166** 0.366	**WS.81117**	**GS.81117**	**1.00** 0.039	**0.173** 0.381
90 3.5433	**120** 4.7244	**92** 3.6220	**6.50** 0.256	**AS90120**	**0.038** 0.084	**LS90120**	**1.50** 0.059	**0.245** 0.540	**WS.81118**	**GS.81118**	**1.00** 0.039	**0.253** 0.558
100 3.9370	**135** 5.3150			**AS100135**	**0.050** 0.110							
110 4.3307	**145** 5.7087		**7.00** 0.276	**AS110145**	**0.055** 0.121	**LS110145**	**1.50** 0.059	**0.373** 0.822				
120 4.7244	**155** 6.1024			**AS120155**	**0.059** 0.130							
130 5.1181	**170** 6.6929		**9.00** 0.354	**AS130170**	**0.074** 0.163	**LS130170**	**1.50** 0.059	**0.065** 0.143				
140 5.5118	**180** 7.0866			**AS140180**	**0.078** 0.172							
150 5.9055	**190** 7.4803			**AS150190**	**0.083** 0.183							
160 6.2992	**200** 7.8740			**AS160200**	**0.089** 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.



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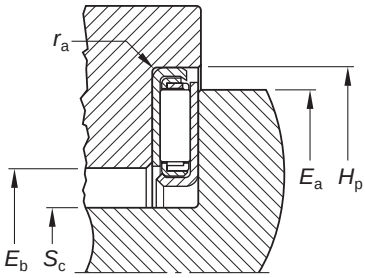
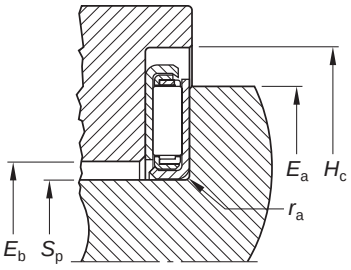


FNTKF Housing Piloting



FNTKF Shaft Piloting

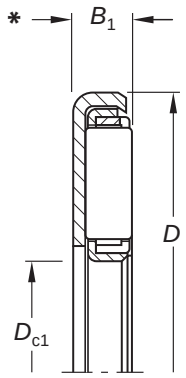
Shaft Diameter	Dimensions mm/in.			Assembly Designation	Load Ratings kN/lbf.		Limiting Speed Oil	Mounting Dimensions mm/in. Housing Piloting		Shaft Piloting		Nominal	
	E13	e13	-0.2, -.002		Dynamic	Static		H10	Max.	h10	Min.		
mm	d	D	B_2*		C	C_o	RPM	H	S_c	S_p	H_c	E_a	E_b
10	10 0.3937	28 1.1024	3.7 0.146	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.

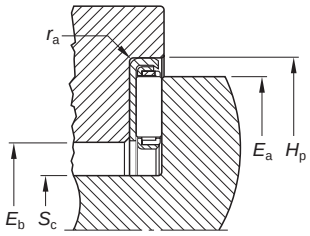
UNITIZED THRUST BEARING TYPE FNTK

METRIC SERIES

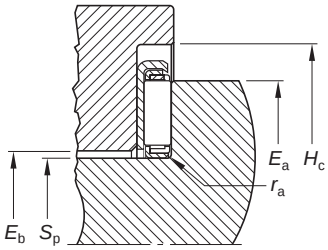
- Combine low friction and thin cross-section with the convenience of complete packaged assembly.
- Integral washer allows use where one thrust backup surfaces is not suitably hardened or ground.
- Backup surface should meet limits of permissible out-of-squareness, dishing or coning (see Figures 1 and 2 on page C232).
- Backup surface finish of 0.2 µm R_a (min.) or 8.0 µin 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

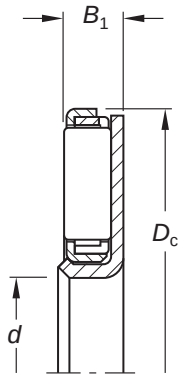
Shaft Diameter	Dimensions mm/in.			Assembly Designation	Load Ratings kN/lbf.		Limiting Speed Oil	Mounting Dimensions mm/in. Housing Piloting		Shaft Piloting		Nominal	
	E13	e13	-0.2, -.002		Dynamic	Static		H10	Max.	h10	Min.		
mm	d	D	B_2		C	C_o	RPM	H	S_c	S_p	H_c	E_a	E_b
12	12 0.4724	28 1.1024	2.85 0.1122	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

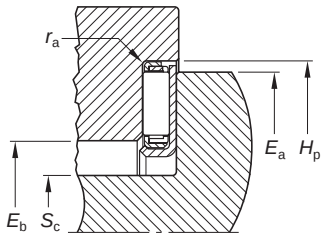
- Combine low friction and thin cross-section with the convenience of complete packaged assembly.
- Integral washer allows use where one thrust backup surfaces is not suitably hardened or ground.
- Backup surface should meet limits of permissible out-of-squareness, dishing or coning (see Figures 1 and 2 on page C232).
- Backup surface finish of 0.2 µm R_a (min.) or 8.0 µin 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.



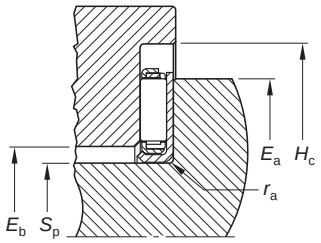
FNTF

Shaft Diameter	Dimensions mm/in. (E13)	(C12)	(-0.1)	Assembly Designation	Load Ratings kN/lbf Dynamic	Static	Limiting Speed Oil
mm	d	D_c	B_1*		C	C_0	RPM
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



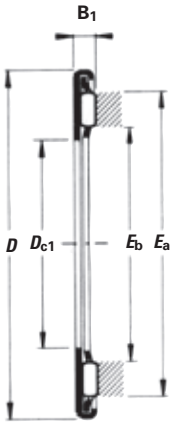
FNTF Shaft Piloting

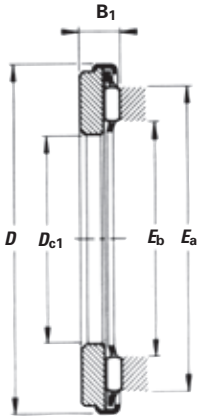
Mounting Dimensions mm/in.					
Housing Piloting		Shaft Piloting			
(H10)	(Max.)	(h10)	(Min.)	(Nom.)	(Nom.)
H_p	S_c	S_p	H_c	E_a	E_b
26 1.024	**8.5** 0.335	**10** 0.394	**27.5** 1.083	**25** 0.984	**14** 0.551
28 1.102	**11.5** 0.453	**13** 0.512	**29.5** 1.161	**27** 1.063	**17** 0.669
30 1.181	**13.5** 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_{as} = 1.0 mm max. (0.039 in. max.)

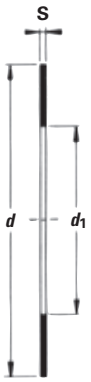
UNITIZED THRUST BEARINGS

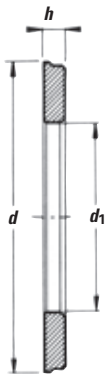
METRIC SERIES





Shaft Diameter	Dimensions mm/in.					Bearing Designation		Wt. kg/lbs.	Load Ratings kN/lbf.		Limiting Speed Oil
						Thin Series	Thick Series		Dynamic	Static	
mm	D_{C1}	D	E_a	E_b	B_1				C	C_o	RPM
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





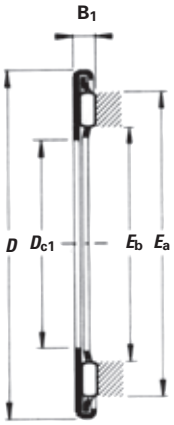
C

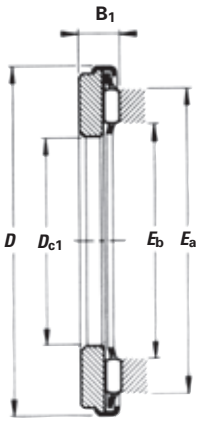
Dimensions mm/in.			Thin Wt. kg/lbs.	Washer Designation		mm/in.	Thick Wt. kg/lbs.	Washer Designation Precision	mm/in.	Precision Wt. kg/lbs.	Shaft
				Thin	Thick						
d	d_1	s				h			h^2		mm
5 0.201	**12.4** 0.488	**0.8** 0.031	**0.001** 0.001	**CP 5 13**							**5**
					CP 2 5 13	**2.0** 0.079	**0.002** 0.004				
6 0.240	**13.4** 0.528	**0.8** 0.031	**0.001** 0.002	**CP 6 14**							**6**
					CP 2 6 14	**2.0** 0.079	**0.002** 0.004				
7 0.280	**14.4** 0.567	**0.8** 0.031	**0.001** 0.002	**CP 7 15**							**7**
					CP 2 7 15	**2.0** 0.079	**0.002** 0.004				
8 0.319	**15.4** 0.606	**0.8** 0.031	**0.001** 0.002	**CP 8 16**							**8**
					CP 2 8 16	**2.0** 0.079	**0.002** 0.005				
9 0.358	**16.4** 0.646	**0.8** 0.031	**0.001** 0.002	**CP 9 17**							**9**
					CP 2 9 17	**2.0** 0.079	**0.002** 0.005				
10 0.396	**21.2** 0.836				**CP 2 10 22**	**2.0** 0.079	**0.002** 0.004				**10**
12 0.474	**25.5** 1.003	**0.8** 0.031	**0.003** 0.006	**CP 12 26**				**CPN 2 12 26**	**2.0** 0.079	**0.006** 0.013	**12**
					CP 2 12 26	**2.0** 0.079	**0.006** 0.014				
13 0.514	**25.5** 1.003	**0.8** 0.031	**0.002** 0.005	**CP 13 26**							**13**
					CP 2 13 26	**2.0** 0.079	**0.006** 0.013				
14 0.553	**25.5** 1.003	**0.8** 0.031	**0.002** 0.005	**CP 14 26**							
					CP 2 14 26	**2.0** 0.079	**0.006** 0.012				
15 0.593	**27.5** 1.081	**0.8** 0.031	**0.003** 0.006	**CP 15 28**				**CPN 2 15 28**	**2.0** 0.079	**0.006** 0.013	**15**
					CP 2 15 28	**2.0** 0.079	**0.006** 0.013				

Continued on next page.

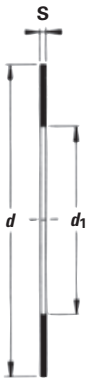
UNITIZED THRUST BEARINGS – *continued*

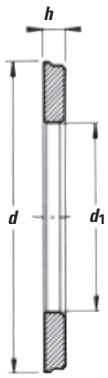
METRIC SERIES





Shaft Diameter	Dimensions mm/in.					Bearing Designation		Wt. kg/lbs.	Load Ratings kN/lbf.		Limiting Speed Oil
						Thin Series	Thick Series		Dynamic	Static	
mm	D_{C1}	D	E_a	E_b	B_1				C	C_o	RPM
17	17 0.678	30 1.183	26.6 1.05	19.0 0.75	2.8 0.110	AX 17 30		7.6 0.017	7.80 1750	22.00 4950	10500
	17 0.677	30 1.183	26.6 1.05	19.0 0.75	4.0 0.157		AX 4 17 30	10 0.022	7.80 1750	22.00 4950	10500
18											
19	19 0.757	32 1.261	28.6 1.13	21.0 0.83	2.8 0.110	AX 19 32		8.6 0.019	8.00 1800	23.30 5240	10000
	19 0.756	32 1.261	28.6 1.13	21.0 0.83	4.0 0.157		AX 4 19 32	13 0.029	8.00 1800	23.30 5240	10000
20	20 0.795	35 1.379	31.6 1.24	22.0 0.87	5.0 0.197		AX 5 20 35	18 0.040	11.80 2650	39.00 8770	9000
25	25 0.994	42 1.655	37.4 1.47	27.7 1.09	2.8 0.110	AX 25 42		11.5 0.025	13.30 2990	49.00 11000	7500
	25 0.992	42 1.655	37.4 1.47	27.7 1.09	5.0 0.197		AX 5 25 42	25 0.055	13.30 2990	49.00 11000	7500
27	27 1.073	44 1.734	39.6 1.56	30.0 1.18	2.8 0.110	AX 27 44		12.1 0.027	13.70 3080	52.00 11690	7200
30	30 1.193	47 1.852	42.4 1.67	32.7 1.29	2.8 0.110	AX 30 47		13.7 0.030	14.50 3260	57.00 12800	6500
	30 1.189	47 1.852	42.4 1.67	32.7 1.29	5.0 0.197		AX 5 30 47	29 0.064	14.50 3260	57.00 12800	6500
31	35 1.385	52 2.048	49.0 1.93	37.2 1.46	2.8 0.110	AX 35 52		18.5 0.041	18.90 4250	84.00 18900	5500
35	35 1.386	52 2.048	49.0 1.93	37.2 1.46	5.0 0.197		AX 5 35 52	35 0.077	18.90 4250	84.00 18900	5500
	35 1.390	53 2.088	49.0 1.93	37.2 1.46	2.8 0.110	AX 35 53		19.3 0.043	18.90 4250	84.00 18900	5500
	35 1.386	53 2.088	49.0 1.93	37.2 1.46	5.0 0.197		AX 5 35 53	36 0.079	18.90 4250	84.00 18900	5500
40	40 1.587	60 2.363	54.9 2.16	43.0 1.69	2.8 0.110	AX 40 60		23.9 0.053	20.40 4590	96.00 21600	5000
	40 1.583	60 2.363	54.9 2.16	43.0 1.69	5.0 0.197		AX 5 40 60	46 0.101	20.40 4590	96.00 21600	5000





Dimensions mm/in.			Thin Wt. kg/lbs.	Washer Designation		mm/in.	Thick Wt. kg/lbs.	Washer Designation Precision	mm/in.	Precision Wt. kg/lbs.	Shaft
				Thin	Thick						
d	d_1	s				h			h^2		mm
17 0.671	**29.5** 1.160	**0.8** 0.031	**0.003** 0.006	**CP 17 30**				**CPN 7 17 30**	**7.0** 0.276	**0.025** 0.055	**17**
					CP 2 17 30	**2.0** 0.079	**0.007** 0.015				
18 0.711	**29.5** 1.160	**0.8** 0.031	**0.003** 0.006	**CP 18 30**							
					CP 2 18 30	**2.0** 0.079	**0.007** 0.015				
19 0.750	**31.5** 1.239	**0.8** 0.031	**0.004** 0.008	**CP 19 32**							**19**
					CP 2 19 32	**2.0** 0.079	**0.009** 0.020				
20 0.789	**34.5** 1.357				**CP 3 20 35**	**3.0** 0.118	**0.013** 0.029	**CPN 3 20 35**	**3.0** 0.118	**0.013** 0.029	**20**
25 0.988	**41.5** 1.634	**0.8** 0.031	**0.005** 0.012	**CP 25 42**				**CPN 3 25 42**	**3.0** 0.118	**0.019** 0.042	**25**
					CP 3 25 42	**3.0** 0.118	**0.019** 0.042				
27 1.065	**43.7** 1.719	**0.8** 0.031	**0.006** 0.013	**CP 27 44**							**27**
30 1.183	**46.5** 1.830	**0.8** 0.031	**0.006** 0.013	**CP 30 47**				**CPN 5 30 47**	**5.0** 0.197	**0.037** 0.082	**30**
					CP 3 30 47	**3.0** 0.118	**0.022** 0.049				
35 1.380	**51.5** 2.026	**0.8** 0.031	**0.007** 0.015	**CP 35 52**				**CPN 3 35 52**	**3.0** 0.118	**0.027** 0.060	**31**
					CP 3 35 52	**3.0** 0.118	**0.026** 0.057				**35**
		0.8 0.031	**0.007** 0.016	**CP 35 53**							
					CP 3 35 53	**3.0** 0.118	**0.027** 0.060				
40 1.577	**59.5** 2.341	**0.8** 0.031	**0.009** 0.021	**CP 40 60**				**CPN 3 40 60**	**3.0** 0.118	**0.034** 0.075	**40**

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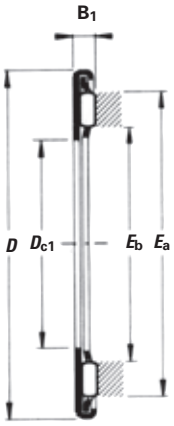
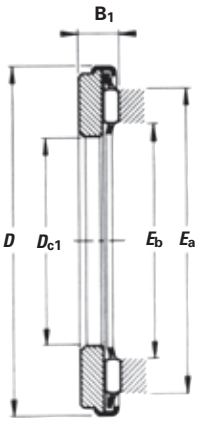
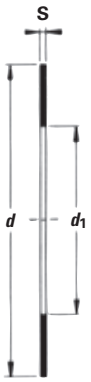
UNITIZED THRUST BEARINGS – *continued*

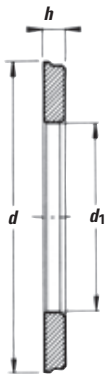
METRIC SERIES





Shaft Diameter	Dimensions mm/in.					Bearing Designation		Wt. kg/lbs.	Load Ratings kN/lbf.		Limiting Speed Oil
						Thin Series	Thick Series		Dynamic	Static	
mm	D_{C1}	D	E_a	E_b	B_1				C	C_o	RPM
45	45 1.783	65 2.560	59.9 2.36	48.0 1.89	2.8 0.110	AX 45 65		24.7 0.054	21.80 4900	109 24500	4500
	45 1.780	65 2.560	59.9 2.36	48.0 1.89	5.0 0.197		AX 5 45 65	50 0.110	21.80 4900	109 24500	4500
50	50 1.982	70 2.757	65.7 2.59	53.3 2.10	2.8 0.110	AX 50 70		25.5 0.056	22.50 5060	118 26500	4000
	50 1.976	70 2.757	65.7 2.59	53.3 2.10	5.0 0.197		AX 5 50 70	55 0.121	22.50 5060	118 26500	4000
55	55 2.179	78 3.072	72.5 2.85	58.4 2.30	2.8 0.110	AX 55 78		34 0.075	28.50 6410	164 36900	3800
	55 2.174	78 3.072	72.5 2.85	58.4 2.30	6.0 0.236		AX 6 55 78	89 0.196	28.50 6410	164 36900	3800
60	60 2.371	85 3.347	79.2 3.12	63.5 2.50	6.0 0.236		AX 6 60 85	106 0.234	31.50 7080	193 43400	3500
65	65 2.573	90 3.544	84.2 3.31	68.5 2.70	3.5 0.138	AX 3,5 65 90		59 0.130	33.50 7530	210 47200	3200
	65 2.568	90 3.544	84.2 3.31	68.5 2.70	6.0 0.236		AX 6 65 90	114 0.251	33.50 7530	210 47200	3200
70	70 2.770	95 3.741	89.2 3.51	73.5 2.89	3.5 0.138	AX 3,5 70 95		61 0.134	34.50 7760	223 50100	3000
	70 2.765	95 3.741	89.2 3.51	73.5 2.89	6.0 0.236		AX 6 70 95	120 0.265	34.50 7760	223 50100	3000
75	75 2.967	100 3.938	94.2 3.71	78.5 3.09	3.5 0.138	AX 3,5 75 100		65 0.143	36.00 8090	240 54000	2900
	75 2.961	100 3.938	94.2 3.71	78.5 3.09	6.0 0.236		AX 6 75 100	127 0.280	36.00 8090	240 54000	2900
80	80 3.165	105 4.135	99.2 3.91	83.5 3.29	3.5 0.138	AX 3,5 80 105		69 0.152	36.50 8210	253 56900	2700
	80 3.158	105 4.135	99.2 3.91	83.5 3.29	6.0 0.236		AX 6 80 105	134 0.295	36.50 8210	253 56900	2700
85	85 3.362	110 4.332	104.2 4.10	88.5 3.48	3.5 0.138	AX 3,5 85 110		78 0.172	38.00 8540	270 60700	2600
	85 3.356	110 4.332	104.2 4.10	88.5 3.48	6.0 0.236		AX 6 85 110	142 0.313	38.00 8540	270 60700	2600
90	90 3.559	120 4.725	112.9 4.44	94.2 3.71	4.5 0.177	AX 4,5 90 120		117 0.258	59.00 13300	360 80900	2400
	90 3.553	120 4.725	112.9 4.44	94.2 3.71	8.0 0.315		AX 8 90 120	238 0.525	59.00 13300	360 80900	2400





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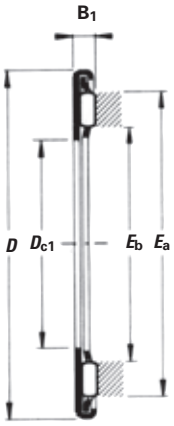
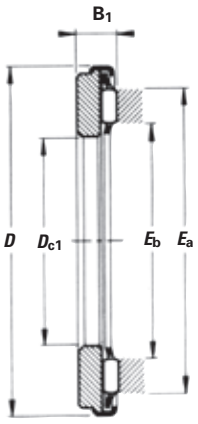
Dimensions mm/in.			Thin Wt. kg/lbs.	Washer Designation		mm/in.	Thick Wt. kg/lbs.	Washer Designation Precision	mm/in.	Precision Wt. kg/lbs.	Shaft
				Thin	Thick						
d	d_1	s				h			h^2		mm
					CP 3 40 60	3.0 0.118	0.034 0.075				
45 1.774	64.3 2.533	0.8 0.031	0.010 0.022	CP 45 65				CPN 3 45 65	3.0 0.118	0.037 0.082	45
				CP 3 45 65	3.0	0.037 0.118	0.082				
50 1.970	69.4 2.731	0.8 0.031	0.011 0.024	CP 50 70							50
				CP 3 50 70	3.0	0.040 0.118	0.088				
55 2.167	77.4 3.046	0.8 0.031	0.014 0.031	CP 55 78							55
				CP 4 55 78		4.0 0.157	0.069 0.152				
60 2.366	84.3 3.318			CP 4 60 85	4.0	0.083 0.157	0.183			60	
65 2.563	89.3 3.515	1.5 0.059	0.033 0.073	CP 1,5 65 90							65
					CP 4 65 90	4.0 0.157	0.088 0.194				
70 2.760	94.3 3.711	1.5 0.059	0.034 0.076	CP 1,5 70 95				CPN 4 70 95	4.0 0.157	0.093 0.205	70
					CP 4 70 95	4.0 0.157	0.093 0.205				
75 2.961	99 3.901	1.5 0.059	0.037 0.082	CP 1,5 75 100							75
					CP 4 75 100	4.0 0.157	0.099 0.218				
80 3.157	104 4.098	1.5 0.059	0.039 0.086	CP 1,5 80 105							80
					CP 4 80 105	4.0 0.157	0.104 0.229				
85 3.350	109 4.302	1.5 0.059	0.047 0.103	CP 1,5 85 110							85
					CP 4 85 110	4.0 0.157	0.111 0.245				
90 3.544	119 4.676	1.5 0.059	0.052 0.115	CP 1,5 90 120							90

Continued on next page.

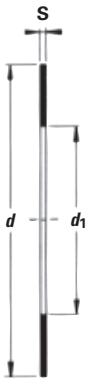
UNITIZED THRUST BEARINGS – *continued*

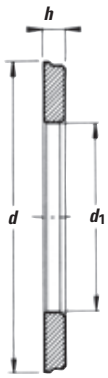
METRIC SERIES





Shaft Diameter	Dimensions mm/in.					Bearing Designation		Wt. kg/lbs.	Load Ratings kN/lbf.		Limiting Speed Oil
						Thin Series	Thick Series		Dynamic	Static	
mm	D_{C1}	D	E_a	E_b	B_1				C	C_o	RPM
100	100 3.947	135 5.316	127.3 5.01	104.2 4.10	9.0 0.354		AX 9 100 135	364 0.802	73.00 16400	490 110000	2100
110	110 4.346	145 5.709	137.3 5.41	114.2 4.50	4.5 0.177	AX 4,5 110 145		168 0.370	77.00 17300	550 124000	2000
	110 4.341	145 5.709	137.3 5.41	114.2 4.50	9.0 0.354		AX 9 110 145	393 0.866	77.00 17300	550 124000	2000
120	120 4.740	155 6.103	147.3 5.80	124.2 4.89	4.5 0.177	AX 4,5 120 155		182 0.401	80.00 18000	590 133000	1800
	120 4.734	155 6.103	147.3 5.80	124.2 4.89	9.0 0.354		AX 9 120 155	424 0.935	80.00 18000	590 133000	1800
130	130 5.129	170 6.694	161.0 6.34	135.0 5.31	11.0 0.432		AX 11 130 170	660 1.455	106 23800	710 160000	1700
140	140 5.522	180 7.087	171.0 6.73	145.0 5.71	9.0 0.353		AX 11 140 180	670 1.477	111 25000	770 173000	1600
150	150 5.916	190 7.481	181.0 7.13	155.0 6.10	9.0 0.353		AX 11 150 190	710 1.565	115 25900	830 187000	1500
160	160 6.310	200 7.874	191.0 7.52	165.0 6.50	9.0 0.353		AX 11 160 200	760 1.676	118 26500	870 196000	1400
170	170 6.704	215 8.465	207.0 8.15	175.0 6.89	12.0 0.471		AX 12 170 215	1000 2.205	165 37100	1160 261000	1300
180	180 7.097	225 8.859	217.0 8.54	185.0 7.28	12.0 0.471		AX 12 180 225	1050 2.315	173 38900	1250 281000	1200
190	190 7.493	240 9.449	232.0 9.13	196.0 7.72	13.9 0.549		AX 14 190 240	1400 3.086	230 51700	1650 371000	1200
200	200 7.886	250 9.843	242.0 9.53	206.0 8.11	13.9 0.549		AX 14 200 250	1500 3.307	239 53700	1730 389000	1100
220	220 8.674	270 10.630	262.0 10.31	226.0 8.90	13.9 0.549		AX 14 220 270	1600 3.527	248 55800	1850 416000	1000
240	240 9.461	300 11.811	286.0 11.26	246.0 9.69	14.9 0.588		AX 15 240 300	2300 5.071	280 62900	2240 504000	900





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Dimensions mm/in.			Thin Wt. kg/lbs.	Washer Designation		mm/in.	Thick Wt. kg/lbs.	Washer Designation Precision	mm/in.	Precision Wt. kg/lbs.	Shaft
				Thin	Thick						
d	d_1	s				h			h^2		mm
					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

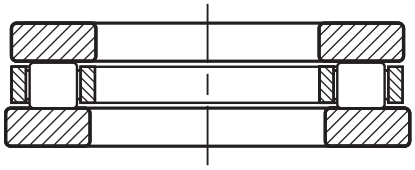
Cylindrical roller thrust bearings provide rolling bearing arrangements which can accommodate high dynamic axial loads as well as shock loads. The simple geometry of the bearing components allows the use of many design arrangements. As an example, for less demanding applications it is possible to combine 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.

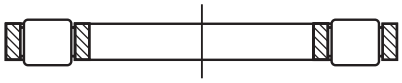
REFERENCE STANDARDS ARE:

- **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

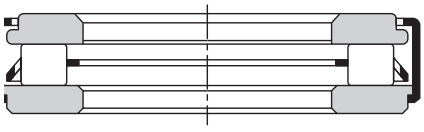
TYPES OF METRIC SERIES CYLINDRICAL ROLLER THRUST BEARINGS AND THEIR COMPONENTS.



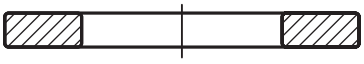
811, 812 Series
Cylindrical roller thrust bearings



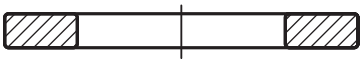
K.811, K.812
Cylindrical roller and cage thrust assemblies



ARZ Series
Unitized cylindrical roller thrust bearing



WS.811, WS.812
Shaft washers



GS.811, GS.812
Housing washers

Suffixes	
LPB	machined light metal window type cage.
TVP	molded window type cage of glass reinforced nylon.

CONSTRUCTION

BASIC DESIGNS

Cylindrical roller thrust bearings of dimension Series 811 and 812 comprise of a cylindrical roller and cage thrust assembly (K), a shaft washer (WS) and a housing washer (GS). Providing the back up surfaces can be hardened and ground they can be used as raceways for the cylindrical rollers of the cylindrical roller and cage thrust assembly, resulting in a compact bearing arrangement.

Series AR are available with thin or thick CP washers or heavy CPR thrust washers.

THRUST BEARINGS WITH TWO THRUST WASHERS

Thrust bearing type AXZ and ARZ each have two thrust washers retained by an integral cap, giving protection against the entry of dirt and metal particles while helping to retain the lubricant.

CAGE DESIGNS

Metric series 811 and 812 cylindrical roller thrust bearings use molded cages of glass fiber reinforced nylon 6/6 (suffix TVP), or machined cages of light metal (suffix LPB). The cages are designed to be piloted on the shaft. The reinforced nylon cages can be used at temperatures up to 120° C (250˚ F) continuously for extended periods. When lubricating these bearings with oil it should be ensured that the oil does not contain additives detrimental to the cage over extended life at operating temperatures higher than 100° C (212˚ F). Also, care should be exercised that oil change intervals are observed as old oil may reduce cage life at such temperatures.

The rolling elements of the AR Series thrust bearings are retained and guided in radial pockets within the cage. The cage is retained in relation to the thrust washer by means of a retaining cap. The design of a one-piece steel cage employs a special curvature that guides the rolling elements by their ends along their centerlines.

In addition, this special curvature gives the steel cage great rigidity while providing maximum lubricant space. This unitized assembly of components facilitates installation and provides a high axial load capacity while occupying only minimal space.

AR Series needle thrust bearings with a thin washer are of minimal thickness and provide excellent economy. They should be considered whenever the degree of support and rotational accuracy requirement allow.

BEARING THRUST WASHERS

SHAFT WASHERS AND HOUSING WASHERS

Shaft washers of types WS.811 and WS.812 as well as housing washers of types GS.811 and GS.812 are components of the metric series cylindrical roller thrust bearings of series 811 and 812. They are made of bearing quality steel, with hardened and precision ground and lapped flat raceway surfaces. The tolerances of the thrust bearing bore and outside diameter shown in the engineering section apply to shaft and housing piloted metric series washers.

HEAVY THRUST WASHERS (LS), THIN THRUST WASHERS (AS)

These thrust washers, more frequently used with needle roller and cage thrust assemblies of metric series FNT or AXK, are also suitable for use with the cylindrical roller and cage thrust assemblies K.811. The heavy thrust washer of series LS are made of bearing quality steel, hardened and precision ground on the flat raceway surfaces. The bore and outside diameters of the heavy thrust washers are not ground, therefore, when used with K.811 type assemblies they are only suggested where accurate centering is not required. The thin thrust washers of series AS may be used in applications where the loads are light. Both types of these washers are listed in the tabular part of the metric series needle roller and cage thrust assemblies section.

THIN (CP) AND THICK (CPR) THRUST WASHERS

The washer incorporated in the AR Series thrust bearing is made from hardened bearing steel and forms one of the raceways for the rolling elements. The opposing raceway is generally provided by a separate thrust washer of similar design supplied by Timken. When the AR Series thrust bearing is piloted by the revolving part, the thrust washer must be piloted by the stationary part and vice versa. If the revolving part and the stationary part are noticeably eccentric to each other, the thrust bearing with integral washer must, without exception, be piloted by the revolving part.

The second raceway for the rolling elements may also be formed by the face of a shoulder or an inserted washer, provided these have the correct hardness and geometrical dimensions.

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.

C

TABLE 2 –
TOLERANCES FOR OUTSIDE DIAMETER (d_1) AND BORE DIAMETER (d) OF SERIES AS THRUST WASHERS.

d_1 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_1) AND BORE DIAMETER (d) OF SERIES LS HEAVY THRUST WASHERS.

d_1 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				

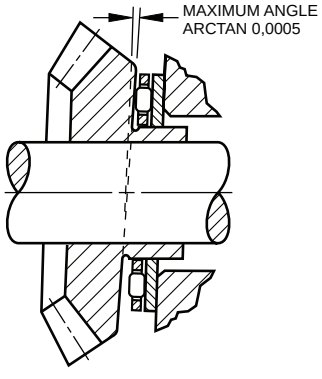
MOUNTING TOLERANCES

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.

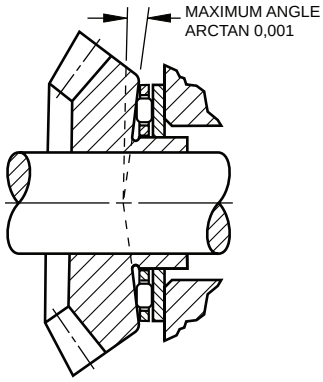
TABLE 4 –
MOUNTING TOLERANCES FOR SHAFTS AND HOUSINGS FOR METRIC SERIES COMPONENTS.

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:

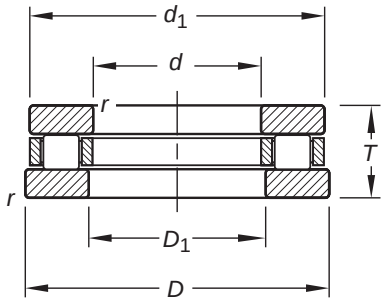
$$F_{a\ min} = 0.1 \bullet C_0/2200 \quad (kN)$$

where

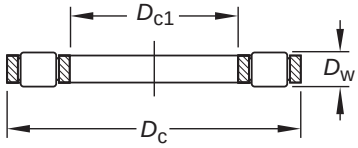
C_0 – static load rating (kN)
$F_{a\ min}$ – minimum axial load (kN)

CYLINDRICAL ROLLER THRUST BEARINGS
CYLINDRICAL ROLLER AND CAGE THRUST ASSEMBLIES

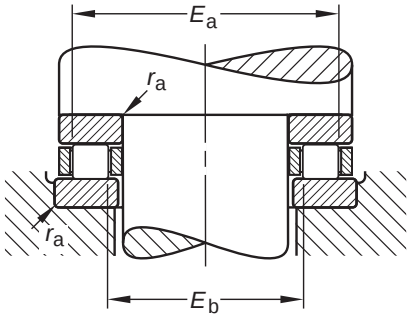
METRIC SERIES



811, 812

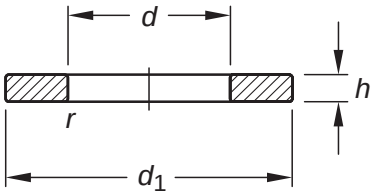


K811, K812

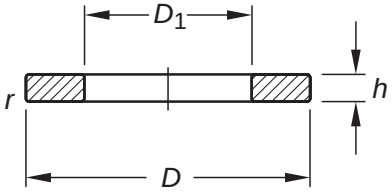


Raceway contact dimensions

Shaft Diameter	Dimensions mm/in. E11	a13					Assembly Designation	Load Ratings kN/lbf. Dynamic	Static	Limiting Speed Oil	Wt. kg/lbs.
mm	D_{c1}	D_c	D_w	E_b	E_a	$r_{as\ max}$		C	C_o	RPM	
15	15 0.5906	28 1.1024	3.5 0.1378	18 0.709	25 0.984	0.3 0.012	K.81102LPB	12.8 2880	28.6 6430	12000	0.006 0.013
	15 0.5906	28 1.1024	3.5 0.1378	18 0.709	25 0.984	0.3 0.012	K.81102TVP	12.8 2880	28.6 6430	12000	0.006 0.013
17	17 0.6693	30 1.1811	3.5 0.1378	20 0.787	27 1.063	0.3 0.012	K.81103LPB	14.2 3190	33.4 7510	11000	0.008 0.018
	17 0.6693	30 1.1811	3.5 0.1378	20 0.787	27 1.063	0.3 0.012	K.81103TVP	14.2 3190	33.4 7510	11000	0.008 0.018
20	20 0.7874	35 1.3780	4.5 0.1772	23 0.906	32 1.260	0.3 0.012	K.81104TVP	23.6 5310	56.8 12800	9500	0.009 0.020
25	25 0.9843	42 1.6535	5.0 0.1969	28 1.102	39 1.535	0.6 0.024	K.81105TVP	31.2 7010	81.0 18200	8000	0.014 0.031
30	30 1.1811	47 1.8504	5.0 0.1969	33 1.299	44 1.732	0.6 0.024	K.81106LPB	33.0 7420	91.1 20500	6700	0.026 0.057
	30 1.1811	47 1.8504	5.0 0.1969	33 1.299	44 1.732	0.6 0.024	K.81106TVP	33.0 7420	91.1 20500	6700	0.016 0.035
	30 1.1811	52 2.0472	7.5 0.2953	33 1.299	49 1.929	0.6 0.024	K.81206LPB	56.9 12800	141 31700	6300	0.052 0.115
	30 1.1811	52 2.0472	7.5 0.2953	33 1.299	49 1.929	0.6 0.024	K.81206TVP	56.9 12800	141 31700	6300	0.034 0.075
35	35 1.3780	52 2.0472	5.0 0.1969	38 1.496	49 1.929	0.6 0.024	K.81107LPB	34.8 7820	101 22700	6000	0.025 0.055
	35 1.3780	52 2.0472	5.0 0.1969	38 1.496	49 1.929	0.6 0.024	K.81107TVP	34.8 7820	101 22700	6000	0.020 0.044
	35 1.3780	62 2.4409	7.5 0.2953	41 1.614	56 2.205	1.0 0.039	K.81207LPB	61.6 13800	164 36900	5300	0.073 0.161
	35 1.3780	62 2.4409	7.5 0.2953	41 1.614	56 2.205	1.0 0.039	K.81207TVP	61.6 13800	164 36900	5300	0.055 0.121
40	40 1.5748	60 2.3622	6.0 0.2362	44 1.732	56 2.205	0.6 0.024	K.81108LPB	49.8 11200	148 33300	5300	0.044 0.097
	40 1.5748	60 2.3622	6.0 0.2362	44 1.732	56 2.205	0.6 0.024	K.81108TVP	49.8 11200	148 33300	5300	0.031 0.068
	40 1.5748	68 2.6772	9.0 0.3543	45 1.772	63 2.480	1.0 0.039	K.81208TVP	86.8 19500	233 52400	4800	0.076 0.168
45	45 1.7717	65 2.5591	6.0 0.2362	49 1.929	61 2.402	0.6 0.024	K.81109LPB	52.3 11800	163 36600	4800	0.035 0.077
	45 1.7717	65 2.5591	6.0 0.2362	49 1.929	61 2.402	0.6 0.024	K.81109TVP	52.3 11800	163 36600	4800	0.035 0.077
	45 1.7717	73 2.8740	9.0 0.3543	50 1.969	68 2.677	1.0 0.039	K.81209TVP	94.2 21200	266 59800	4500	0.083 0.183



WS.811, WS.812



GS.811, GS.812

Dimensions mm/in.			Max.	Min.		Asembly Designation		Wt. kg/lbs.	Shaft Diameter
d	D_1	D_1 d_1	h		$r_{s\ min}$				mm
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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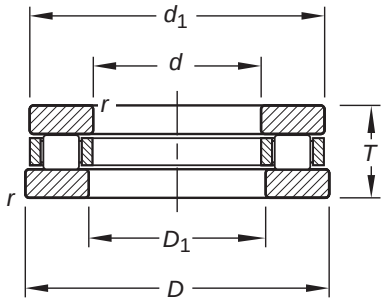
CYLINDRICAL ROLLER THRUST BEARINGS
CYLINDRICAL ROLLER AND CAGE THRUST ASSEMBLIES – *continued*

METRIC SERIES



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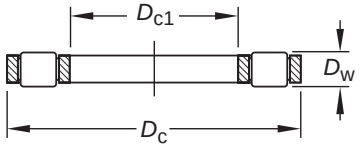
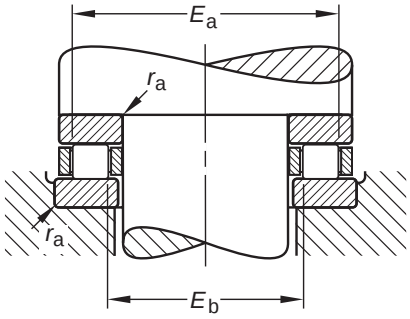
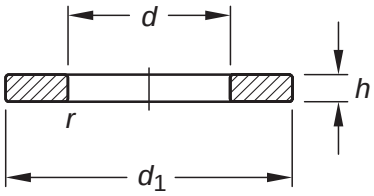


K811, K812

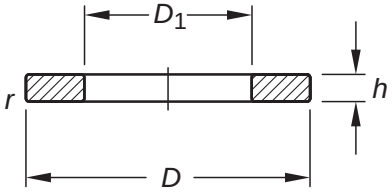


Raceway contact dimensions

Shaft Diameter	Dimensions mm/in. E11	a13					Assembly Designation	Load Ratings kN/lbf. Dynamic	Static	Limiting Speed Oil	Wt. kg/lbs.
mm	D_{c1}	D_c	D_w	E_b	E_a	$r_{as\ max}$		C	C_o	RPM	
50	50 1.9685	70 2.7559	6.0 0.2362	54 2.126	66 2.598	0.6 0.024	K.81110LPB	54.8 12300	177 39800	4300	0.052 0.115
	50 1.9685	70 2.7559	6.0 0.2362	54 2.126	66 2.598	0.6 0.024	K.81110TVP	54.8 12300	177 39800	4300	0.042 0.093
	50 1.9685	78 3.0709	9.0 0.3543	55 2.165	73 2.874	1.0 0.039	K.81210TVP	101 22700	299 67200	4000	0.089 0.196
55	55 2.1654	78 3.0709	6.0 0.2362	60 2.362	73 2.874	0.6 0.024	K.81111TVP	60.3 13600	207 46500	4000	0.066 0.146
	55 2.1654	90 3.5433	11.0 0.4331	61 2.402	84 3.307	1.0 0.039	K.81211LPB	138 31000	403 90600	3600	0.156 0.344
	55 2.1654	90 3.5433	11.0 0.4331	61 2.402	84 3.307	1.0 0.039	K.81211TVP	138 31000	403 90600	3600	0.140 0.309
60	60 2.3622	85 3.3465	7.5 0.2953	65 2.559	80 3.150	1.0 0.039	K.81112TVP	84.4 19000	281 63200	3600	0.103 0.227
	60 2.3622	95 3.7402	11.0 0.4331	66 2.598	89 3.504	1.0 0.039	K.81212LPB	129 29000	378 85000	3400	0.166 0.366
65	65 2.5591	90 3.5433	7.5 0.2953	70 2.756	85 3.346	1.0 0.039	K.81113TVP	88.3 19900	305 68600	3400	0.109 0.240
	65 2.5591	100 3.9370	11.0 0.4331	71 2.795	94 3.701	1.0 0.039	K.81213LPB	134 30100	403 90600	3200	0.176 0.388
70	70 2.7559	95 3.7402	7.5 0.2953	75 2.953	90 3.543	1.0 0.039	K.81114TVP	92.1 20700	328 73700	3200	0.056 0.123
	70 2.7559	105 4.1339	11.0 0.4331	76 2.992	99 3.898	1.0 0.039	K.81214LPB	138 31000	428 96200	3000	0.186 0.410
75	75 2.9528	100 3.9370	7.5 0.2953	80 3.150	95 3.740	1.0 0.039	K.81115LPB	86.1 19400	305 68600	3000	0.091 0.201
	75 2.9528	110 4.3307	11.0 0.4331	81 3.189	104 4.094	1.0 0.039	K.81215LPB	143 32100	453 101800	2800	0.197 0.434
80	80 3.1496	105 4.1339	7.5 0.2953	85 3.346	100 3.937	1.0 0.039	K.81116LPB	87.5 19700	316 71000	2800	0.103 0.227
	80 3.1496	115 4.5276	11.0 0.4331	86 3.386	109 4.291	1.0 0.039	K.81216LPB	147 33000	478 107500	2600	0.208 0.459
85	85 3.3465	110 4.3307	7.5 0.2953	90 3.543	105 4.134	1.0 0.039	K.81117LPB	88.9 20000	328 73700	2600	0.108 0.238
	85 3.3465	125 4.9213	12.0 0.4724	93 3.661	117 4.606	1.0 0.039	K.81217LPB	174 39100	572 128600	2400	0.376 0.829
90	90 3.5433	120 4.7244	9.0 0.3543	96 3.780	114 4.488	1.0 0.039	K.81118LPB	119 26800	432 97100	2400	0.156 0.344
	90 3.5433	135 5.3150	14.0 0.5512	98 3.858	127 5.000	1.0 0.039	K.81218LPB	215 48300	691 155300	2400	0.540 1.190



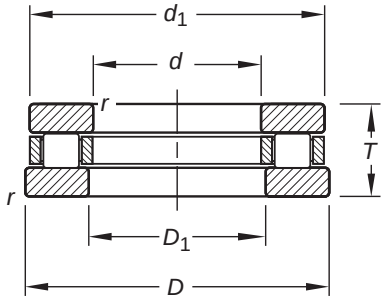
WS.811, WS.812



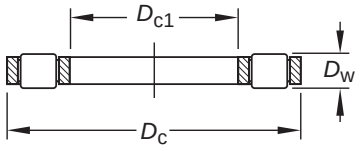
GS.811, GS.812

Dimensions mm/in.						Asembly Designation		Wt. kg/lbs.	Shaft Diameter
			Max.	Min.					
d	D_1	D_1 d_1	h		$r_{s\ min}$				mm
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	

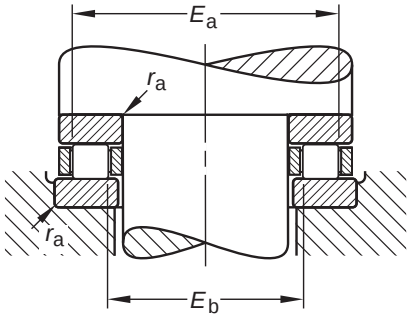
CYLINDRICAL ROLLER THRUST BEARINGS
CYLINDRICAL ROLLER AND CAGE THRUST ASSEMBLIES
METRIC SERIES



811, 812



K811, K812



Raceway contact dimensions

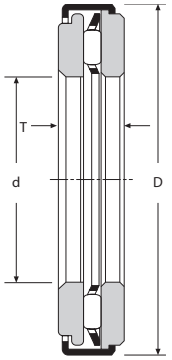
Shaft Diameter	Dimensions mm/in.							Bearing Designation	Load Ratings N/lbf. Dynamic	Load Ratings N/lbf. Static	Limiting Speed Oil	Wt. kg/lbs.
mm	d	D	D_w	T	E_b	E_a	r as max		C	C_o	RPM	
15	15 0.5906	28 1.1024	3.5 0.1378	9 0.354	18 0.709	25 0.984	0.3 0.012	81102LPB	12.8 2880	28.6 6430	12000	0.029 0.064
	15 0.5906	28 1.1024	3.5 0.1378	9 0.354	18 0.709	25 0.984	0.3 0.012	81102TVP	12.8 2880	28.6 6430	12000	0.022 0.049
17	17 0.6693	30 1.1811	3.5 0.1378	9 0.354	20 0.787	27 1.063	0.3 0.012	81103TVP	14.2 3190	33.4 7510	11000	0.000 0.000
20	20 0.7874	35 1.3780	4.5 0.1772	10 0.394	23 0.906	32 1.260	0.3 0.012	81104TVP	23.6 5310	56.8 12800	9500	0.040 0.088
25	25 0.9843	42 1.6535	5.0 0.1969	11 0.433	28 1.102	39 1.535	0.6 0.024	81105TVP	31.2 7010	81.0 18200	8000	0.070 0.154
30	30 1.1811	47 1.8504	5.0 0.1969	11 0.433	33 1.299	44 1.732	0.6 0.024	81106TVP	33.0 7420	91.1 20500	6700	0.060 0.132
	30 1.1811	52 2.0472	7.5 0.2953	16 0.630	33 1.299	49 1.929	0.6 0.024	81206TVP	56.9 12800	141 31700	6300	0.128 0.282
35	35 1.3780	52 2.0472	5.0 0.1969	12 0.472	38 1.496	49 1.929	0.6 0.024	81107TVP	34.8 7820	101 22700	6000	0.081 0.179
	35 1.3780	62 2.4409	7.5 0.2953	18 0.709	41 1.614	56 2.205	1.0 0.039	81207TVP	61.6 13800	164 36900	5300	0.250 0.551
40	40 1.5748	60 2.3622	6.0 0.2362	13 0.512	44 1.732	56 2.205	0.6 0.024	81108TVP	49.8 11200	148 33300	5300	0.100 0.220
	40 1.5748	68 2.6772	9.0 0.3543	19 0.748	45 1.772	63 2.480	1.0 0.039	81208TVP	86.8 19500	233 52400	4800	0.266 0.586
45	45 1.7717	65 2.5591	6.0 0.2362	14 0.551	49 1.929	61 2.402	0.6 0.024	81109TVP	52.3 11800	163 36600	4800	0.141 0.311
50	50 1.9685	70 2.7559	6.0 0.2362	14 0.551	54 2.126	66 2.598	0.6 0.024	81110LPB	54.8 12300	177 39800	4300	0.152 0.335
	50 1.9685	70 2.7559	6.0 0.2362	14 0.551	54 2.126	66 2.598	0.6 0.024	81110TVP	54.8 12300	177 39800	4300	0.160 0.353
	50 1.9685	78 3.0709	9.0 0.3543	22 0.866	55 2.165	73 2.874	1.0 0.039	81210TVP	101 22700	299 67200	4000	0.437 0.963
55	55 2.1654	78 3.0709	6.0 0.2362	16 0.630	60 2.362	73 2.874	0.6 0.024	81111TVP	60.3 13600	207 46500	4000	0.233 0.514
	55 2.1654	90 3.5433	11.0 0.4331	25 0.984	61 2.402	84 3.307	1.0 0.039	81211TVP	138 31000	403 90600	3600	0.584 1.287

C

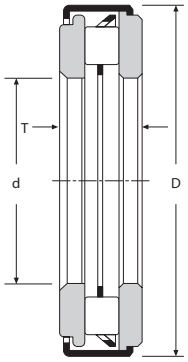
Shaft Diameter	Dimensions mm/in.							Bearing Designation	Load Ratings kN/lbf. Dynamic	Load Ratings kN/lbf. Static	Limiting Speed Oil	Wt. kg/lbs.
mm	d	D	D_w	T	E_b	E_a	$r_{as\ max}$		C	C_o	RPM	
60	60 2.3622	85 3.3465	7.5 0.2953	17 0.669	65 2.559	80 3.150	1.0 0.039	81112TVP	84.4 19000	281 63200	3600	0.315 0.694
	60 2.3622	95 3.7402	11.0 0.4331	26 1.024	66 2.598	89 3.504	1.0 0.039	81212LPB	129 29000	378 85000	3400	0.770 1.698
65	65 2.5591	90 3.5433	7.5 0.2953	18 0.709	70 2.756	85 3.346	1.0 0.039	81113TVP	88.3 19900	305 68600	3400	0.360 0.794
	65 2.5591	100 3.9370	11.0 0.4331	27 1.063	71 2.795	94 3.701	1.0 0.039	81213LPB	134 30100	403 90600	3200	0.805 1.775
70	70 2.7559	95 3.7402	7.5 0.2953	18 0.709	75 2.953	90 3.543	1.0 0.039	81114TVP	92.1 20700	328 73700	3200	0.352 0.776
	70 2.7559	105 4.1339	11.0 0.4331	27 1.063	76 2.992	99 3.898	1.0 0.039	81214LPB	138 31000	428 96200	3000	0.868 1.914
75	75 2.9528	100 3.9370	7.5 0.2953	19 0.748	80 3.150	95 3.740	1.0 0.039	81115LPB	86.1 19400	305 68600	3000	0.405 0.893
	75 2.9528	110 4.3307	11.0 0.4331	27 1.063	81 3.189	104 4.094	1.0 0.039	81215LPB	143 32100	453 102000	2800	0.780 1.720
80	80 3.1496	105 4.1339	7.5 0.2953	19 0.748	85 3.346	100 3.937	1.0 0.039	81116LPB	87.5 19700	316 71000	2800	0.412 0.908
	80 3.1496	115 4.5276	11.0 0.4331	28 1.102	86 3.386	109 4.291	1.0 0.039	81216LPB	147 33000	478 107000	2600	1.080 2.381
85	85 3.3465	110 4.3307	7.5 0.2953	19 0.748	90 3.543	105 4.134	1.0 0.039	81117LPB	88.9 20000	328 73700	2600	0.480 1.058
	85 3.3465	125 4.9213	12.0 0.4724	31 1.220	93 3.661	117 4.606	1.0 0.039	81217LPB	174 39100	572 129000	2400	1.360 2.998
90	90 3.5433	120 4.7244	9.0 0.3543	22 0.866	96 3.780	114 4.488	1.0 0.039	81118LPB	119 26800	432 97100	2400	0.710 1.565
	90 3.5433	135 5.3150	14.0 0.5512	35 1.378	98 3.858	127 5.000	1.0 0.039	81218LPB	215 48300	691 155000	2400	1.850 4.079

NEEDLE OR ROLLER THRUST BEARINGS

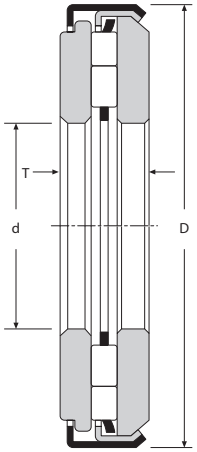
METRIC SERIES



AXZ



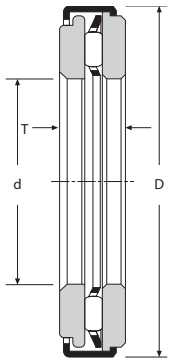
ARZ LIGHT



ARZ HEAVY

Shaft Diameter	mm/in.			AXZ	ARZ Light	ARZ Heavy	Load Ratings kN/lbf.		Limiting Speed Oil	Wt. kg/lbs.
mm	d	D	T				C	C_0	RPM	
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
	10 0.394	22.4 0.882	6 0.236	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
	12 0.472	26.4 1.039	7 0.275		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
	15 0.591	28.4 1.118	7 0.275		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
	17 0.669	30.4 1.197	7 0.275		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
	20 0.787	35.4 1.394	10 0.394		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
	25 0.984	43 1.693	10 0.394		ARZ 10 25 43		25.5 5730	70.0 15700	7500	0.057 0.126
	25 0.984	53 2.087	11 0.433			ARZ 11 25 53	32.5 7310	122 27400	6500	0.122 0.269
30	30 1.181	48 1.890	8 0.315	AXZ 8 30 48			14.50 3260	57.0 12800	6500	0.054 0.119
	30 1.181	48 1.890	10 0.394		ARZ 10 30 48		26.5 5960	77.0 17300	6500	0.065 0.143
	30 1.181	61 2.402	14 0.551			ARZ 14 30 61	46.0 10340	162 36400	5600	0.196 0.432
35	35 1.378	54 2.126	8 0.315	AXZ 8 35 54			18.90 4250	84.0 18900	5500	0.066 0.146
	35 1.378	54 2.126	11 0.433		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

Continued on next page.



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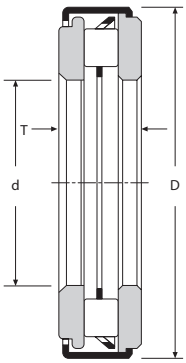
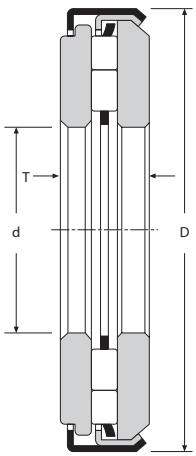


ARZ LIGHT

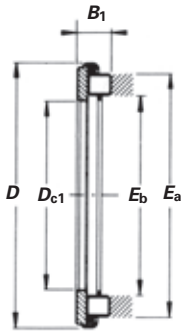


ARZ HEAVY

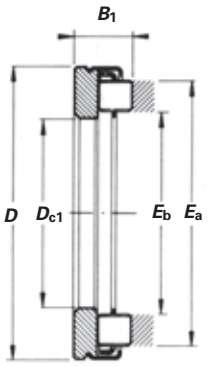
Shaft Diameter	mm/in.			AXZ	ARZ Light	ARZ Heavy	Load Ratings kN/lbf		Limiting Speed Oil	Wt. kg/lbs.
mm	d	D	T				C	C_0	RPM	
40	40 1.575	61 2.402	8 0.315	AXZ 8 40 61			20.40 4590	96.0 21600	5000	0.084 0.185
	40 1.575	61 2.402	12 0.472		ARZ 12 40 61		46.0 10340	129 29000	5000	0.114 0.251
	40 1.575	79 3.110	17 0.669			ARZ 17 40 79	71.0 15960	265 59600	4200	0.387 0.853
45	45 1.772	66 2.598	8 0.315	AXZ 8 45 66			21.80 4900	109 24500	4500	0.092 0.203
	45 1.772	66 2.598	12 0.472		ARZ 12 45 66		49.0 11000	143 32100	4500	0.126 0.278
	45 1.772	86 3.386	22 0.866			ARZ 22 45 86	92.0 20700	340 76400	3800	0.595 1.312
50	50 1.969	71 2.795	8 0.315	AXZ 8 50 71			22.50 5100	118 26500	4000	0.100 0.220
	50 1.969	71 2.795	12 0.472		ARZ 12 50 71		51.0 11500	157 35300	4000	0.137 0.302
	50 1.969	96 3.780	22 0.866			ARZ 22 50 96	108.0 24300	430 96700	3400	0.756 1.66
55	55 2.165	106 4.173	22 0.866			ARZ 22 55 106	125.0 28100	530 119100	3100	0.917 2.022
60	60 2.362	86 3.386	10 0.394	AXZ 10 60 86			31.50 7100	193 43400	3500	0.194 0.428
	60 2.362	86 3.386	14 0.551		ARZ 14 60 86		71.0 16000	255 57300	3500	0.246 0.542
	60 2.362	111 4.370	22 0.866			ARZ 22 60 111	130.0 29200	580 130400	2900	0.977 2.15
65	65 2.559	116 4.567	22 0.866			ARZ 22 65 116	135.0 30300	620 139400	2800	1.040 2.29
70	70 2.756	96 3.780	10 0.394	AXZ 10 70 96			34.50 7800	223 50100	3000	0.220 0.485
	70 2.756	96 3.780	14 0.551		ARZ 14 70 96		77.0 17300	295 66300	3000	0.279 0.615
80	80 3.150	106 4.173	10 0.394	AXZ 10 80 106			36.50 8200	253 56900	2700	0.256 0.564
	80 3.150	106 4.173	14 0.551		ARZ 14 80 106		82.0 18400	330 74200	2700	0.312 0.688

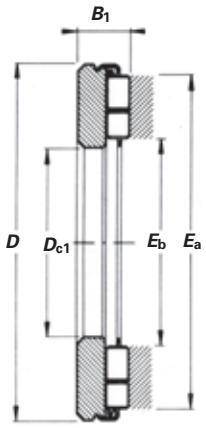
UNITIZED ROLLER THRUST BEARING ASSEMBLIES

METRIC SERIES



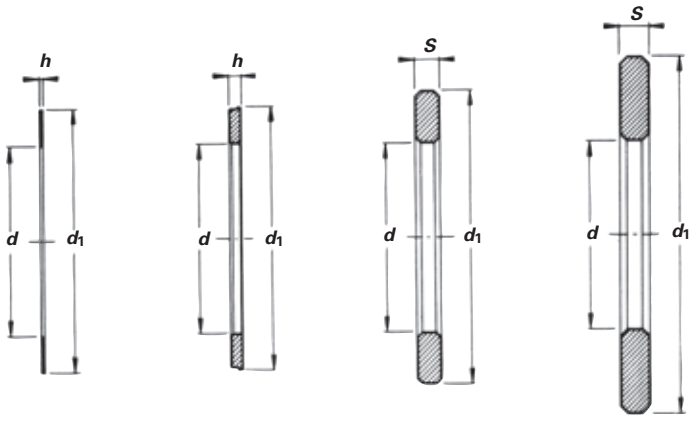
AR Light





AR Heavy

Shaft Diameter	mm/in.					Light Series	Heavy Series	Wt. kg/lbs.	Load Ratings kN/lbf.		Limiting Speed Oil
mm	D_{c1}	D	B_1	E_a	E_b	AR	AR		Dynamic C	Static C_0	RPM
10	10 0.394	22 0.866	4.5 0.177	18.5 0.73	12.2 0.48	AR 4,5 10 22		0.007 0.016	8.2 1840	17.9 4020	15500
12	12 0.472	26 1.024	5 0.197	22.9 0.90	14.8 0.58	AR 5 12 26		0.011 0.024	12.7 2860	29.5 6630	13000
15	15 0.591	28 1.103	5 0.197	24.9 0.98	16.8 0.66	AR 5 15 28		0.011 0.024	14.0 3150	34.0 7640	11500
17	17 0.669	30 1.181	5 0.197	26.9 1.06	18.8 0.74	AR 5 17 30		0.013 0.028	15.0 3370	39.0 8770	10500
20	20 0.787	35 1.378	7 0.276	31.6 1.24	22.0 0.87	AR 7 20 35		0.022 0.049	22.0 4950	54.0 12100	9000
25	25 0.984	42 1.654	7 0.276	37.3 1.47	27.7 1.09	AR 7 25 42		0.031 0.068	25.5 5730	70.0 15700	7500
	25 0.984	52 2.047	7 0.276	47.0 1.85	29.0 1.14		AR 7 25 52	0.070 0.154	32.5 7310	122.0 27400	6500
30	30 1.181	47 1.851	7 0.276	42.3 1.67	32.7 1.29	AR 7 30 47		0.036 0.079	26.5 5960	77.0 17300	6500
	30 1.181	60 2.362	9 0.354	53.5 2.11	33.5 1.32		AR 9 30 60	0.113 0.249	46.0 10340	162.0 36400	5600
35	35 1.378	53 2.103	8 0.315	47.8 1.88	37.8 1.49	AR 8 35 53,4		0.052 0.115	33.8 7600	94.0 21100	5500
	35 1.378	68 2.677	9 0.354	60.6 2.39	39.0 1.54		AR 9 35 68	0.144 0.317	51.0 11500	194.0 43600	4900
40	40 1.575	60 2.378	9 0.354	54.8 2.16	42.8 1.69	AR 9 40 60,4		0.070 0.154	46.0 10300	129.0 29000	5000
	40 1.575	78 3.071	11 0.433	70.0 2.76	44.0 1.73		AR 11 40 78	0.225 0.496	71.0 16000	265.0 59600	4200
45	45 1.772	65 2.575	9 0.354	59.8 2.35	47.8 1.88	AR 9 45 65,4		0.077 0.170	49.0 11000	143.0 32100	4500
	45 1.772	85 3.347	14 0.551	77.0 3.03	49.0 1.93		AR 14 45 85	0.350 0.772	92.0 20700	340.0 76400	3800
50	50 1.968	70 2.772	9 0.354	64.8 2.55	52.8 2.08	AR 9 50 70,4		0.082 0.181	51.0 11500	15 7.0 35300	4000
	50 1.968	95 3.740	14 0.551	86.0 3.39	54.0 2.13		AR 14 50 95	0.448 0.988	108.0 24300	430.0 96700	3400
55	55 2.165	78 3.087	10 0.394	72.5 2.85	58.5 2.30	AR 10 55 78,4		0.125 0.276	61.0 13700	203.0 45600	3800
	55 2.165	105 4.134	14 0.551	96.2 3.79	60.2 2.37		AR 14 55 105	0.537 1.184	125.0 28100	530.0 119100	3100



CP Thin CP Thick CP Heavy

mm/in.		Thin Series	mm/in.	Wt. kg/lbs.	Thick Series	mm/in.	Wt.	Heavy Series	mm/in.	Wt. kg/lbs.	Shaft Diameter
d	d_1		S^1			h^2			h^2		mm
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		0.031	0.024		0.118	0.088	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	

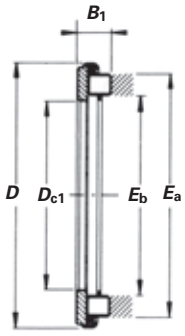
(1) ±0.03 mm (±0.0012") under 150 N (34 lbs.) load

(2) ±0.05 mm (±0.0020") under 250 N (56 lbs.) load

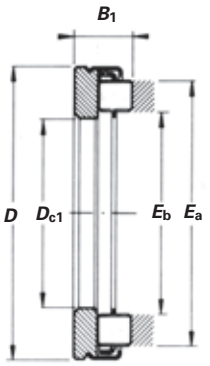
Continued on next page.

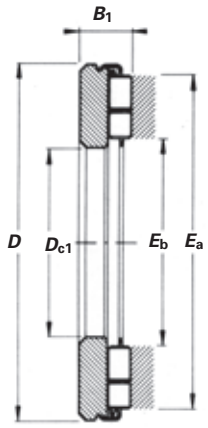
UNITIZED ROLLER THRUST BEARING ASSEMBLIES – *continued*

METRIC SERIES



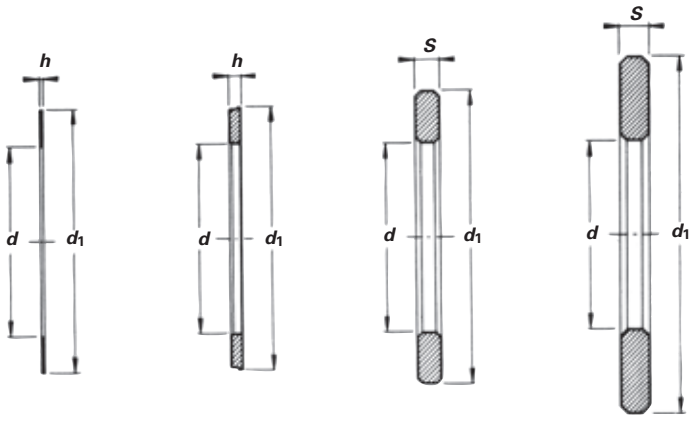
AR Light





AR Heavy

Shaft Diameter	mm/in.					Light Series	Heavy Series	Wt. kg/lbs.	Load Ratings kN/lbf.		Limiting Speed Oil
mm	D_{c1}	D	B_1	E_a	E_b	AR	AR		Dynamic C	Static C_0	RPM
60	60 2.362	85 3.362	10 0.394	79.5 3.13	63.5 2.50	AR 10 60 85,4		0.150 0.331	71.0 16000	255.0 57300	3500
	60 2.362	110 4.331	14 0.551	101.2 3.98	65.2 2.57		AR 14 60 110	0.572 1.261	130.0 29200	580.0 130400	2900
65	65 2.559	90 3.559	10 0.394	84.5 3.33	68.5 2.70	AR 10 65 90,4		0.160 0.353	74.0 16600	275.0 61800	3200
	65 2.559	115 4.528	14 0.551	106.2 4.18	70.2 2.76		AR 14 65 115	0.610 1.345	135.0 30300	620.0 139400	2800
70	70 2.756	95 3.756	10 0.394	89.5 3.52	73.5 2.89	AR 10 70 95,4		0.170 0.375	77.0 17300	295.0 66300	3000
	70 2.756	125 4.921	16 0.630	116.0 4.57	76.0 2.99		AR 16 70 125	0.775 1.709	174.0 39100	710.0 159600	2600
75	75 2.953	100 3.938	10 0.394	94.5 3.72	78.5 3.09	AR 10 75 100,4		0.180 0.397	80.0 18000	313.0 70400	2800
	75 2.953	135 5.315	16 0.630	126.0 4.96	82.0 3.23		AR 16 75 135	0.893 1.969	198.0 44500	860.0 193300	2400
80	80 3.150	105 4.150	10 0.394	99.5 3.92	83.5 3.29	AR 10 80 105,4		0.190 0.419	82.0 18400	330.0 74200	2700
	80 3.150	140 5.512	16 0.630	131.0 5.16	87.0 3.43		AR 16 80 140	0.960 2.116	208.0 46800	940.0 211300	2300
85	85 3.346	150 5.906	18 0.709	138.0 5.43	92.0 3.62		AR 18 85 150	1.256 2.769	230.0 51700	1010.0 227100	2100
90	90 3.550	155 6.103	18 0.709	143.0 5.63	97.0 3.82	AR 18 90 155		1.330 2.932	245.0 55100	1090.0 245000	2000
100	100 3.937	170 6.693	20 0.787	157.0 6.18	109.0 4.29		AR 20 100 170	1.740 3.836	280.0 62900	1250.0 281000	1800
110	110 4.331	190 7.481	24 0.945	178.0 7.01	118.0 4.65		AR 24 110 190	2.500 5.512	365.0 82100	1600.0 359700	1700
120	120 4.724	210 8.268	24 0.945	199.0 7.83	127.0 5.00		AR 24 120 210	3.200 7.055	470.0 105700	2300.0 517100	1500
130	130 5.118	225 8.858	24 0.945	214.0 8.43	138.0 5.43		AR 24 130 225	3.600 7.937	510.0 114700	2640.0 593500	1400
140											



CP Thin CP Thick CP Heavy

mm/in.		Thin Series	mm/in.	Wt. kg/lbs.	Thick Series	mm/in.	Wt.	Heavy Series	mm/in.	Wt. kg/lbs.	Shaft Diameter
d	d_1		S^1			h^2			h^2		mm
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

(1) ±0.03 mm (±0.0012") under 150 N (34 lbs.) load

(2) ±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.

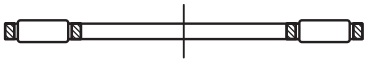
REFERENCE STANDARDS ARE:

- **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.

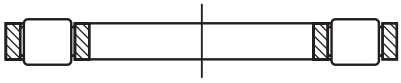
Before selecting specific thrust assemblies or thrust bearings, the engineering section of the catalog should be reviewed.

C

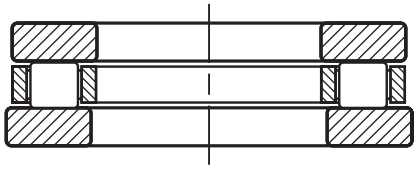
TYPES OF INCH SERIES THRUST ASSEMBLIES, THRUST BEARINGS AND THRUST WASHERS.



NTA
Needle roller and cage thrust assembly



NTH
Cylindrical roller and cage thrust assembly



NTHA
Cylindrical roller thrust bearing

TRA…TRD
Thrust washers

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	mm	inch
6.0	0.24	133.4	5.25	-.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	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

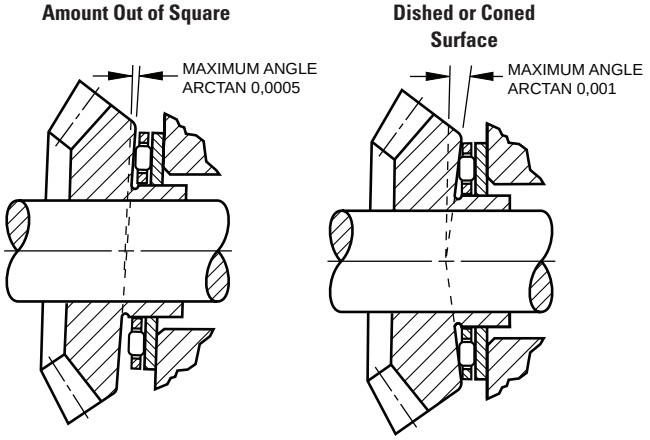
Types TRID and TRJD thrust washers for use with cylindrical roller and cage thrust assemblies are designed to pilot from the housing and to clear the shaft. Types TRI and TRJ thrust washers are designed to pilot from the shaft and clear the housing. The thrust washers should be stationary with respect 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 μin R_a (0.20 μm 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.

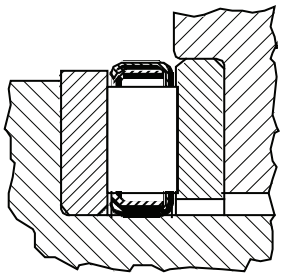


Figure a

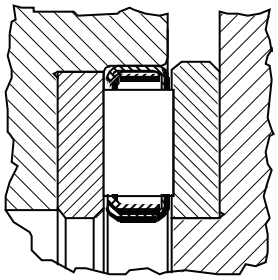


Figure b

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

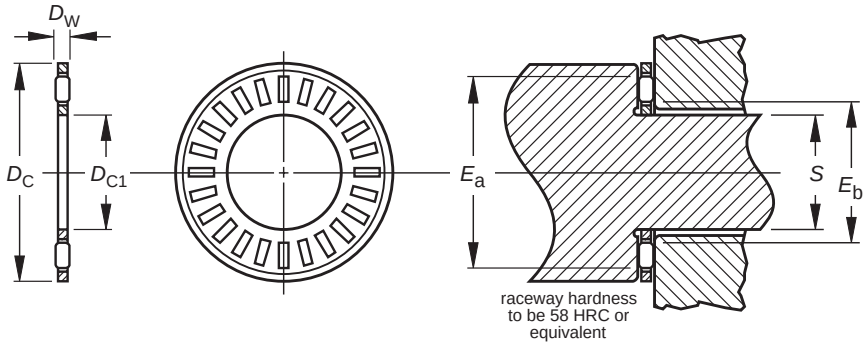
Needle roller and cage thrust assemblies and thrust washers are also made to special dimensions and configurations, as well as from special materials, when quantities permit economical manufacture.

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).

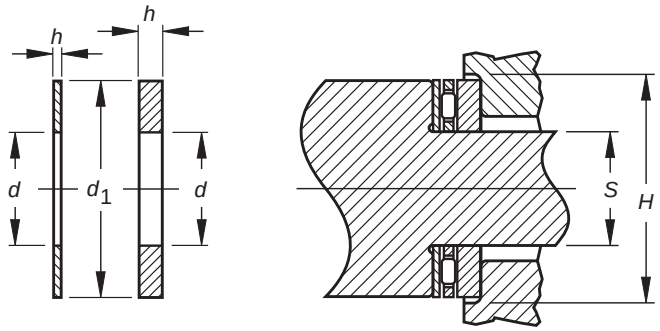


NTA

Shaft Diameter	Dimensions mm/in.					Assembly Designation	Load Ratings kN/lbf. Dynamic	Load Ratings kN/lbf. Static	Limiting Speed Oil	Wt. kg/lbs.
in.	D_{c1}	D_c	D_w	E_b	E_a		C	C_o	RPM	
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 2 960	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.						Dia. To Clear O.D.	Washer Wt. kg/lbs.	Shaft Diameter
			Min.	Max.	Piloting Dimensions Min.	Max.			
	d	d_1	h		S		H		in.
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

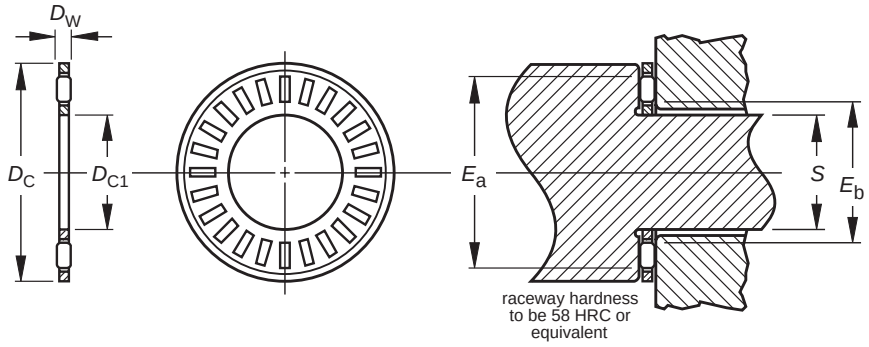
Δ If the shaft and the housing adjacent to the bearing O.D. are not concentric, the T.I.R. between the shaft and housing should be added to this dimension.

Continued on next page.

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).

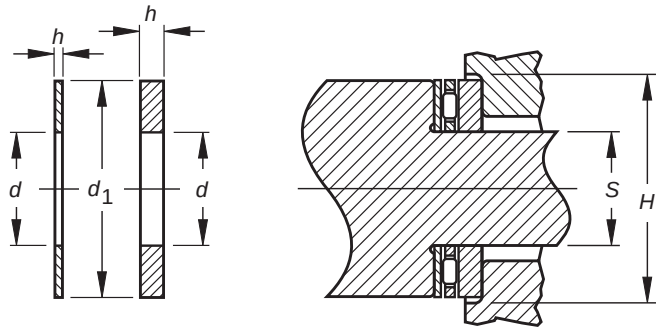


NTA

Shaft Diameter	Dimensions mm/in.					Assembly Designation	Load Ratings kN/lbf.		Limiting Speed Oil	Wt. kg/lbs.
							Dynamic	Static		
in.	D_{c1}	D_c	D_w	E_b	E_a		C	C_o	RPM	
7/8	**22.23** 0.875	**36.50** 1.437	**1.984** 0.0781	**24.38** 0.960	**33.782** 1.330	**NTA-1423**	**13.43** 3020	**49.82** 11200	**12000**	**0.005** 0.011
	22.23 0.875	**42.85** 1.687	**1.984** 0.0781	**25.91** 1.020	**39.878** 1.570	**NTC-1427**	**18.46** 4150	**78.29** 17600	**9800**	**0.008** 0.017
1	**25.40** 1.000	**39.675** 1.562	**1.984** 0.0781	**27.69** 1.090	**36.83** 1.450	**NTA-1625**	**13.83** 3110	**53.82** 12100	**11000**	**0.006** 0.013
1 1/8	**28.58** 1.125	**44.45** 1.75	**1.9837** 0.0781	**30.73** 1.210	**41.656** 1.640	**NTA-1828**	**16.68** 3750	**71.17** 16000	**9600**	**0.009** 0.019
1 1/4	**31.75** 1.250	**49.20** 1.937	**1.9837** 0.0781	**34.04** 1.340	**46.228** 1.820	**NTA-2031**	**20.15** 4530	**93.41** 21000	**8600**	**0.010** 0.021

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.						Dia. To Clear O.D.	Washer Wt. kg/lbs.	Shaft Diameter
			Min.	Max.	Piloting Dimensions Min.	Max.			
	d	d_1	h		S		H		in.
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

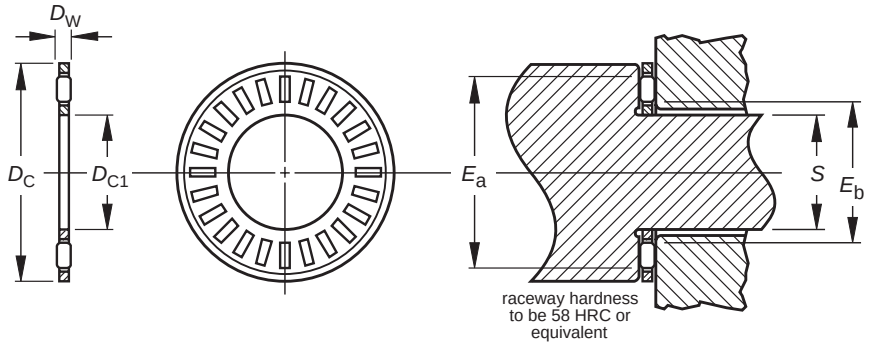
Δ If the shaft and the housing adjacent to the bearing O.D. are not concentric, the T.I.R. between the shaft and housing should be added to this dimension.

Continued on next page.

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).

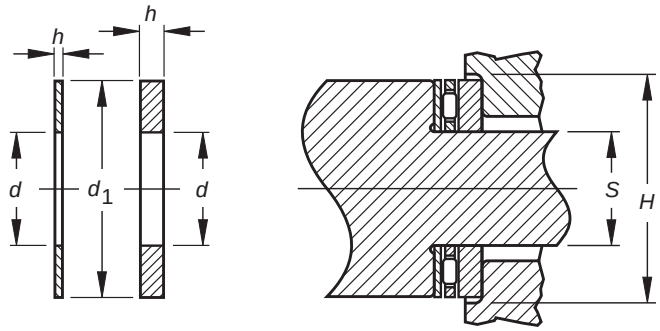


NTA

Shaft Diameter	Dimensions mm/in.					Assembly Designation	Load Ratings kN/lbf.		Limiting Speed Oil	Wt. kg/lbs.
							Dynamic	Static		
in.	D_{c1}	D_c	D_w	E_b	E_a		C	C_o	RPM	
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.						Dia. To Clear O.D.	Washer Wt. kg/lbs.	Shaft Diameter
			Min.	Max.	Piloting Dimensions Min.	Max.			
	d	d_1	h		S		H		in.
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	

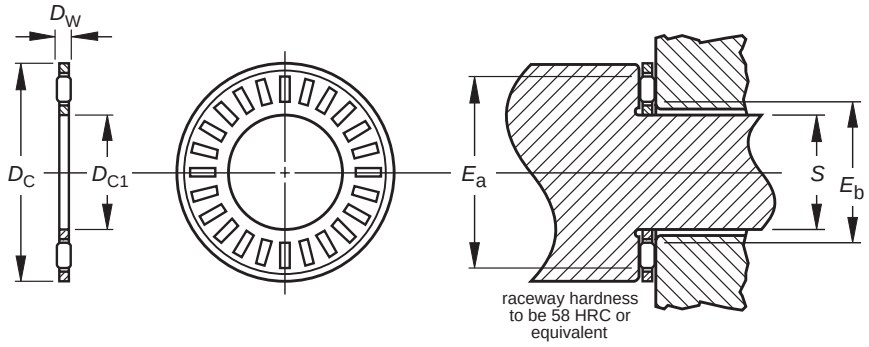
Δ If the shaft and the housing adjacent to the bearing O.D. are not concentric, the T.I.R. between the shaft and housing should be added to this dimension.

Continued on next page.

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).

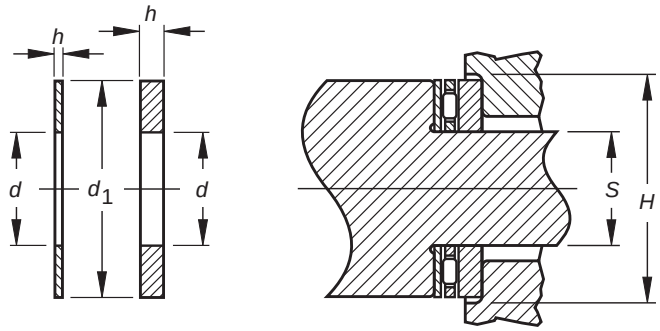


NTA

Shaft Diameter	Dimensions mm/in.					Assembly Designation	Load Ratings kN/lbf. Dynamic	Load Ratings kN/lbf. Static	Limiting Speed Oil	Wt. kg/lbs.
in.	D_{c1}	D_c	D_w	E_b	E_a		C	C_o	RPM	
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 1/4	57.15 2.250	79.375 3.125	3.175 0.1250	59.94 2.360	75.184 2.960	NTA-3650	37.68 8470	177.04 39800	5300	0.029 0.064
2 1/2	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
2 3/4	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.						Dia. To Clear O.D.	Washer Wt. kg/lbs.	Shaft Diameter
			Min.	Max.	Piloting Dimensions Min.	Max.			
	d	d_1	h		S		H		in.
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**

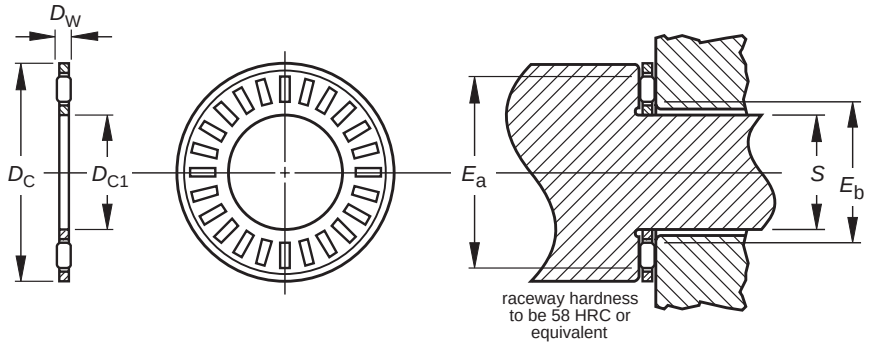
Δ If the shaft and the housing adjacent to the bearing O.D. are not concentric, the T.I.R. between the shaft and housing should be added to this dimension.

Continued on next page.

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).

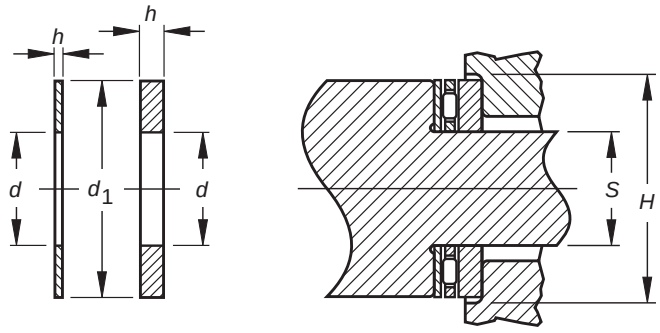


NTA

Shaft Diameter	Dimensions mm/in.					Assembly Designation	Load Ratings kN/lbf. Dynamic	Load Ratings kN/lbf. Static	Limiting Speed Oil	Wt. kg/lbs.
in.	D_{c1}	D_c	D_w	E_b	E_a		C	C_o	RPM	
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.

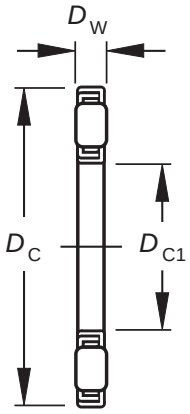


Thrust Washer Designation	Dimensions mm/in.						Dia. To Clear O.D.	Washer Wt. kg/lbs.	Shaft Diameter
			Min.	Max.	Piloting Dimensions Min.	Max.			
	d	d_1	h		S		H		in.
TRB-4458			**1.52** 0.060	**1.60** 0.063				**0.035** 0.077	
TRC-4458			**2.34** 0.092	**2.41** 0.095				**0.051** 0.113	
TRD-4458			**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



NTH

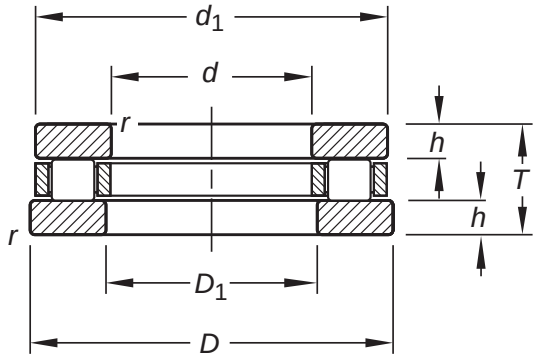
Shaft Diameter	Dimensions mm/in. +.38, -0.015 -0, -0	-.13, -0.005 -.51, -0.020	+0, +0.000 -.005, -0.0002	Bearing Designation	Load Ratings kN/lbf. Dynamic	Static	Limiting Speed Oil
in.	D_{c1}	d_c	D_w		C	C_o	RPM
1 1/2	**38.15** 1.502	**75.44** 2.970	**6.35** 0.250	**NTH-2448**	**81.8** 18400	**280** 62900	**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.	Piloting Dimensions mm/in. Shaft Piloting +0, +0.000 -.13, -0.005 Min.		Housing Piloting Max.	Housing Piloting -.13, -0.005 -0, -0.000	Raceway Contact		Shaft Diameter
	S_p	H_c	S_c	H_p	E_b	E_a	in.
0.10 0.23	**38.10** 1.500	**76.96** 3.030	**36.63** 1.442	**75.57** 2.975	**44.70** 1.760	**68.83** 2.710	**1 1/2**
0.21 0.47	**50.80** 2.000	**92.84** 3.655	**49.33** 1.942	**91.44** 3.600	**57.40** 2.260	**84.33** 3.320	**2**
0.22 0.49	**53.98** 2.125	**96.01** 3.780	**52.5** 2.067	**94.62** 3.725	**60.71** 2.390	**87.38** 3.440	**2 1/8**
0.24 0.52	**57.15** 2.250	**99.19** 3.905	**55.68** 2.192	**97.79** 3.850	**63.75** 2.510	**90.68** 3.570	**2 1/4**
0.24 0.54	**60.33** 2.375	**102.36** 4.030	**58.85** 2.317	**100.97** 3.975	**67.06** 2.640	**93.73** 3.690	**2 3/8**
0.26 0.57	**63.50** 2.500	**105.54** 4.155	**62.03** 2.442	**104.14** 4.100	**70.10** 2.760	**97.03** 3.820	**2 1/2**
0.28 0.62	**66.68** 2.625	**111.13** 4.375	**65.2** 2.567	**109.73** 4.320	**73.41** 2.890	**102.36** 4.030	**2 5/8**
0.29 0.64	**69.85** 2.750	**114.30** 4.500	**68.45** 2.695	**112.90** 4.445	**76.45** 3.010	**105.66** 4.160	**2 3/4**
0.31 0.69	**76.20** 3.000	**120.65** 4.750	**74.8** 2.945	**119.25** 4.695	**82.80** 3.260	**112.01** 4.410	**3**
0.34 0.75	**82.55** 3.250	**127.00** 5.000	**81.15** 3.195	**125.60** 4.945	**89.15** 3.510	**118.36** 4.660	**3 1/4**
0.37 0.81	**88.90** 3.500	**133.78** 5.267	**87.5** 3.445	**132.38** 5.212	**95.76** 3.770	**125.73** 4.950	**3 1/2**

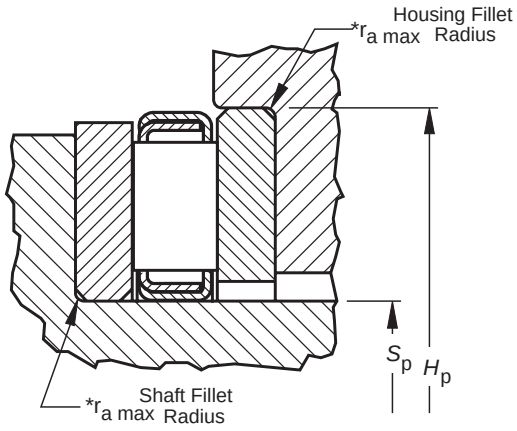
CYLINDRICAL ROLLER THRUST BEARINGS

- 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 sufaces 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. Shaft Piloted Washer Min.	Max.	Nom.	Housing Piloted Washer Max.	Min.	Nom.		Bearing Designation	Bearing Wt. kg/lbs.
in.	d		d_1	D		D_1	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. Dynamic	Load Ratings kN/lbf. Static	Limiting Speed Oil	Dimensions mm/in. +0, +0.000 -.127, -0.0050	+.127, +0.0050 -0, -0.000		+0, +0.000 -.076, -0.0030	Bore Piloted Washer	Washer Wt. kg/lbs.	O.D. Piloted Washer	Washer Wt. kg/lbs.	Shaft Diameter
C	C_o	RPM	S_p	H_p	$r_{s\ min}$	h					in.
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**

* $r_{as\ max}$ is equal to minimum washer chamfer $r_{s\ min}$.

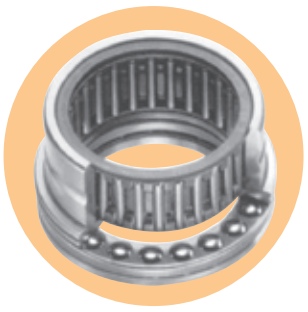
NOTES

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

Prefix
RAX radial needle roller and thrust needle (or cylindrical) roller bearing without inner ring or thrust washer
RAXF closed end drawn cup design radial needle roller and needle thrust roller bearing without inner ring or thrust washer
RAXZ unitized machined outer ring thrust cylindrical roller and radial needle roller bearing

RAXF 7 15 TC

Suffix
TB radial play under rollers set to lower half of F6 tolerance
TC radial play under rollers set to upper half of F6 tolerance

NAXR 20 Z.TN

Suffix
TN molded polymer retainer
Z thrust washer retaining dust cap

Bore diameter
20 = 20 mm

Series
NAXR machined outer ring thrust cylindrical roller and radial needle roller bearing without inner ring
700 drawn cup design radial needle roller and needle thrust roller bearing without inner ring or thrust washer
400 machined ring radial needle roller and thrust needle roller bearing without inner ring or thrust washer
500 machined ring radial needle roller and thrust cylindrical roller bearing

Inner rings for Combined Needle Roller Bearings - Metric Nominal Dimensions

Prefix
JR inner ring for use with NAXR series bearings

JR 25 x 30 x 18

IM 10 14 16 P

Bore diameter
25 = 25 mm

Outside diameter
14 = 14 mm

Width
18 = 18 mm

Prefix
IM inner ring for use non-NAXR series bearings

Suffix
P ISO 492 toleranced inner ring

Thrust Washers for Combined Needle Roller Bearings - Metric Nominal Dimensions

Prefix
CP thrust washer for metric needle roller bearings

CP 15 28 Thin Washer designation

CP 2 15 28 Thick Washer designation

Thickness
2 = 2 mm

Bore diameter
15 = 15 mm

Outside diameter
28 = 28 mm

Combined Needle Roller Bearings

C

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.

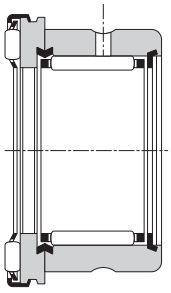
Combined bearings make an effective alternative in place of two separate bearings in terms of cost, handling and packaging. Combined bearings are possible to use with or without matching inner rings and thrust washers, though these are listed opposite the bearing part numbers, where possible, in the following pages of tables, for convenience.

REFERENCE STANDARDS ARE:

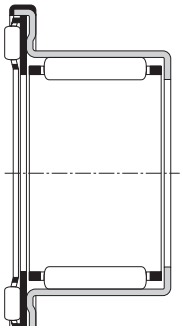
- **DIN 5429, Part 1** – Needle roller – thrust cylindrical roller bearings, series NAXR, NAXR.Z
- **ISO 1206** – Needle roller bearings – light and medium series – dimensions and tolerances

TYPES OF METRIC SERIES COMBINED BEARINGS

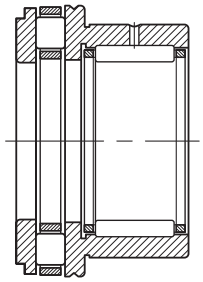
Needle roller-cylindrical roller thrust bearings



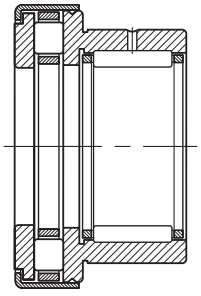
RAX 400



RAX 700



RAX 500



NAXR.Z

Suffixes	
TN	molded cage of reinforced engineered polymer
Z	retained with a dust cap
Z.TN	retained with a dust cap, molded cage of reinforced engineered polymer
TB	radial play under rollers set to lower half of F6 tolerance limits
TC	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)[1]	10 40	40 70	k6 m6	h6 h6
Load Rotates Relative to Housing	M6 (N6)[1]	all diameters		g6	f6
RAX 700 RAXF 700	H6 (H7)	all diameters		k5	h5 (h6)

[1] 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.

C

LOAD RATINGS

Minimum axial load for combined bearings excluding RAX700:

The minimum axial load $F_{amin} = C_0 / 2200$ (kN)

where C_0 = static load rating (kN)

DYNAMIC EQUIVALENT LOAD

Combined bearings can accommodate radial and axial loads.

Radial needle roller complement

$P = F_r$ (kN)

Cylindrical or needle roller thrust complement

$P_a = F_a$ (kN)

STATIC EQUIVALENT LOAD

For all combined bearings series:

Radial needle roller complement

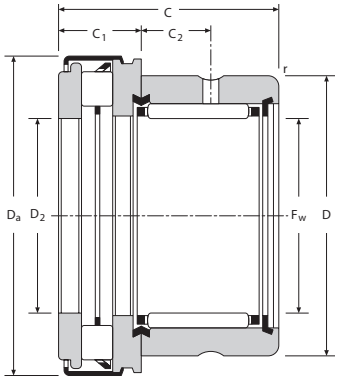
$P_0 = F_r$ (kN)

Cylindrical or needle roller thrust complement

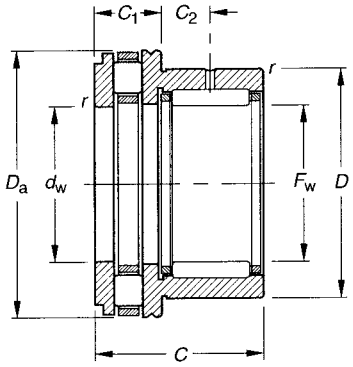
$P_{0a} = F_a$ (kN)

CYLINDRICAL ROLLER THRUST SERIES

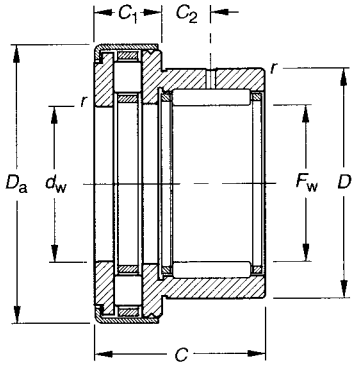
METRIC SERIES



RAXZ500



NAXR



NAXR.Z

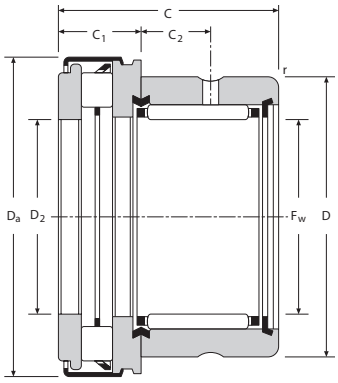
Outside Dia.	Dimensions mm/in.							
				E7		+0 +0.000 -0.2 -0.008		
mm	F_w	D	C	d_w	D_a	C_1	C_2	r_{smin}
10	10 0.394	19 0.748	21.5 0.846	14 0.551	22.4 0.882	7.5 0.295	6 0.236	0.35 0.014
12	12 0.472	21 0.827	22 0.866	14 0.551	26.4 1.039	8 0.315	6 0.236	0.35 0.014
15	15 0.591	24 0.945	23 0.906	15 0.591	28 1.102	9 0.354	6.5 0.256	0.3 0.012
	15 0.591	24 0.945	23 0.906	15 0.591	29 1.142	9 0.354	6.5 0.256	0.3 0.012
	15 0.591	24 0.945	22 0.866	14 0.551	28.4 1.118	8 0.315	6 0.236	0.35 0.014
17	17 0.669	26 1.024	25 0.984	17 0.669	30 1.181	9 0.354	8.0 0.315	0.3 0.012
	17 0.669	26 1.024	25 0.984	17 0.669	31 1.220	9 0.354	8.0 0.315	0.3 0.012
	17 0.669	26 1.024	24 0.945	16 0.630	30.4 1.197	8 0.315	8 0.315	0.65 0.026
20	20 0.787	30 1.181	30 1.181	20 0.787	35 1.378	10 0.394	10.5 0.413	0.3 0.012
	20 0.787	30 1.181	30 1.181	20 0.787	36 1.417	10 0.394	10.5 0.413	0.3 0.012
	20 0.787	30 1.181	29 1.142	18 0.709	35.4 1.394	11 0.433	9 0.354	0.85 0.033
25	25 0.984	37 1.457	30 1.181	25 0.984	42 1.654	11 0.433	9.5 0.374	0.6 0.024
	25 0.984	37 1.457	30 1.181	25 0.984	43 1.693	11 0.433	9.5 0.374	0.6 0.024
	25 0.984	37 1.457	29 1.142	18 0.709	43 1.693	11 0.433	9 0.354	0.85 0.033
30	30 1.181	42 1.654	30 1.181	30 1.181	47 1.850	11 0.433	9.5 0.374	0.6 0.024
	30 1.181	42 1.654	30 1.181	30 1.181	48 1.890	11 0.433	9.5 0.374	0.6 0.024
	30 1.181	42 1.654	29 1.142	18 0.709	48 1.890	11 0.433	9 0.354	0.85 0.033
35	35 1.378	47 1.850	30 1.181	35 1.378	52 2.047	12 0.472	9.0 0.354	0.6 0.024
	35 1.378	47 1.850	30 1.181	35 1.378	53 2.087	12 0.472	9.0 0.354	0.6 0.024
	35 1.378	47 1.850	30 1.181	18 0.709	54 2.126	12 0.472	9 0.354	0.85 0.033
40	40 1.575	52 2.047	32 1.260	40 1.575	60 2.362	13 0.512	10.0 0.394	0.6 0.024
	40 1.575	52 2.047	32 1.260	40 1.575	61 2.402	13 0.512	10.0 0.394	0.6 0.024
	40 1.575	52 2.047	31 1.220	18 0.709	61 2.402	13 0.512	9 0.354	0.85 0.033

Bearing Designation			Limiting Speed Oil	Load Ratings kN/lbs.				Wt. kg/lbs.	Matching Inner Ring Designation	Shaft Dia.
				Radial		Thrust				
RAXZ	NAXR	NAXR.Z		Dynamic	Static	Dynamic	Static			
			RPM	C	C_0	C	C_0			mm
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	

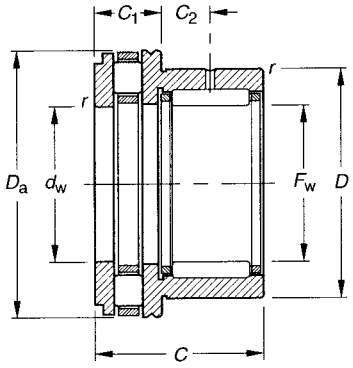
Continued on next page.

C

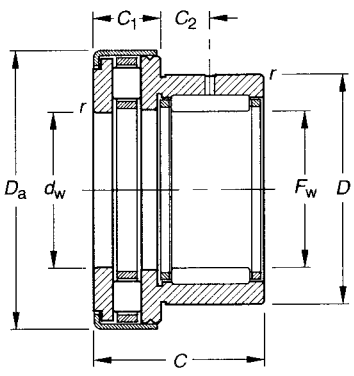
CYLINDRICAL ROLLER THRUST SERIES – *continued*



RAXZ500



NAXR



NAXR.Z

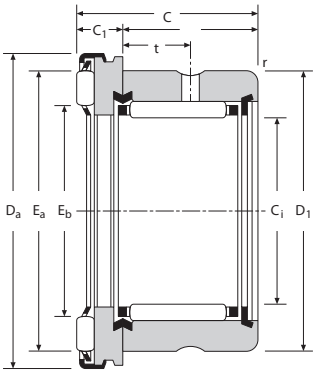
Outside Dia.	Dimensions mm/in.							
				E7		+0 +0.000 -0.2 -0.008		
mm	F_w	D	C	d_w	D_a	C_1	C_2	r_{smin}
45	45 1.772	58 2.283	32 1.260	45 1.772	65 2.559	14 0.551	9.0 0.354	0.6 0.024
	45 1.772	58 2.283	32 1.260	45 1.772	66 2.598	14 0.551	9.0 0.354	0.6 0.024
	45 1.772	58 2.283	31 1.220	18 0.709	66 2.598	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

Bearing Designation			Limiting Speed Oil	Load Ratings kN/lbs.				Wt. kg/lbs.	Matching Inner Ring Designation	Shaft Dia.
				Radial		Thrust				
RAXZ	NAXR	NAXR.Z		Dynamic	Static	Dynamic	Static			
			RPM	C	C_0	C	C_0			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

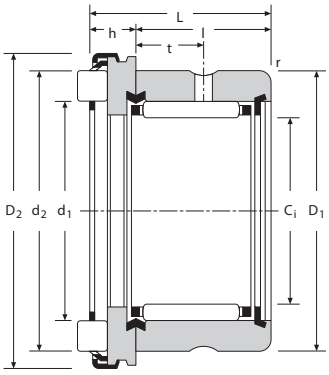
C

NEEDLE ROLLER AND CYLINDRICAL ROLLER THRUST SERIES

METRIC SERIES



RAX 400



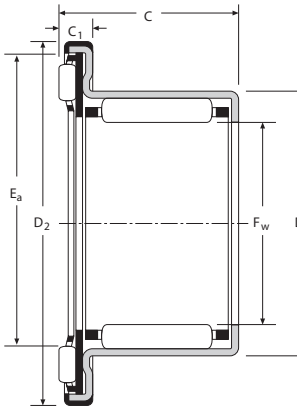
RAX 500

Outside Dia.	Dimensions mm/in. -.1 -0.004 -.2 -0.008			E7		+.05 +0.0019 -.06 -0.0024		
mm	F_w	C	D	d_a	E_b	E_a	C_1	C_2
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
	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
12	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
15	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
	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
17	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
	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
20	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
	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
25	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
	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
30	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
	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
35	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
	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
40	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
45	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
	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
50	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
	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
60	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
	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
70	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
	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

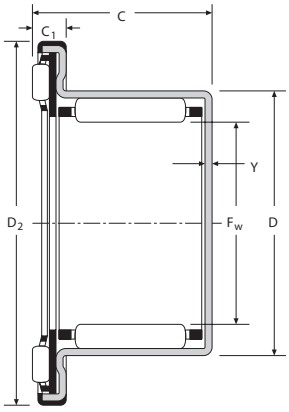
Bearing Designation		Limiting Speed Oil	Load Ratings kN/lbs.				Wt. kg/lbs.	Matching Inner Ring	Thin Plate	Thick Plate	Shaft Dia.
			Radial		Thrust						
400 Series	500 Series		Dynamic	Static	Dynamic	Static					
		RPM	C	C_0	C	C_0					mm
RAX 410		15500	5.90 1330	7.16 1610	5.00 1120	10.9 2450	0.025 0.055		CP 10 22	CP 2 10 22	10
	RAX 510	15500	5.90 1330	7.16 1610	8.20 1840	17.9 4020	0.026 0.057		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.						+.05 +0.0019 -.06 -0.0024	Bearing Designation Open End	Bearing Designation Closed End
mm	F_w	D	C	D_a	E_{ab}	E_a	C_1		
5	5 0.1969	9 0.3543	11 0.433	15.5 0.6102	7.2 0.28	11.2 0.44	3.3 0.130	RAX 705	
12	12 0.4724	18 0.7087	14.2 0.559	27.5 1.0827	15 0.59	22.6 0.89	4.2 0.165	RAX 712	RAXF 712
14	14 0.5512	20 0.7874	14.2 0.559	29.5 1.1614	17 0.67	24.6 0.97	4.2 0.165	RAX 714	RAXF 714
15	15 0.5906	21 0.8268	14.2 0.559	31.5 1.2402	19 0.75	26.6 1.05	4.2 0.165	RAX 715	RAXF 715
18	18 0.7087	24 0.9449	18.2 0.717	33.5 1.3189	21 0.83	28.6 1.13	4.2 0.165	RAX 718	RAXF 718
20	20 0.7874	26 1.0236	18.2 0.717	36.5 1.4370	22 0.87	31.6 1.24	4.2 0.165	RAX 720	RAXF 720
25	25 0.9843	33 1.2992	22.2 0.874	45.5 1.7913	30 1.18	39.6 1.56	4.2 0.165	RAX 725	RAXF 725
30	30 1.1811	38 1.4961	22.2 0.874	50.5 1.9882	35 1.38	44.7 1.76	4.2 0.165	RAX 730	RAXF 730
35	35 1.3780	43 1.6929	22.2 0.874	56.5 2.2244	39 1.54	50.9 2.00	4.2 0.165	RAX 735	
40	40 1.5748	48 1.8898	22.2 0.874	61.5 2.4213	43 1.69	54.9 2.16	4.2 0.165	RAX 740	RAXF 740
45	45 1.7717	52 2.0472	22.2 0.874	66.5 2.6181	48 1.89	59.9 2.36	4.2 0.165	RAX 745	

mm/in.	Limiting Speed Oil	Load Ratings kN/lbs. Radial		Thrust		Wt. kg/lbs.	mm/in.	Matching			Shaft Dia.
		Dynamic	Static	Dynamic	Static		Ring Gage	Inner Ring	Thin Plate	Thick Plate	
Y	RPM	C	C_0	C	C_0						mm
–	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

C

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.

C

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 = $14/16 = 7/8$ in.

RC - 10 14 10 - FS

Bore
10 = $10/16 = 5/8$ in.

Width
10 = $10/16 = 5/8$ in.

Drawn Cup Roller Clutches

C

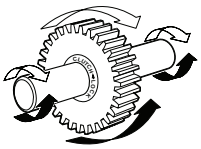
DRAWN CUP ROLLER CLUTCHES

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

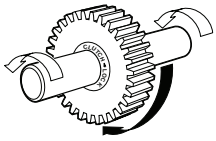
Shaft drives gear clockwise (white arrows)



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)

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

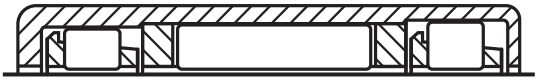
Drawn Cup Clutch & Bearing Assembly Type RCB with Integral Springs

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.

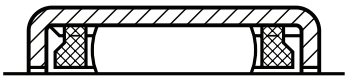
Two designs of precision molded clutch cages are employed. Clutch and clutch and bearing assembly types FC, FC-K, FCS, FCL-K, RC-FS, FCB, FCBL-K and RCB-FS use a glass fiber reinforced nylon cage equipped with inserted stainless steel leaf springs. The stainless steel springs permit higher rates of clutch 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.



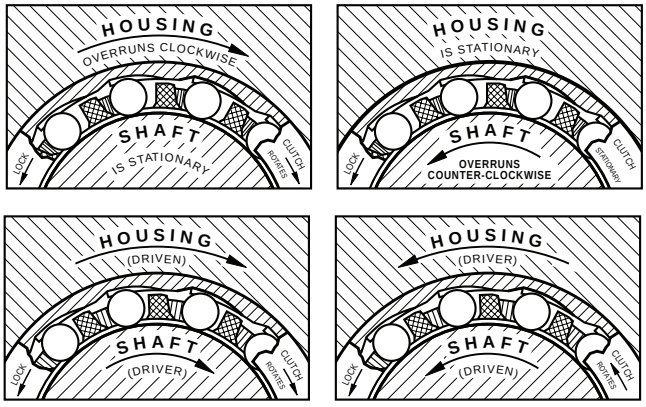
Clutch Only

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

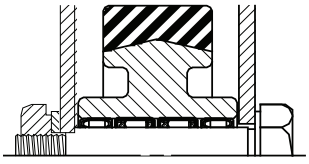
Timken® Torrington® clutches and clutch and bearing assemblies are successfully applied in a wide range of commercial products where indexing, backstopping and overrunning operations must be performed reliably. The sketches on these pages illustrate some of the many possible uses.

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.

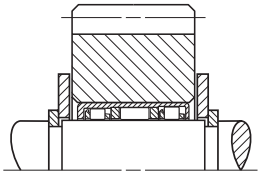
Timken Torrington drawn cup roller clutches are manufactured to commercial hardware standards and are used extensively in appliances, business machines, industrial and recreation equipment and a wide range of other applications.

Clutch & Bearing Arrangement



for Heavy Loads

Clutch & Bearing Assembly



for Light Loads

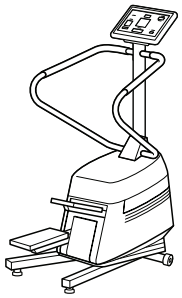
In any application where our clutch may be considered, it will be part of a system in which the operating conditions and the clutch mounting will affect its function. Before any clutch selection is made, it is important that the following catalog section be carefully studied to understand the effects 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].

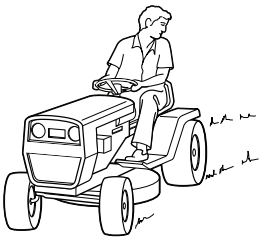
Consideration should be given to the shaft and housing design requirements such as:

- 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.

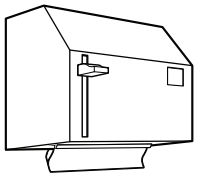
A test program under all expected operating conditions should be carried out before putting a new application into production. Timken customer engineers are constantly working with and testing new applications, and, their experience can be of great help to the designer considering the use of a drawn cup roller clutch.



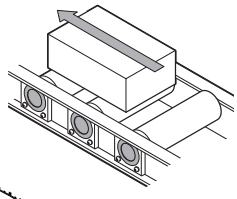
Stair Steppers, and other Athletic Equipment



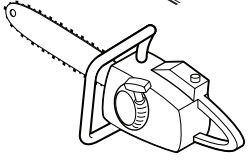
Lawnmower Differential



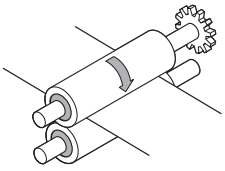
Tape Dispensers and Similar Web Roll Feed Mechanisms



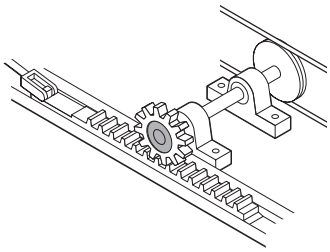
Conveyor Rollers



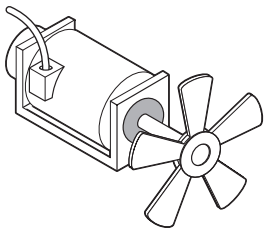
Chainsaw Starters



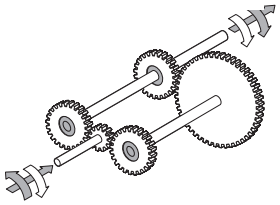
Paper Feed Rolls in Business Machines



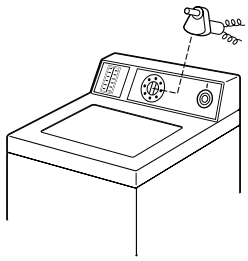
Rack Indexing Drive



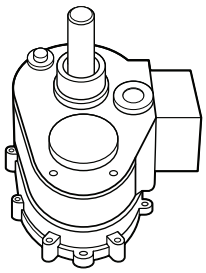
Motor Backstops



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_a (63 microinches R_a).

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.

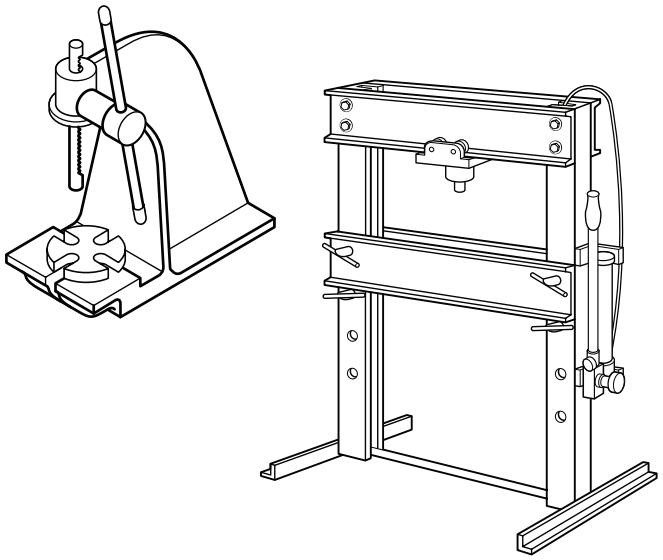
For long fatigue life, the shaft raceway, must have a hardness equivalent to 58 HRC, and ground to the suggested diameter shown in the tables of dimensions. It may be through hardened, or it may be case hardened, with an effective case depth of 0.4 mm (0.015 inch). (Effective case depth is defined as 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_a. Deviations will reduce the load capacity and fatigue life of the shaft.

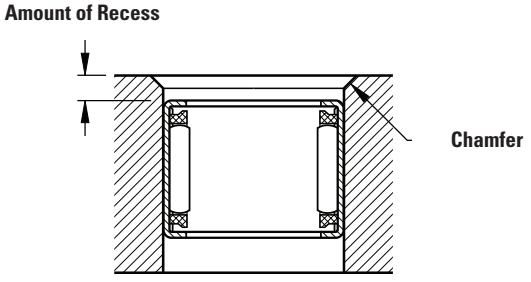
INSTALLATION

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.

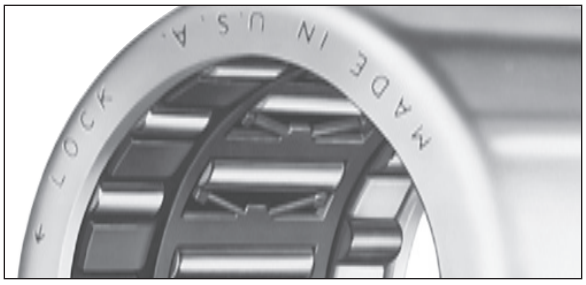
Installation procedures are summarized in the following sketches:



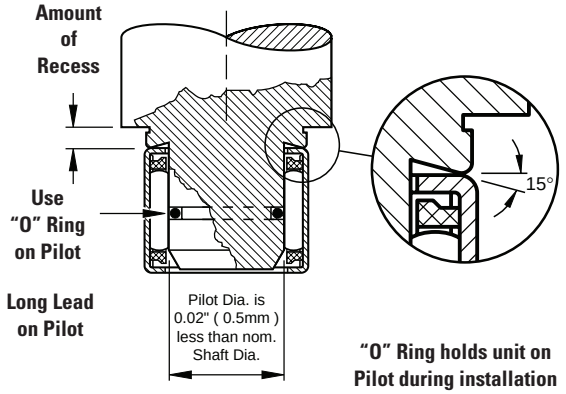
Use an arbor press or hydraulic ram press which will exert steady pressure. Never use a hammer or other tool requiring pounding to drive the clutch into its housing.



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.

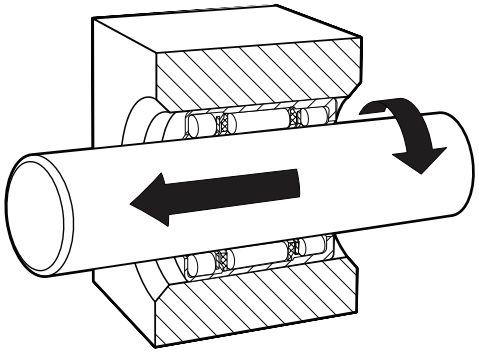


IMPORTANT: The mounted clutch or clutch and bearing assembly engages when the housing is rotated relative to the shaft in the direction of the arrow and LOCK marking [LOCK] stamped on the cup. Make sure that the unit is oriented properly before pressing it into its housing.



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.

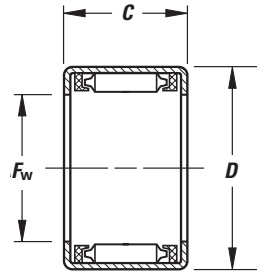
Gage sizes are listed in the tables of dimensions. Plug gage sizes reflect adjustment for the loose and tight conditions resulting from high or low housings or shafts.

DRAWN CUP ROLLER CLUTCHES

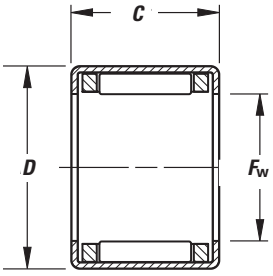
METRIC SERIES

- 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 lited 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



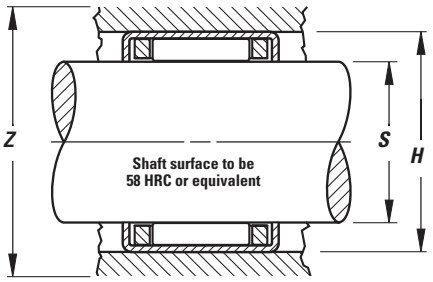
FC



FCS, FCL-K and FC-K

Shaft Diameter	Dimensions mm/in.		-0,3 mm -0.012 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	Suitable Drawn Cup Bearing[1]
mm	F_w	D	C			Z	RPM	
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

[1] See pages C42-C49 for suitable bearing types and sizes.



.25 mm (.010 in.) min.

Ring Gage	Gaging mm/in. Clutch Locking Plug	Clutch Overrun Plug	Mounting mm/in. Shaft Raceway Diameter		Housing Bore		Wt. kg/lbs. Approx.
			Max.	Min.	Min.	Max.	
			S		H		
7.984 0.3143	**3.980** 0.1567	**4.004** 0.1576	**4.000** 0.1575	**3.995** 0.1573	**7.984** 0.3143	**7.993** 0.3147	**0.001** 0.002
9.984 0.3931	**5.980** 0.2354	**6.004** 0.2364	**6.000** 0.2362	**5.995** 0.236	**9.984** 0.3931	**9.993** 0.3934	**0.003** 0.007
11.980 0.4717	**7.976** 0.314	**8.005** 0.3152	**8.000** 0.315	**7.994** 0.3147	**11.980** 0.4717	**11.991** 0.4721	**0.003** 0.007
13.98 0.5504	**7.976** 0.314	**8.005** 0.3152	**8.000** 0.315	**7.994** 0.3147	**13.980** 0.5504	**13.991** 0.5508	**0.007** 0.015
13.980 0.5504	**9.976** 0.3928	**10.005** 0.3939	**10.000** 0.3937	**9.994** 0.3935	**13.980** 0.5504	**13.991** 0.5508	**0.004** 0.009
15.980 0.6291	**9.976** 0.3928	**10.005** 0.3939	**10.000** 0.3937	**9.994** 0.3935	**15.980** 0.6291	**15.991** 0.6296	**0.009** 0.02
17.980 0.7079	**11.974** 0.4714	**12.006** 0.4727	**12.000** 0.4724	**11.992** 0.4721	**17.980** 0.7079	**17.991** 0.7083	**0.012** 0.026
21.976 0.8652	**15.972** 0.6288	**16.006** 0.6302	**16.000** 0.6299	**15.992** 0.6296	**21.976** 0.8652	**21.989** 0.8657	**0.018** 0.04
25.976 1.0227	**19.970** 0.7862	**20.007** 0.7877	**20.000** 0.7874	**19.991** 0.787	**25.976** 1.0227	**25.989** 1.0232	**0.021** 0.046
31.972 1.2587	**24.967** 0.983	**25.007** 0.9845	**25.000** 0.9843	**24.991** 0.9839	**31.972** 1.2587	**31.988** 1.2594	**0.034** 0.075
36.972 1.4556	**29.967** 1.1798	**30.007** 1.1814	**30.000** 1.1811	**29.991** 1.1807	**36.972** 1.4556	**36.988** 1.4562	**0.042** 0.093

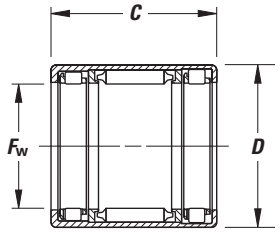
DRAWN CUP ROLLER CLUTCHES AND BEARING ASSEMBLIES

METRIC SERIES

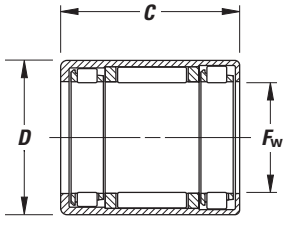
- Clutch and bearing assembly engages when housing rotated (relative to shaft) in direction of arrow marking [LOCK] as labeled on cup.
- Shaft raceway and housing bore diameters necessary for proper mounting and operation are listed on the opposite page.
- Proper inspection requires use of ring gage 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

Clutch and Bearing Assemblies



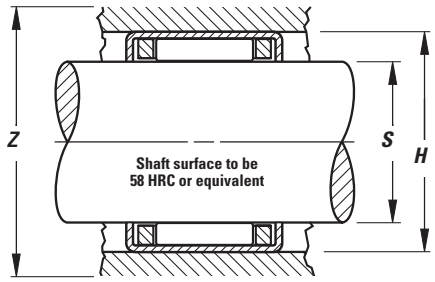
FCB



FCBL-K and FCBN-K

Shaft Diameter	Dimensions mm/in.		-0,3 mm -0.012 in.	Clutch and Bearing Assembly Designation	Torque Rating N•m/in.-lbf.	Minimum O.D. of Steel Housing for Rated Torque	Load Ratings Static kN/lbf.	Load Ratings Dynamic kN/lbf.	Overrun Limiting Speed for Rotating Shaft
mm	F_w	D	C			Z	C_0	C	RPM
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.

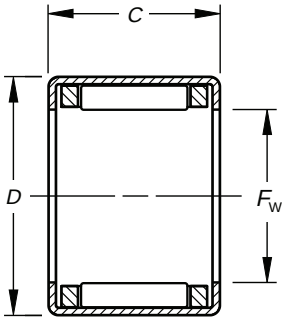
Gaging mm/in.				Mounting mm/in.				
Ring Gage	Clutch Locking Plug	Clutch Overrun and Bearing Go Plug	Bearing No Go Plug	Shaft Raceway Diameter		Housing Bore		Wt. kg/lbs. Approx.
				Max.	Min.	Min.	Max.	
				S		H		
11.980 0.4717	**7.976** 0.3140	**8.005** 0.3152	**8.033** 0.3163	**8.000** 0.3150	**7.994** 0.3147	**11.980** 0.4717	**11.991** 0.4721	**0.005** 0.011
13.980 0.5504	**7.976** 0.3140	**8.005** 0.3152	**8.033** 0.3163	**8.000** 0.3150	**7.994** 0.3147	**13.980** 0.5504	**13.991** 0.5508	**0.011** 0.024
15.980 0.6291	**9.976** 0.3928	**10.005** 0.3939	**10.033** 0.3950	**10.000** 0.3937	**9.994** 0.3935	**15.980** 0.6291	**15.991** 0.6296	**0.013** 0.029
17.980 0.7079	**11.974** 0.4714	**12.006** 0.4727	**12.036** 0.4739	**12.000** 0.4724	**11.992** 0.4721	**17.980** 0.7079	**17.991** 0.7083	**0.018** 0.040
25.976 1.0227	**19.970** 0.7862	**20.007** 0.7877	**20.043** 0.7891	**20.000** 0.7874	**19.991** 0.7870	**25.976** 1.0227	**25.989** 1.0232	**0.028** 0.062
31.972 1.2587	**24.967** 0.9830	**25.007** 0.9845	**25.043** 0.9859	**25.000** 0.9843	**24.991** 0.9839	**31.972** 1.2587	**31.988** 1.2594	**0.048** 0.106
36.972 1.4556	**29.967** 1.1798	**30.007** 1.1814	**30.043** 1.1828	**30.000** 1.1811	**29.991** 1.1807	**36.972** 1.4556	**36.988** 1.4562	**0.054** 0.119

DRAWN CUP ROLLER CLUTCHES

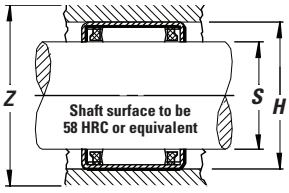
INCH SERIES

- 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.



RC and RC-FS



.25 mm (.010 in.) min.

Shaft Diameter	Dimensions mm/in.			Clutch Designations		Torque Rating N•m/in.-lbs.	Minimum O.D. of Steel Housing For Rated Torque	Overun Limiting Speed for Rotating Shaft
			-0.25 mm -0.010 in.	With Stainless Steel Springs	With Integral Springs			
in.	F_w	D	C				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.

[1] See pages C82-C89 for other suitable bearing types and sizes.

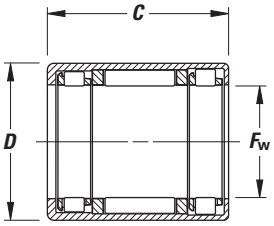
	Gaging mm/in.			Mounting mm/in.				
	Ring Gage	Clutch Locking Plug	Clutch Overrun Plug	Shaft Raceway Diameter		Housing Bore		Wt. kg/lbs.
				Max.	Min.	Min.	Max.	
				S		H		
—	**7.155** 0.2817	**3.160** 0.1244	**3.195** 0.1258	**3.175** 0.1250	**3.167** 0.1247	**7.142** 0.2812	**7.155** 0.2817	**0.001** 0.002
J-45	**11.125** 0.4380	**6.337** 0.2495	**6.383** 0.2513	**6.350** 0.2500	**6.337** 0.2495	**11.100** 0.4370	**11.125** 0.4380	**0.004** 0.008
JH-68	**15.888** 0.6255	**9.512** 0.3745	**9.558** 0.3763	**9.525** 0.3750	**9.512** 0.3745	**15.862** 0.6245	**15.888** 0.6255	**0.008** 0.017
JH-87	**19.063** 0.7505	**12.687** 0.4995	**12.733** 0.5013	**12.700** 0.5000	**12.687** 0.4995	**19.037** 0.7495	**19.063** 0.7505	**0.009** 0.020
JH-1010	**22.238** 0.8755	**15.862** 0.6245	**15.908** 0.6263	**15.875** 0.6250	**15.862** 0.6245	**22.212** 0.8745	**22.238** 0.8755	**0.014** 0.030
J-126	**25.387** 0.9995	**19.012** 0.7485	**19.058** 0.7503	**19.050** 0.7500	**19.037** 0.7495	**25.387** 0.9995	**25.413** 1.0005	**0.015** 0.034
JH-1612	**33.325** 1.3120	**25.362** 0.9985	**25.408** 1.0003	**25.400** 1.0000	**25.387** 0.9995	**33.325** 1.3120	**33.350** 1.3130	**0.026** 0.058

DRAWN CUP ROLLER CLUTCH AND BEARING ASSEMBLIES

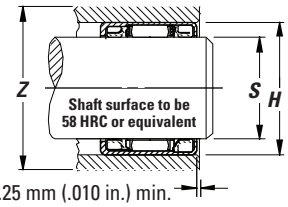
INCH SERIES

- 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 Stainless Steel Springs	Clutch and Bearing Designations With Integral Springs	Torque Rating N•m/in.-lbf.	Minimum O.D. of Steel Housing For Rated Torque	Load Ratings kN/lbf.	
			-0.25 mm -0.010 in.						
in.	F_w	D	C				Z	C	C_0
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
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
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
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.

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	**15.888** 0.6255	**9.512** 0.3745	**9.553** 0.3761	**9.589** 0.3775	**9.525** 0.3750	**9.512** 0.3745	**15.862** 0.6245	**15.888** 0.6255	**0.014** 0.030
17000	**19.063** 0.7505	**12.687** 0.4995	**12.728** 0.5011	**12.764** 0.5025	**12.700** 0.5000	**12.687** 0.4995	**19.037** 0.7495	**19.063** 0.7505	**0.016** 0.036
14000	**22.238** 0.8755	**15.862** 0.6245	**15.903** 0.6261	**15.939** 0.6275	**15.875** 0.6250	**15.862** 0.6245	**22.212** 0.8745	**22.238** 0.8755	**0.023** 0.050
12000	**25.387** 0.9995	**19.012** 0.7485	**19.053** 0.7501	**19.088** 0.7515	**19.050** 0.7500	**19.037** 0.7495	**25.387** 0.9995	**25.413** 1.0005	**0.026** 0.057
8700	**33.325** 1.3120	**25.362** 0.9985	**25.403** 1.0001	**25.438** 1.0015	**25.400** 1.0000	**25.387** 0.9995	**33.325** 1.3120	**33.350** 1.3130	**0.045** 0.100

NOTES

NEEDLE ROLLER BEARING ACCESSORIES

NEEDLE/CYLINDRICAL ROLLERS

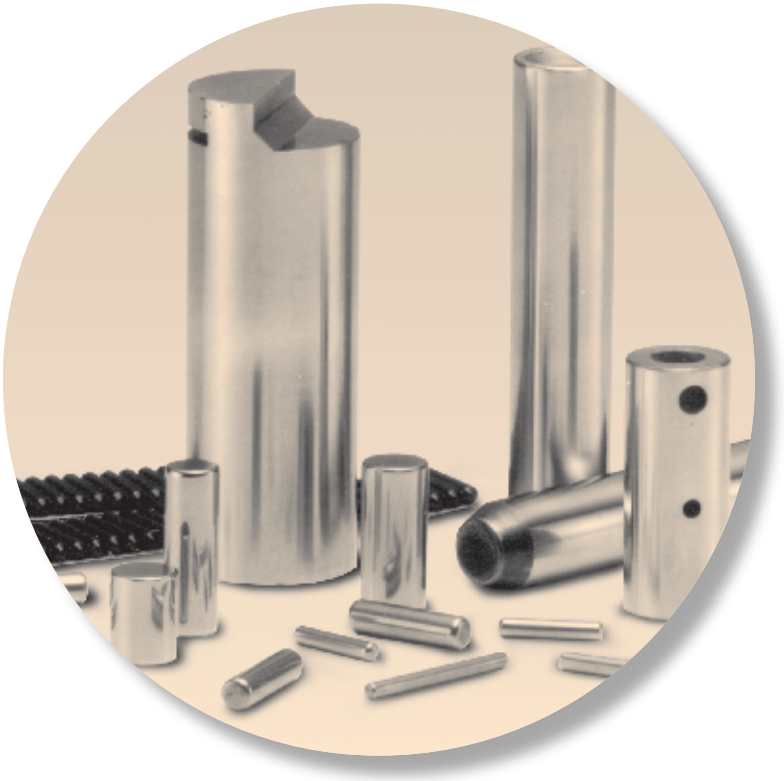
Overview: Loose needle and cylindrical rollers are mainly used as bearing rolling elements to reduce friction and torque in rotating and pivoting applications. However, these precision rollers have many other uses such as shafts or locating pins.

- **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.

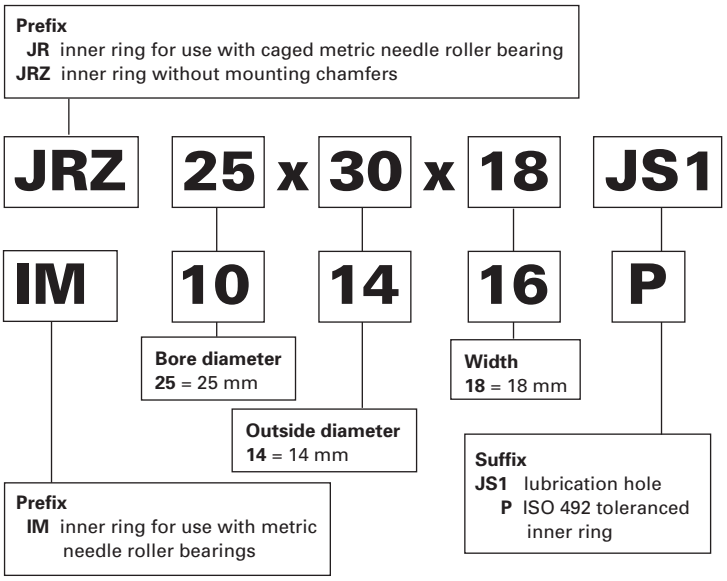
METRIC INNER RINGS

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.).

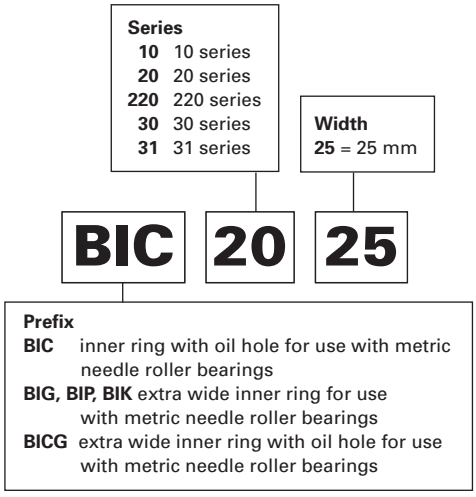
- **Sizes:** 5 mm (0.197 in.) bore to 180 mm (7.087 in.) outside diameter.
- **Markets:** Automotive, truck, power transmissions, and industrial applications.
- **Features:** Available with and without chamfers, some are available with a profiled outside diameter.
- **Benefits:** When it is not practical to manufacture the shaft to raceway quality, an inner ring allows a customer to obtain acceptable bearing performance.



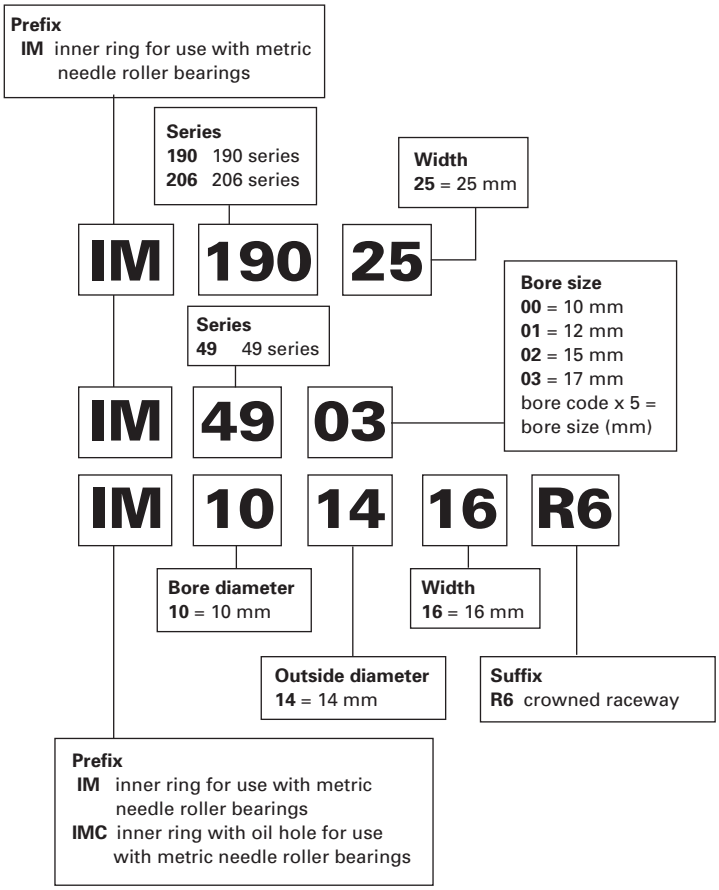
Standard Inner Rings for Needle Roller Bearings - Metric Nominal Dimensions



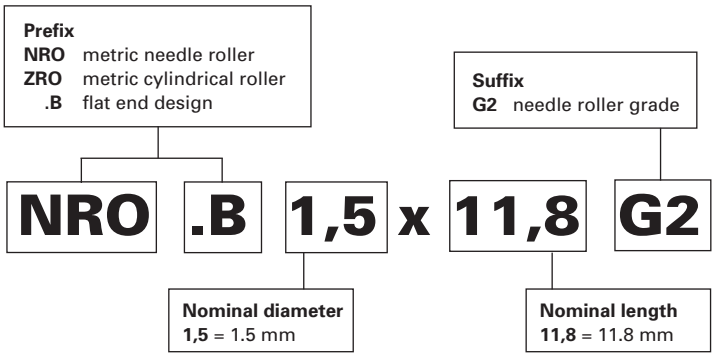
Extra Wide Inner Rings for Needle Roller Bearings - Metric Nominal Dimensions



Inner Rings for Full Complement Needle Roller Bearings - Metric Nominal Dimensions

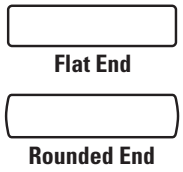


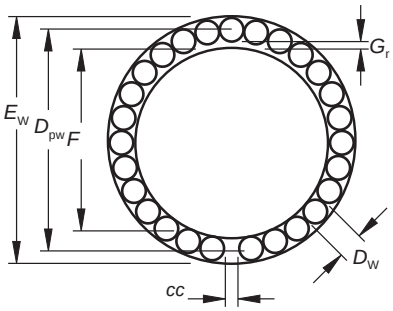
Loose Rollers - Metric Nominal Dimensions

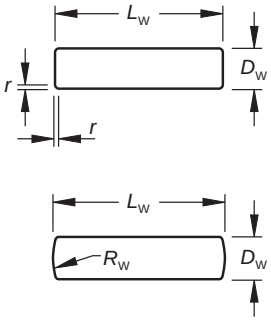


Needle Roller Bearings

C







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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. Dia. D_w	mm/in. Length L_w	Needle Roller Designation	Wt. kg/lbs. 1000 pcs Approx.	Chamfer Dimension Limits mm/in. $r_{s\,min}$		
					Rad.	Axial
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. Dia. D_w	mm/in. Length L_w	Needle Roller Designation	Wt. kg/lbs. 1000 pcs Approx.	Chamfer Dimension Limits mm/in. $r_{s\,min}$		
					Rad.	Axial
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_{DWL}	D_{wmp}										
2	2	high	0	-1	-2	-3	-4	-5	-6	-7	-8	1
		low	-2	-3	-4	-5	-6	-7	-8	-9	-10	
3	3	high	0		-1.5	-3		-4.5	-6		-7	1.5
		low	-3		-4.5	-6		-7.5	-9		-10	
5	5	high	0			-3			-5			2.5
		low	-5			-8			-10			

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_w*		D_w		$r_{s\,min}$*	$r_{s\,max}$	
—	—	—	1	0.1	0.3	0.5
D_w	L_w	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 $r_{s\,min}$ which should also be considered for designs using rounded end needle rollers.

NEEDLE ROLLER LENGTH TOLERANCE

Tolerances on the length L_w for needle rollers of all grades: h13, see Table 4.

TABLE 4 –
TOLERANCES FOR NEEDLE ROLLER LENGTH, NOMINAL METRIC NEEDLE ROLLERS

Nominal Length, L_w 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 ($G_{r\,min}$) and the minimum circumferential clearance divided by π ($cc_{\,min}/\pi$), 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 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°/ Z)
cc	total circumferential clearance. See Tables 8 and 9 for cc_{min}/π values.
G_r	radial internal clearance. See Tables 8 and 9 for $G_{r\,min}$ values
D_{pw}	pitch diameter: $D_{pw} = K \bullet D_{w\,max} + (cc_{min}/\pi) = E_{min} - D_{w\,max}$ $= F_{max} + G_{r\,min} + D_{w\,max}$
E	outer raceway bore diameter: $E_{min} = D_{pw} + D_{w\,max} = (K + 1) \bullet D_{w\,max} + (cc_{min}/\pi)$ $= F_{max} + G_{r\,min} + 2D_{w\,max}$
F	inner raceway diameter: $F_{max} = D_{pw} - D_{w\,max} - G_{r\,min}$ $= (K-1) \bullet D_{w\,max} + (cc_{min}/\pi) - G_{r\,min}$ $= E_{min} - 2D_{w\,max} - G_{r\,min}$
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: $L_{we} = L_{w\,max} - (2 \bullet r_{s\,min})$

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	Dw, needle roller diameter	3000 max.	
2	Table 7	K, for 30 needle rollers	9.56677	
3	(1) X (2)	KDw	28700	
4	Table 8`	ccmin/π = 0.025	0.025 min.	
5	(3) + (4)	Dpw pitch diameter	28725	
6	given	Dw, needle roller diameter	3000 max.	
7	(5) - (6)		25725	
8	Table 8	Gr, 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 ina 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, nomally 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		cc_{min}/π	$G_{r\,min}$
>	≤	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	cc_{min}/π	$G_{r\,min}$
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 cycle engine	5 • normal	7 • 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 ($f_c \bullet Z^{3/4}$). 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:

$$C = f_c \bullet (i \bullet L_{we} \bullet \cos\alpha)^{7/9} \bullet Z^{3/4} \bullet D_{we}^{29/27}$$

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.

α = nominal angle of contact. Since a = 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:

$$C = f_c \bullet Z^{3/4} \bullet L_{we}^{7/9} \bullet D_{we}^{29/27}$$

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.

$C = f_c \bullet Z^{3/4} \bullet L_{we}^{7/9} \bullet D_{we}^{29/27}$

$f_c Z^{3/4}$ from Table 11 = 1145

$D_{we}^{29/27} = 3^{29/27} = 3{,}254$

$L_{we} = 17.8 - 0.2 = 17.6$ mm

$L_{we}^{7/9} = 17.6^{7/9} = 9305$

$C = 1145 \bullet 9305 \bullet 3254 = 34.7$ 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:

$$C_0 = f_0 \bullet \left(1 - \frac{D_{we} \bullet \cos\alpha}{D_{pw}}\right) \bullet i \bullet Z \bullet L_{we} \bullet D_{we} \cos\alpha$$

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.

α = nominal angle of contact. Since $\alpha = 0$ for radial roller bearing, $\cos\alpha = 1$.

The other symbols are described in Table 5.

INNER AND OUTER RACEWAY DIMENSIONS, MM

	D_w = 1.5				D_w = 2.0				D_w = 2.5			
	Max.	Min.	Min.	Max.	Max.	Min.	Min.	Max.	Max.	Min.	Min.	Max.
Z	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	30.522	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 ($D_{we}^{29/27}$ $L_{we}^{7/9}$)

D_w = 1.5		D_w = 2.0		D_w = 2.5	
Needle Roller Designation	$D_{we}^{(29/27)}L_{we}^{(7/9)}$	Needle Roller Designation	$D_{we}^{(29/27)}L_{we}^{(7/9)}$	Needle Roller Designation	$D_{we}^{(29/27)}L_{we}^{(7/9)}$
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

	D_w =3.0				D_w =3.5				D_w =4.0			
	Max.	Min.	Min.	Max.	Max.	Min.	Min.	Max.	Max.	Min.	Min.	Max.
Z	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 ($D_{we}^{29/27}$ $L_{we}^{7/9}$)

	D_w = 3.0		D_w = 3.5		D_w = 4.0	
	Needle Roller Designation	$D_{we}^{(29/27)}L_{we}^{(7/9)}$	Needle Roller Designation	$D_{we}^{(29/27)}L_{we}^{(7/9)}$	Needle Roller Designation	$D_{we}^{(29/27)}L_{we}^{(7/9)}$
	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

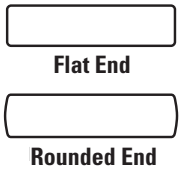
INNER AND OUTER RACEWAY DIMENSIONS, MM

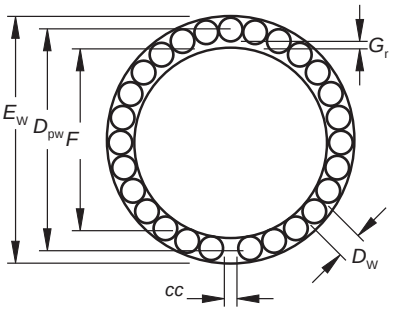
	D_w = 5.0				D_w = 6.0			
	Max.	min.	Min.	Max.	Max.	Min.	Min.	Max.
Z	F		E		F		E	
14	17.484	17.476	27.495	27.508	20.976	20.967	32.989	33.005
15	19.061	19.052	29.074	29.087	22.870	22.861	34.883	34.899
16	20.641	20.632	30.654	30.670	24.767	24.758	36.780	36.796
17	22.223	22.214	32.236	32.252	26.665	26.656	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	30.476	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	51.314	49.528	49.517	61.544	61.563
30	42.868	42.857	52.884	52.903	51.432	51.419	63.451	63.470
31	44.457	44.446	54.473	54.492	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

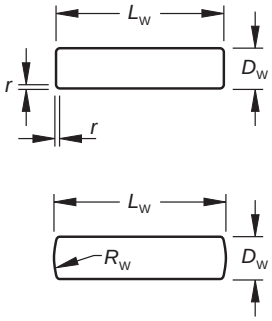
Timken® Torrington® Metric Series Needle Roller Designation and Load Rating Multiplier ($D_{we}^{29/27}$ $L_{we}^{7/9}$)

	D_w = 5.0		D_w = 6.0	
	Needle Roller Designation	$D_{we}^{(29/27)}L_{we}^{(7/9)}$	Needle Roller Designation	$D_w^{(29/27)}L_{we}^{(7/9)}$
	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	Nominal Length																						
D_w	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 π (cc_{min}/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 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, $K = 1/\sin(180°/Z)$
cc	total circumferential clearance. See Tables 8 and 9 for cc_{min}/π values.
G_r	radial internal clearance. See Tables 8 and 9 for $G_{r\,min}$ values
D_{pw}	pitch diameter: $D_{pw} = K \bullet D_{w\,max} + (cc_{min}/\pi) = E_{min} - D_{w\,max}$ $= F_{max} + G_{r\,min} + D_{w\,max}$
E	outer raceway bore diameter: $E_{min} = D_{pw} + D_{w\,max} = (K + 1) \bullet D_{w\,max} + (cc_{min}/\pi)$ $= F_{max} + G_{r\,min} + 2D_{w\,max}$
F	inner raceway diameter: $F_{max} = D_{pw} - D_{w\,max} - G_{r\,min}$ $= (K-1) \bullet D_{w\,max} + (cc_{min}/\pi) - G_{r\,min}$ $= E_{min} - 2D_{w\,max} - G_{r\,min}$
D_w	nominal needle roller diameter
D_{we}	needle roller diameter applicable in the calculation of load ratings: $D_{we} = D_{pw} - F_{max} - G_{r\,min} = \dfrac{D_{pw} - cc_{min}/\pi}{K}$ $= \dfrac{F_{max} + G_{r\,min} - (cc_{min}/\pi)}{(K-1)}$ $= E_{min} - D_{pw} = \dfrac{E_{min} - cc_{min}/\pi}{(K+1)}$
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: $L_{we} = L_{w\,max} - (0.4 \bullet D_{we})$ for flat end needle rollers: $L_{we} = L_{w\,max} - (2 \bullet r_{s\,min})$

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}/π = 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}/π	$G_{r\ min}$
>	≤	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}/π	$G_{r\ min}$
universal joint	⅓ • normal	½ • 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		Tolerence 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		Tolerence 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.

$$Y \bullet D_{w\,min} > E_{max} = \text{keystone condition}$$

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 keystoned 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 ($f_c \bullet Z^{3/4}$). 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.

α = 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.

$C = f_c \bullet Z^{3/4} \bullet L_{we}^{7/9} \bullet D_{we}^{29/27}$

$f_c Z^{3/4}$ from Table 9 = 102900

$D_{we}^{29/27} = 0.1250^{29/27} = 0.1072$

$L_{we} = 0.750 - (0.4 \bullet 0.1250) = 0.700$ (see Table 2)

$L_{we}^{7/9} = 0.700^{7/9} = 0.758$

$C = 102900 \bullet 0.1072 \bullet 0.758 = 8360$ 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:

$$C_0 = f_0 \bullet \left(1 - \frac{D_{we} \bullet \cos}{D_{pw}}\right) i \; Z \; L_{we} \; D_{we} \; \cos \alpha$$

where: $f_0 = 6430$ when pound-force and inch units are used

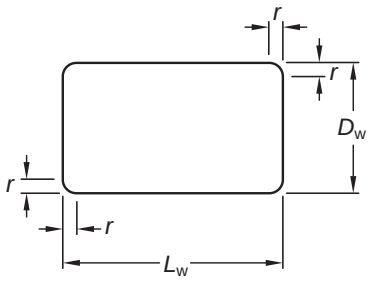
D_{pw} = pitch diameter of the needle roller complement (inch).

i = number of rows of rollers in any one bearing.

α = 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:

ZRO.6 x 8
P0/M6

Nominal diameter: D_w = 6 mm

Nominal length: L_w = 8 mm

Mean deviation of the diameter ±0 µm (see Table 2)

Mean deviation of the length -6 µm. (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	ZRO.3x5	0.027
3.5	5	0.2	0.4	ZRO.3.5x5	0.037
4	4	0.2	0.4	ZRO.4x4	0.039
4	6	0.2	0.4	ZRO.4x6	0.058
4	8	0.2	0.4	ZRO.4x8	0.078
5	5	0.2	0.6	ZRO.5x5	0.075
5	8	0.2	0.6	ZRO.5x8	0.121
5.5	8	0.2	0.6	ZRO.5.5x8	0.146
6	6	0.2	0.6	ZRO.6x6	0.13
6	12	0.2	0.6	ZRO.6x12	0.261
6.5	9	0.2	0.6	ZRO.6.5x9	0.23
7	7	0.2	0.6	ZRO.7x7	0.206
7	10	0.2	0.6	ZRO.7x10	0.296
7	14	0.2	0.6	ZRO.7x14	0.417
7.5	7.5	0.2	0.6	ZRO.7.5x7.5	0.254
7.5	9	0.2	0.6	ZRO.7.5x9	0.312
7.5	11	0.2	0.6	ZRO.7.5x11	0.374
8	8	0.2	0.6	ZRO.8x8	0.308
8	12	0.2	0.6	ZRO.8x12	0.465
9	10	0.3	0.7	ZRO.9x10	0.5
9	14	0.3	0.7	ZRO.9x14	0.68
10	10	0.3	0.7	ZRO.10x10	0.6
10	11	0.3	0.7	ZRO.10x11	0.68
10	14	0.3	0.7	ZRO.10x14	0.85
11	15	0.3	0.7	ZRO.11x15	1.1
12	14	0.3	0.7	ZRO.12x14	1.23
13	20	0.4	0.8	ZRO.13x20	2.04
14	14	0.4	0.8	ZRO.14x14	1.66
14	20	0.4	0.8	ZRO.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 µm	low µm	µm	µm														max. µm
—	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 µm	high µm	µm	µm				µm
—	48	+9	-15	6	+6	0	-6	-12	6

C

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

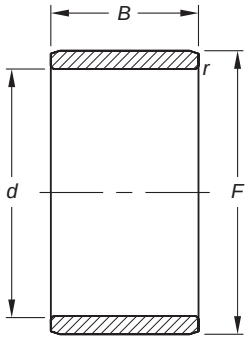
Inch series inner rings for use with inch series drawn cup bearings are tabulated on page C92 of this catalog. See catalog page C150 for inch series inner rings for use with inch series needle roller bearings.

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



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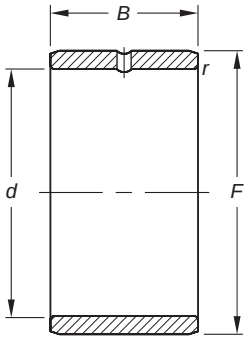
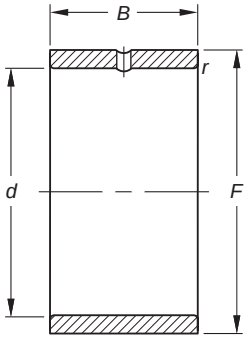


JR.JS1

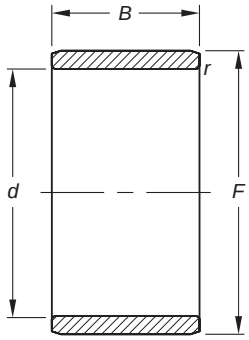


JRZ.JS1

Shaft Diameter	Dimensions mm/in.				Inner Ring Designation	Wt. kg/lbs.
mm	d	F	B	$r_{s\,min}$		
5	5 0.1969	8 0.3150	8 0.315	0.3 0.01	JR5x8x8JS1	0.002 0.004
	5 0.1969	8 0.3150	12 0.4724	0.3 0.01	JR5x8x12	0.003 0.007
	5 0.1969	8 0.3150	16 0.630	0.3 0.01	JR5x8x16	0.004 0.009
6	6 0.2362	9 0.3543	8 0.315	0.3 0.01	JR6x9x8JS1	0.002 0.004
	6 0.2362	9 0.3543	12 0.472	0.3 0.01	JR6x9x12	0.003 0.007
	6 0.2362	9 0.3543	16 0.630	0.3 0.01	JR6x9x16	0.004 0.009
	6 0.2362	10 0.3937	10 0.394	0.3 0.01	JR6x10x10	0.004 0.009
	6 0.2362	10 0.3937	10 0.394	0.3 0.01	JR6x10x10JS1	0.004 0.009
	6 0.2362	10 0.3937	12 0.472	0.3 0.01	JRZ6x10x12JS1	0.005 0.011
7	7 0.2756	10 0.3937	10.5 0.413	0.3 0.01	JR7x10x10.5	0.003 0.007
	7 0.2756	10 0.3937	12 0.472	0.3 0.01	JR7x10x12	0.004 0.009
	7 0.2756	10 0.3937	16 0.630	0.3 0.01	JR7x10x16	0.005 0.011
8	8 0.3150	12 0.4724	10 0.394	0.3 0.01	JR8x12x10	0.005 0.011
	8 0.3150	12 0.4724	10 0.394	0.3 0.01	JR8x12x10JS1	0.005 0.011
	8 0.3150	12 0.4724	10.5 0.413	0.3 0.01	JR8x12x10.5	0.005 0.011
	8 0.3150	12 0.4724	12 0.472	0.3 0.01	JRZ8xl2x12JS1	0.006 0.013
	8 0.3150	12 0.4724	12.5 0.492	0.3 0.01	JR8x12x12.5	0.006 0.013
	8 0.3150	12 0.4724	16 0.630	0.3 0.01	IM 8 12 16 P	0.007 0.016
9	9 0.3543	12 0.4724	12 0.472	0.3 0.01	JR9x12x12	0.005 0.011
	9 0.3543	12 0.4724	16 0.630	0.3 0.01	JR9x12x16	0.006 0.013
10	10 0.3937	13 0.5118	12.5 0.492	0.3 0.01	JR10x13x12.5	0.005 0.011
	10 0.3937	14 0.5512	11 0.433	0.3 0.01	JR10x14x11JS1	0.007 0.015
	10 0.3937	14 0.5512	12 0.472	0.3 0.01	JR10x14x12	0.007 0.015
	10 0.3937	14 0.5512	12 0.472	0.3 0.01	JR10x14x12JS1	0.007 0.015
	10 0.3937	14 0.5512	13 0.512	0.3 0.01	JR10x14x13	0.007 0.015
	10 0.3937	14 0.5512	14 0.551	0.3 0.01	JRZ10x14x14JS1	0.008 0.018
	10 0.3937	14 0.5512	16 0.630	0.3 0.01	JR10x14x16	0.009 0.020

INNER RINGS – *continued*

METRIC SERIES



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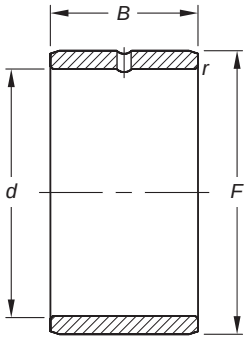
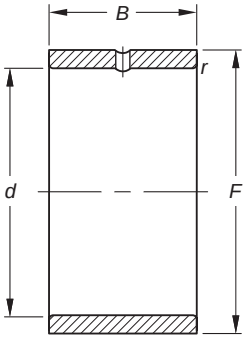


JR.JS1



JRZ.JS1

Shaft Diameter	Dimensions mm/in.				Inner Ring Designation	Wt. kg/lbs.
mm	d	F	B	$r_{s\ min}$		
10	10 0.3937	14 0.5512	20 0.787	0.3 0.01	JR10x14x20	0.012 0.026
12	12 0.4724	15 0.5906	12.5 0.492	0.3 0.01	JR12x15x12.5	0.006 0.013
	12 0.4724	15 0.5906	16 0.630	0.3 0.01	JR12x15x16	0.008 0.018
	12 0.4724	15 0.5906	16.5 0.650	0.3 0.01	JR12x15x16.5	0.008 0.018
	12 0.4724	15 0.5906	18.5 0.728	0.3 0.01	JR12x15x18.5	0.009 0.020
	12 0.4724	15 0.5906	22.4 0.882	0.2 0.01	IM 12 15 22,4 P	0.011 0.024
	12 0.4724	15 0.5906	22.5 0.886	0.3 0.01	JR12x15x22.5	0.011 0.024
	12 0.4724	16 0.6299	12 0.472	0.3 0.01	JR12x16x12	0.008 0.018
	12 0.4724	16 0.6299	12 0.472	0.3 0.01	JR12x16x12JS1	0.008 0.018
	12 0.4724	16 0.6299	13 0.512	0.3 0.01	JR12x16x13	0.008 0.018
	12 0.4724	16 0.6299	14 0.551	0.3 0.01	JRZ12x16x14JS1	0.010 0.022
	12 0.4724	16 0.6299	16 0.630	0.3 0.01	JR12x16x16	0.011 0.024
	12 0.4724	16 0.6299	20 0.787	0.3 0.01	JR12x16x20	0.014 0.031
	12 0.4724	16 0.6299	22 0.866	0.3 0.01	JR12x16x22	0.015 0.033
13	13 0.5118	18 0.7087	16 0.630	0.35 0.014	IM 13 18 16 P	0.015 0.032
14	14 0.5512	17 0.6693	17 0.669	0.3 0.01	JR14x17x17	0.009 0.020
15	15 0.5906	18 0.7087	16.5 0.650	0.3 0.01	JR15x18x16.5	0.010 0.022
	15 0.5906	19 0.7480	16 0.630	0.3 0.01	JR15x19x16	0.013 0.029
	15 0.5906	19 0.7480	20 0.787	0.3 0.01	JR15x19x20	0.017 0.037
	15 0.5906	20 0.7874	12 0.472	0.3 0.01	JR15x20x12	0.012 0.026
	15 0.5906	20 0.7874	12 0.472	0.3 0.01	JR15x20x12JS1	0.012 0.026
	15 0.5906	20 0.7874	13 0.512	0.3 0.01	JR15x20x13	0.014 0.031
	15 0.5906	20 0.7874	14 0.551	0.3 0.01	JRZ15x20x14JS1	0.015 0.033
	15 0.5906	20 0.7874	16 0.630	0.3 0.01	JR15x20x16	0.017 0.037
	15 0.5906	20 0.7874	20 0.787	0.35 0.014	IM 15 20 20 P	0.021 0.045
	15 0.5906	20 0.7874	23 0.906	0.3 0.01	JR15x20x23	0.025 0.055
	15 0.5906	20 0.7874	26 1.024	0.3 0.01	JR15x20x26	0.028 0.062

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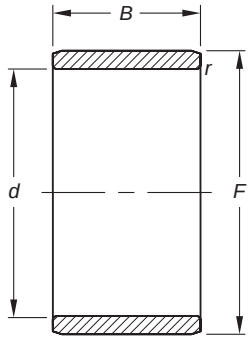
INNER RINGS – *continued*

METRIC SERIES



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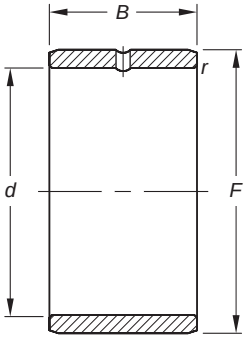
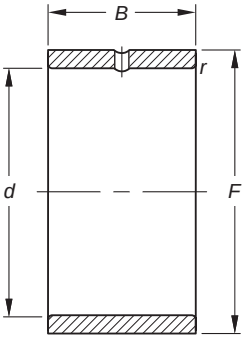


JR.JS1

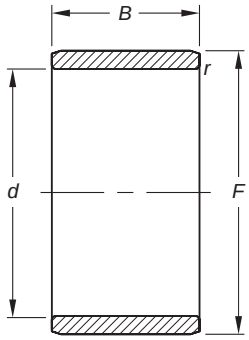


JRZ.JS1

Shaft Diameter	Dimensions mm/in.				Inner Ring Designation	Wt. kg/lbs.
mm	d	F	B	$r_{s\ min}$		
17	17 0.6693	20 0.7874	16.5 0.650	0.3 0.01	JR17x20x16.5	0.011 0.024
	17 0.6693	20 0.7874	20 0.787	0.3 0.01	JR17x20x20	0.014 0.031
	17 0.6693	20 0.7874	20.5 0.807	0.3 0.01	JR17x20x20.5	0.014 0.031
	17 0.6693	20 0.7874	30.5 1.201	0.3 0.01	JR17x20x30.5	0.021 0.046
	17 0.6693	21 0.8268	16 0.630	0.3 0.01	JR17x21x16	0.015 0.033
	17 0.6693	21 0.8268	20 0.787	0.3 0.01	JR17x21x20	0.019 0.042
	17 0.6693	22 0.8661	13 0.512	0.3 0.01	JR17x22x13	0.015 0.033
	17 0.6693	22 0.8661	16 0.630	0.3 0.01	JR17x22x16	0.019 0.042
	17 0.6693	22 0.8661	16 0.630	0.3 0.01	JR17x22x16JS1	0.019 0.042
	17 0.6693	22 0.8661	16 0.630	0.3 0.01	JRZ17x22x16JS1	0.019 0.042
	17 0.6693	22 0.8661	20 0.787	0.35 0.014	IM 17 22 20 P	0.023 0.051
	17 0.6693	22 0.8661	23 0.906	0.3 0.01	JR17x22x23	0.028 0.062
	17 0.6693	22 0.8661	26 1.024	0.3 0.01	JR17x22x26	0.031 0.068
	17 0.6693	22 0.8661	32 1.260	0.3 0.01	JR17x22x32	0.038 0.084
20	20 0.7874	24 0.9449	16 0.630	0.3 0.01	JR20x24x16	0.018 0.040
	20 0.7874	24 0.9449	20 0.787	0.3 0.01	JR20x24x20	0.022 0.049
	20 0.7874	25 0.9843	16 0.630	0.3 0.01	JR20x25x16	0.022 0.049
	20 0.7874	25 0.9843	16 0.630	0.3 0.01	JR20x25x16JS1	0.022 0.049
	20 0.7874	25 0.9843	17 0.669	0.3 0.01	JR20x25x17	0.023 0.051
	20 0.7874	25 0.9843	18 0.709	0.3 0.01	JRZ20x25x18JS1	0.025 0.055
	20 0.7874	25 0.9843	20 0.787	0.3 0.01	JR20x25x20	0.028 0.062
	20 0.7874	25 0.9843	20.5 0.807	0.3 0.01	JR20x25x20.5	0.029 0.064
	20 0.7874	25 0.9843	26 1.024	0.3 0.01	JR20x25x26	0.036 0.079
	20 0.7874	25 0.9843	26.5 1.043	0.3 0.01	JR20x25x26.5	0.037 0.082
	20 0.7874	25 0.9843	30 1.181	0.3 0.01	JR20x25x30	0.042 0.093
	20 0.7874	25 0.9843	32 1.260	0.3 0.01	JR20x25x32	0.044 0.097
	20 0.7874	25 0.9843	38.5 1.516	0.3 0.01	JR20x25x38.5	0.054 0.119

INNER RINGS – *continued*

METRIC SERIES



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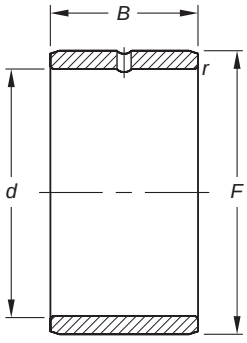
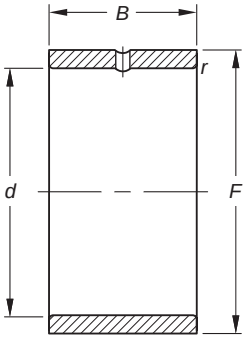


JR.JS1



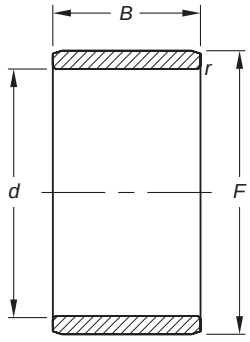
JRZ.JS1

Shaft Diameter	Dimensions mm/in.				Inner Ring Designation	Wt. kg/lbs.
mm	d	F	B	$r_{s\ min}$		
22	22 0.8661	26 1.0236	16 0.630	0.3 0.01	JR22x26x16	0.019 0.042
	22 0.8661	26 1.0236	20 0.787	0.3 0.01	JR22x26x20	0.023 0.051
	22 0.8661	28 1.1024	17 0.669	0.3 0.01	JR22x28x17	0.030 0.066
	22 0.8661	28 1.1024	20.5 0.807	0.3 0.01	JR22x28x20.5	0.038 0.084
	22 0.8661	28 1.1024	30 1.181	0.3 0.01	JR22x28x30	0.056 0.123
23	23 0.9055	28 1.1024	20 0.787	0.35 0.014	IM 23 28 20 P	0.030 0.066
25	25 0.9843	29 1.1417	20 0.787	0.3 0.01	JR25x29x20	0.027 0.060
	25 0.9843	29 1.1417	30 1.181	0.3 0.01	JR25x29x30	0.040 0.088
	25 0.9843	30 1.1811	16 0.630	0.3 0.01	JR25x30x16	0.027 0.060
	25 0.9843	30 1.1811	16 0.630	0.3 0.01	JR25x30x16JS1	0.027 0.060
	25 0.9843	30 1.1811	17 0.669	0.3 0.01	JR25x30x17	0.028 0.062
	25 0.9843	30 1.1811	18 0.709	0.3 0.01	JRZ25x30x18JS1	0.031 0.068
	25 0.9843	30 1.1811	20 0.787	0.3 0.01	JR25x30x20	0.034 0.075
	25 0.9843	30 1.1811	20.5 0.807	0.3 0.01	JR25x30x20.5	0.035 0.077
	25 0.9843	30 1.1811	26 1.024	0.3 0.01	JR25x30x26	0.044 0.097
	25 0.9843	30 1.1811	26.5 1.043	0.3 0.01	JR25x30x26.5	0.045 0.099
	25 0.9843	30 1.1811	30 1.181	0.3 0.01	JR25x30x30	0.051 0.112
	25 0.9843	30 1.1811	32 1.260	0.3 0.01	JR25x30x32	0.054 0.119
	25 0.9843	30 1.1811	38.5 1.516	0.3 0.01	JR25x30x38.5	0.066 0.146
28	28 1.1024	32 1.2598	17 0.669	0.3 0.01	JR28x32x17	0.028 0.062
	28 1.1024	32 1.2598	20 0.787	0.3 0.01	JR28x32x20	0.030 0.066
	28 1.1024	32 1.2598	30 1.181	0.3 0.01	JR28x32x30	0.044 0.097
30	30 1.1811	35 1.3780	16 0.630	0.3 0.01	JR30x35x16	0.031 0.068
	30 1.1811	35 1.3780	17 0.669	0.3 0.01	JR30x35x17	0.033 0.073
	30 1.1811	35 1.3780	18 0.709	0.3 0.01	JRZ30x35x18JS1	0.036 0.079
	30 1.1811	35 1.3780	20 0.787	0.3 0.01	JR30x35x20	0.039 0.086
	30 1.1811	35 1.3780	20 0.787	0.3 0.01	JRZ30x35x20JS1	0.039 0.086

Continued on next page.

INNER RINGS – *continued*

METRIC SERIES



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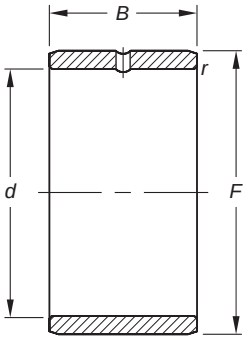
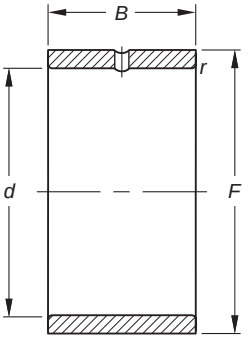


JR.JS1

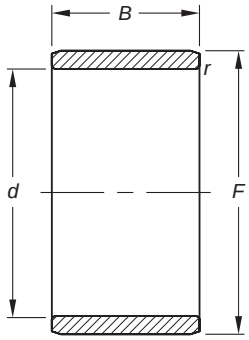


JRZ.JS1

Shaft Diameter	Dimensions mm/in.				Inner Ring Designation	Wt. kg/lbs.
mm	d	F	B	$r_{s\ min}$		
30	30 1.1811	35 1.3780	20.5 0.807	0.3 0.01	JR30x35x20.5	0.040 0.088
	30 1.1811	35 1.3780	26 1.024	0.3 0.01	JR30x35x26	0.054 0.119
	30 1.1811	35 1.3780	30 1.181	0.3 0.01	JR30x35x30	0.057 0.126
	30 1.1811	35 1.3780	32 1.260	0.3 0.01	JR30x35x32	0.062 0.137
	30 1.1811	38 1.4961	20 0.787	0.6 0.02	JR30x38x20JS1	0.067 0.148
32	32 1.2598	37 1.4567	20 0.787	0.3 0.01	JR32x37x20	0.043 0.095
	32 1.2598	37 1.4567	30 1.181	0.3 0.01	JR32x37x30	0.064 0.141
	32 1.2598	40 1.5748	20 0.787	0.6 0.02	JR32x40x20	0.069 0.152
	32 1.2598	40 1.5748	36 1.417	0.6 0.02	JR32x40x36	0.128 0.282
35	35 1.3780	40 1.5748	17 0.669	0.3 0.01	JR35x40x17	0.040 0.088
	35 1.3780	40 1.5748	20 0.787	0.3 0.01	JR35x40x20	0.046 0.101
	35 1.3780	40 1.5748	20.5 0.807	0.3 0.01	JR35x40x20.5	0.049 0.108
	35 1.3780	40 1.5748	22 0.866	0.3 0.01	JR35x40x22	0.052 0.115
	35 1.3780	40 1.5748	30 1.181	0.3 0.01	JR35x40x30	0.071 0.157
	35 1.3780	40 1.5748	34 1.339	0.3 0.01	JR35x40x34	0.080 0.176
	35 1.3780	40 1.5748	40 1.575	0.3 0.01	JR35x40x40	0.094 0.207
	35 1.3780	42 1.6535	20 0.787	0.6 0.02	JR35x42x20	0.065 0.143
	35 1.3780	42 1.6535	20 0.787	0.6 0.02	JR35x42x20JS1	0.065 0.143
	35 1.3780	42 1.6535	23 0.906	0.6 0.02	JRZ35x42x23JS1	0.074 0.163
	35 1.3780	42 1.6535	36 1.417	0.6 0.02	JR35x42x36	0.122 0.269
	35 1.3780	44 1.7323	22 0.866	0.6 0.02	JR35x44x22	0.097 0.214
37	37 1.4567	42 1.6535	20 0.787	0.35 0.014	IM 37 42 20 P	0.046 0.101
38	38 1.4961	43 1.6929	20 0.787	0.3 0.01	JR38x43x20	0.050 0.110
	38 1.4961	43 1.6929	30 1.181	0.3 0.01	JR38x43x30	0.075 0.165
40	40 1.5748	45 1.7717	17 0.669	0.3 0.01	JR40x45x17	0.044 0.097
	40 1.5748	45 1.7717	20 0.787	0.3 0.01	JR40x45x20	0.052 0.115
	40 1.5748	45 1.7717	20.5 0.807	0.3 0.01	JR40x45x20.5	0.054 0.119

INNER RINGS – *continued*

METRIC SERIES



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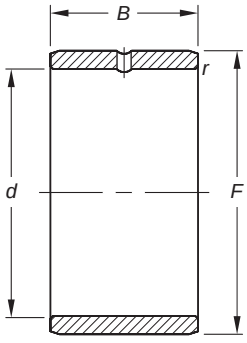
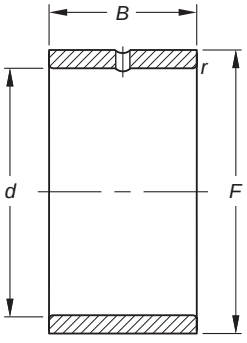


JR.JS1



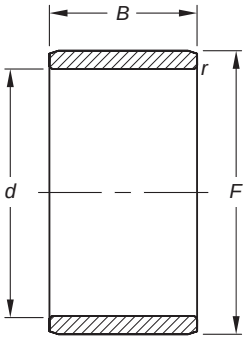
JRZ.JS1

Shaft Diameter	Dimensions mm/in.				Inner Ring Designation	Wt. kg/lbs.
mm	d	F	B	$r_{s\ min}$		
40	40 1.5748	45 1.7717	25 0.984	0.35 0.014	IM 40 45 25 P	0.062 0.137
	40 1.5748	45 1.7717	30 1.181	0.3 0.01	JR40x45x30	0.078 0.172
	40 1.5748	45 1.7717	34 1.339	0.3 0.01	JR40x45x34	0.089 0.196
	40 1.5748	45 1.7717	40 1.575	0.3 0.01	JR40x45x40	0.115 0.254
	40 1.5748	48 1.8898	22 0.866	0.6 0.02	JR40x48x22	0.094 0.207
	40 1.5748	48 1.8898	23 0.906	0.6 0.02	JRZ40x48x23JS1	0.100 0.220
	40 1.5748	48 1.8898	40 1.575	0.6 0.02	JR40x48x40	0.173 0.381
	40 1.5748	50 1.9685	20 0.787	1 0.04	JR40x50x20	0.110 0.243
42	42 1.6535	47 1.8504	20 0.787	0.3 0.01	JR42x47x20	0.055 0.121
	42 1.6535	47 1.8504	30 1.181	0.3 0.01	JR42x47x30	0.083 0.183
45	45 1.7717	50 1.9685	20 0.787	0.3 0.01	JR45x50x20	0.058 0.128
	45 1.7717	50 1.9685	25 0.984	0.6 0.02	JR45x50x25	0.073 0.161
	45 1.7717	50 1.9685	25.5 1.004	0.3 0.01	JR45x50x25.5	0.075 0.165
	45 1.7717	50 1.9685	35 1.378	0.6 0.02	JR45x50x35	0.103 0.227
	45 1.7717	50 1.9685	40 1.575	0.3 0.01	JR45x50x40	0.117 0.258
	45 1.7717	52 2.0472	22 0.866	0.6 0.02	JR45x52x22	0.090 0.198
	45 1.7717	52 2.0472	23 0.906	0.6 0.02	JR45x52x23	0.096 0.212
	45 1.7717	52 2.0472	23 0.906	0.6 0.02	JRZ45x52x23JS1	0.096 0.212
	45 1.7717	52 2.0472	40 1.575	0.6 0.02	JR45x52x40	0.167 0.368
	45 1.7717	55 2.1654	20 0.787	1 0.04	JR45x55x20	0.133 0.293
	45 1.7717	55 2.1654	20 0.787	1 0.04	JR45x55x20JS1	0.133 0.293
	45 1.7717	55 2.1654	22 0.866	1 0.04	JR45x55x22	0.135 0.298
	45 1.7717	55 2.1654	40 1.575	1 0.04	JR45x55x40	0.247 0.545
50	50 1.9685	55 2.1654	20 0.787	0.3 0.01	JR50x55x20	0.065 0.143
	50 1.9685	55 2.1654	25 0.984	0.6 0.02	JR50x55x25	0.081 0.179
	50 1.9685	55 2.1654	35 1.378	0.65 0.026	IM 50 55 35 P	0.107 0.236
	50 1.9685	55 2.1654	35 1.378	0.6 0.02	JR50x55x35	0.113 0.249

Continued on next page.

INNER RINGS – *continued*

METRIC SERIES



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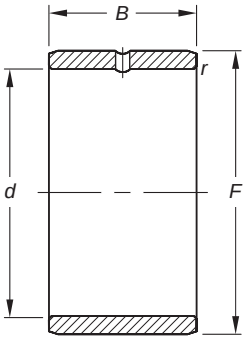
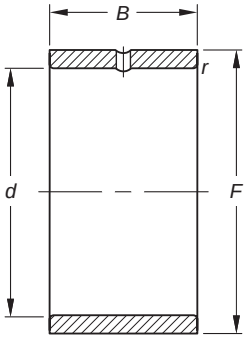


JR.JS1

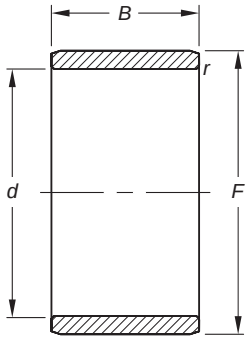


JRZ.JS1

Shaft Diameter	Dimensions mm/in.				Inner Ring Designation	Wt. kg/lbs.
mm	d	F	B	$r_{s\ min}$		
50	50 1.9685	55 2.1654	40 1.575	0.3 0.01	JR50x55x40	0.130 0.287
	50 1.9685	58 2.2835	22 0.866	0.6 0.02	JR50x58x22	0.117 0.258
	50 1.9685	58 2.2835	23 0.906	0.6 0.02	JRZ50x58x23JS1	0.122 0.269
	50 1.9685	58 2.2835	40 1.575	0.6 0.02	JR50x58x40	0.213 0.470
	50 1.9685	60 2.3622	20 0.787	1 0.04	JR50x60x20	0.155 0.342
	50 1.9685	60 2.3622	20 0.787	1 0.04	JR50x60x20JS1	0.155 0.342
	50 1.9685	60 2.3622	25 0.984	1 0.04	JR50x60x25	0.170 0.375
	50 1.9685	60 2.3622	40 1.575	1 0.04	JR50x60x40	0.310 0.683
55	55 2.1654	60 2.3622	25 0.984	0.6 0.02	JR55x60x25	0.088 0.194
	55 2.1654	60 2.3622	35 1.378	0.65 0.026	IM 55 60 35 P	0.118 0.260
	55 2.1654	60 2.3622	35 1.378	0.6 0.02	JR55x60x35	0.124 0.273
	55 2.1654	63 2.4803	25 0.984	1 0.04	JR55x63x25	0.141 0.311
	55 2.1654	63 2.4803	45 1.772	1 0.04	JR55x63x45	0.286 0.631
	55 2.1654	65 2.5591	30 1.181	1 0.04	JR55x65x30	0.222 0.489
	55 2.1654	65 2.5591	60 2.362	1 0.04	JR55x65x60	0.444 0.979
58	58 2.2835	65 2.5591	25 0.984	0.85 0.033	IM 58 65 25 P	0.125 0.276
60	60 2.3622	68 2.6772	25 0.984	0.6 0.02	JR60x68x25	0.153 0.337
	60 2.3622	68 2.6772	35 1.378	0.6 0.02	JR60x68x35	0.220 0.485
	60 2.3622	68 2.6772	45 1.772	1 0.04	JR60x68x45	0.284 0.626
	60 2.3622	70 2.7559	25 0.984	1 0.04	JR60x70x25	0.200 0.441
	60 2.3622	70 2.7559	30 1.181	1 0.04	JR60x70x30	0.240 0.529
	60 2.3622	70 2.7559	35 1.378	0.85 0.033	IM 60 70 35 P	0.280 0.616
	60 2.3622	70 2.7559	60 2.362	1 0.04	JR60x70x60	0.480 1.058
65	65 2.5591	72 2.8346	25 0.984	1 0.04	JR65x72x25	0.143 0.315
	65 2.5591	72 2.8346	45 1.772	1 0.04	JR65x72x45	0.266 0.586
	65 2.5591	73 2.8740	25 0.984	0.6 0.02	JR65x73x25	0.170 0.375
	65 2.5591	73 2.8740	35 1.378	0.6 0.02	JR65x73x35	0.240 0.529
	65 2.5591	75 2.9528	28 1.102	1 0.04	JR65x75x28	0.240 0.529

INNER RINGS – *continued*

METRIC SERIES



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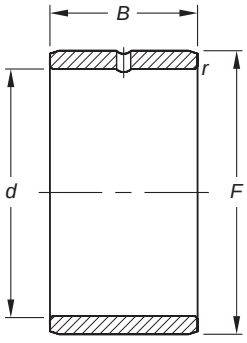
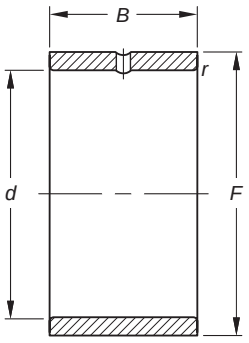


JR.JS1



JRZ.JS1

Shaft Diameter	Dimensions mm/in.				Inner Ring Designation	Wt. kg/lbs.
mm	d	F	B	$r_{s\ min}$		
65	65 2.5591	75 2.9528	30 1.181	1 0.04	JR65x75x30	0.260 0.573
	65 2.5591	75 2.9528	60 2.362	1 0.04	JR65x75x60	0.520 1.146
70	70 2.7559	80 3.1496	25 0.984	1 0.04	JR70x80x25	0.230 0.507
	70 2.7559	80 3.1496	30 1.181	1 0.04	JR70x80x30	0.270 0.595
	70 2.7559	80 3.1496	35 1.378	1 0.04	JR70x80x35	0.320 0.705
	70 2.7559	80 3.1496	54 2.126	1 0.04	JR70x80x54	0.500 1.102
	70 2.7559	80 3.1496	60 2.362	1 0.04	JR70x80x60	0.556 1.226
75	75 2.9528	85 3.3465	25 0.984	1 0.04	JR75x85x25	0.240 0.529
	75 2.9528	85 3.3465	30 1.181	1 0.04	JR75x85x30	0.289 0.637
	75 2.9528	85 3.3465	35 1.378	1 0.04	JR75x85x35	0.338 0.745
	75 2.9528	85 3.3465	54 2.126	1 0.04	JR75x85x54	0.530 1.168
80	80 3.1496	90 3.5433	25 0.984	1 0.04	JR80x90x25	0.260 0.573
	80 3.1496	90 3.5433	30 1.181	1 0.04	JR80x90x30	0.306 0.675
	80 3.1496	90 3.5433	35 1.378	1 0.04	JR80x90x35	0.355 0.783
	80 3.1496	90 3.5433	54 2.126	1 0.04	JR80x90x54	0.565 1.246
85	85 3.3465	95 3.7402	26 1.024	1 0.04	JR85x95x26	0.290 0.639
	85 3.3465	95 3.7402	30 1.181	1 0.04	JR85x95x30	0.334 0.736
	85 3.3465	95 3.7402	36 1.417	1 0.04	JR85x95x36	0.397 0.875
	85 3.3465	100 3.9370	35 1.378	1.1 0.04	JR85x100x35	0.595 1.312
	85 3.3465	100 3.9370	63 2.480	1.1 0.04	JR85x100x63	1.080 2.381
90	90 3.5433	100 3.9370	26 1.024	1 0.04	JR90x100x26	0.300 0.661
	90 3.5433	100 3.9370	30 1.181	1 0.04	JR90x100x30	0.350 0.772
	90 3.5433	100 3.9370	36 1.417	1 0.04	JR90x100x36	0.422 0.930
	90 3.5433	105 4.1339	32 1.260	1.1 0.04	JR90x105x32	0.580 1.279
	90 3.5433	105 4.1339	35 1.378	1.1 0.04	JR90x105x35	0.624 1.376
	90 3.5433	105 4.1339	63 2.480	1.1 0.04	JR90x105x63	1.140 2.513
95	95 3.7402	105 4.1339	26 1.024	1 0.04	JR95x105x26	0.310 0.683

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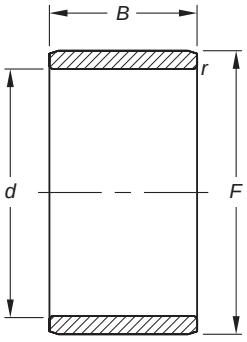
INNER RINGS – *continued*

METRIC SERIES



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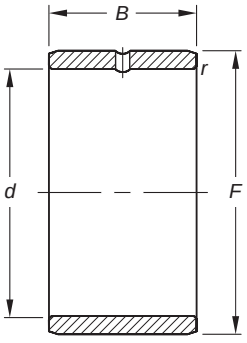
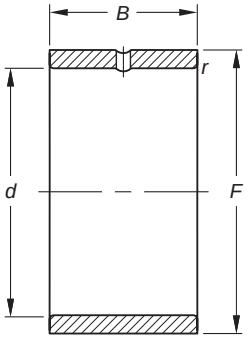


JR.JS1

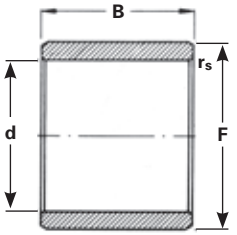


JRZ.JS1

Shaft Diameter	Dimensions mm/in.				Inner Ring Designation	Wt. kg/lbs.
mm	d	F	B	$r_{s\ min}$		
95	95 3.7402	105 4.1339	36 1.417	1 0.04	JR95x105x36	0.430 0.948
	95 3.7402	110 4.3307	35 1.378	1.1 0.04	JR95x110x35	0.653 1.440
	95 3.7402	110 4.3307	63 2.480	1.1 0.04	JR95x110x63	1.200 2.646
100	100 3.9370	110 4.3307	30 1.181	1.1 0.04	JR100x110x30	0.384 0.847
	100 3.9370	110 4.3307	40 1.575	1.1 0.04	JR100x110x40	0.510 1.124
	100 3.9370	115 4.5276	40 1.575	1.1 0.04	JR100x115x40	0.790 1.742
110	110 4.3307	120 4.7244	30 1.181	1 0.04	JR110x120x30	0.425 0.937
	110 4.3307	125 4.9213	40 1.575	1.1 0.04	JR110x125x40	0.870 1.918
120	120 4.7244	130 5.1181	30 1.181	1 0.04	JR120x130x30	0.460 1.014
	120 4.7244	135 5.3150	45 1.772	1.1 0.04	JR120x135x45	1.060 2.337
130	130 5.1181	145 5.7087	35 1.378	1.1 0.04	JR130x145x35	0.890 1.962
	130 5.1181	150 5.9055	50 1.969	1.5 0.06	JR130x150x50	1.730 3.814
140	140 5.5118	155 6.1024	35 1.378	1.1 0.04	JR140x155x35	0.955 2.105
	140 5.5118	160 6.2992	50 1.969	1.5 0.06	JR140x160x50	1.860 4.101
150	150 5.9055	165 6.4961	40 1.575	1.1 0.04	JR150x165x40	1.170 2.579
160	160 6.2992	175 6.8898	40 1.575	1.1 0.04	JR160x175x40	1.240 2.734
170	170 6.6929	185 7.2835	45 1.772	1.1 0.04	JR170x185x45	1.480 3.263
180	180 7.0866	195 7.6772	45 1.772	1.1 0.04	JR180x195x45	1.560 3.439

INNER RINGS FOR FULL COMPLEMENT NEEDLE ROLLER BEARINGS

METRIC SERIES



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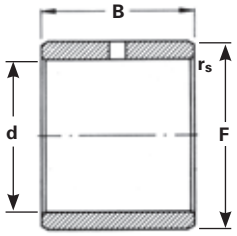

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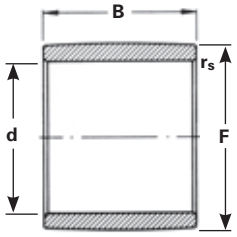

IM…R6

Shaft Diameter	Dimensions mm/in. g5			Hole mm/in.[1] Location		Bearing Designation	Wt. kg/lbs.
mm	d	F	B	C_3	$r_{s\,min}$		
8	8 0.3150	12 0.4724	12.4 0.488		0.3 0.01	IM 8 12 12.4	0.006 0.013
9	9 0.3543	13 0.5118	12.4 0.488		0.3 0.01	IM 9 13 12.4	0.006 0.014
	9 0.3543	13 0.5118	12.4 0.488		0.3 0.01	IM 9 13 12.4 R6	0.006 0.014
10	10 0.3937	14 0.5512	12.4 0.488		0.3 0.01	IM 10 14 12.4	0.007 0.015
	10 0.3937	14 0.5512	16.4 0.646		0.3 0.01	IM 10 14 16.4	0.009 0.020
11	11 0.4331	15 0.5906	12.4 0.488		0.3 0.01	IM 11 15 12.4	0.008 0.018
12	12 0.4724	15 0.5906	12.4 0.488		0.2 0.01	IM 12 15 12.4	0.006 0.013
	12 0.4724	16 0.6299	12.4 0.488		0.2 0.01	IM 12 16 12.4	0.008 0.018
	12 0.4724	16 0.6299	12.4 0.488		0.3 0.01	IM 12 16 12.4 R6	0.008 0.018
	12 0.4724	16 0.6297	12.4 0.488	6.2 0.24	0.3 0.01	IMC 12 16 12.4	0.008 0.018
13	13 0.5118	17 0.6693	12.4 0.488		0.3 0.01	IM 13 17 12.4	0.009 0.019
	13 0.5118	18 0.7087	12.4 0.488		0.35 0.014	IM 13 18 12.4	0.011 0.025
	13 0.5118	18 0.7087	12.4 0.488		0.35 0.014	IM 13 18 12.4 R6	0.011 0.025
	13 0.5118	18 0.7087	16.4 0.646		0.35 0.014	IM 13 18 16.4	0.015 0.033
15	15 0.5906	20 0.7874	12.4 0.488		0.35 0.014	IM 15 20 12.4	0.013 0.028
	15 0.5906	20 0.7874	16.4 0.646		0.35 0.014	IM 15 20 16.4	0.017 0.037
	17 0.6693	22 0.8661	16.4 0.646		0.35 0.014	IM 17 22 16.4	0.019 0.041
	17 0.6693	22 0.8661	16.4 0.646		0.35 0.014	IM 17 22 16.4 R6	0.019 0.041
17	17 0.6693	22 0.8659	16.4 0.646	8.2 0.32	0.35 0.014	IMC 17 22 16.4	0.019 0.041
20	20 0.7874	25 0.9843	16.4 0.646		0.35 0.014	IM 20 25 16.4	0.022 0.047
	20 0.7874	25 0.9843	16.4 0.646		0.35 0.014	IM 20 25 16.4 R6	0.022 0.047
	20 0.7874	25 0.9840	16.4 0.646	8.2 0.32	0.35 0.014	IMC 20 25 16.4	0.022 0.047
	20 0.7874	25 0.9843	20.4 0.803		0.35 0.014	IM 20 25 20.4	0.027 0.060
	20 0.7874	25 0.9840	20.4 0.803	10.2 0.40	0.35 0.014	IMC 20 25 20.4	0.027 0.060
	20 0.7874	25 0.9843	25.0 0.984		0.35 0.014	IM 20 25 25	0.033 0.073
23	23 0.9055	28 1.1024	20.4 0.803		0.35 0.014	IM 23 28 20.4	0.031 0.067
25	25 0.9843	30 1.1811	16.4 0.646		0.35 0.014	IM 25 30 16.4	0.027 0.058
	25 0.9843	30 1.1811	16.4 0.646		0.35 0.014	IM 25 30 16.4 R6	0.027 0.058

[1] single 2 mm dia. thru hole

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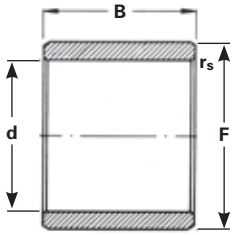
INNER RINGS FOR FULL COMPLEMENT NEEDLE ROLLER BEARINGS – *continued*

METRIC SERIES



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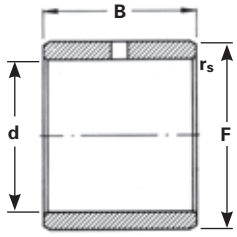

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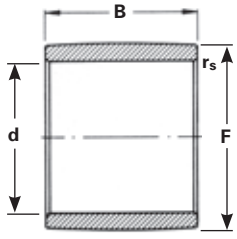


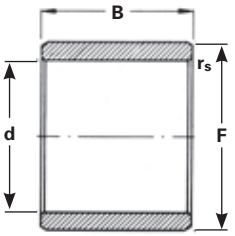
IM…R6

Shaft Diameter	Dimensions mm/in. g5			Hole mm/in.[1] Location		Bearing Designation	Wt. kg/lbs.
mm	d	F	B	C_3	$r_{s\ min}$		
25	25 0.9843	30 1.1808	16.4 0.646	8.2 0.32	0.35 0.014	IMC 25 30 16.4	0.027 0.058
	25 0.9843	30 1.1811	20.4 0.803		0.35 0.014	IM 25 30 20.4	0.033 0.073
	25 0.9843	30 1.1808	20.4 0.803	10.2 0.40	0.35 0.014	IMC 25 30 20.4	0.033 0.073
	25 0.9843	30 1.1811	25 0.984		0.35 0.014	IM 25 30 25	0.040 0.088
30	30 1.1811	35 1.3780	16.4 0.646		0.35 0.014	IM 30 35 16.4	0.031 0.068
	30 1.1811	35 1.3780	16.4 0.646		0.35 0.014	IM 30 35 16.4 R6	0.031 0.068
	30 1.1811	35 1.3776	16.4 0.646	8.2 0.32	0.35 0.014	IMC 30 35 16.4	0.031 0.068
	30 1.1811	35 1.3780	20.4 0.803		0.35 0.014	IM 30 35 20.4	0.039 0.086
	30 1.1811	35 1.3780	20.4 0.803		0.35 0.014	IM 30 35 20.4 R6	0.039 0.086
	30 1.1811	35 1.3776	20.4 0.803	10.2 0.40	0.35 0.014	IMC 30 35 20.4	0.039 0.086
	30 1.1811	35 1.3780	25.0 0.984		0.35 0.014	IM 30 35 25	0.048 0.106
35	35 1.3780	40 1.5748	16.4 0.646		0.35 0.014	IM 35 40 16.4	0.036 0.079
	35 1.3780	40 1.5748	16.4 0.646		0.35 0.014	IM 35 40 16.4 R6	0.036 0.079
	35 1.3780	40 1.5748	20.4 0.803		0.35 0.014	IM 35 40 20.4	0.045 0.099
	35 1.3780	40 1.5748	20.4 0.803		0.35 0.014	IM 35 40 20.4 R6	0.045 0.099
	35 1.3780	40 1.5744	20.4 0.803	10.2 0.40	0.35 0.014	IMC 35 40 20.4	0.045 0.099
	35 1.3780	40 1.5748	25 0.984		0.35 0.014	IM 35 40 25	0.055 0.121
40	40 1.5748	44 1.7323	16.4 0.646		0.3 0.01	IM 40 44 16.4	0.032 0.071
	40 1.5748	44 1.7323	16.4 0.646		0.3 0.01	IM 40 44 16.4 R6	0.032 0.071
	40 1.5748	44 1.7319	16.4 0.646	8.2 0.32	0.3 0.01	IMC 40 44 16.4	0.032 0.071
	40 1.5748	45 1.7717	20.4 0.803		0.35 0.014	IM 40 45 20.4	0.051 0.112
	40 1.5748	44 1.7319	20.4 0.803	10.2 0.40	0.35 0.014	IMC 40 45 20.4	0.05 0.112
45	45 1.7717	50 1.9685	20.4 0.803		0.65 0.026	IM 45 50 20.4	0.056 0.123
	45 1.7717	50 1.9685	20.4 0.803		0.65 0.026	IM 45 50 20.4 R6	0.056 0.123
	45 1.7717	50 1.9685	25 0.984		0.65 0.026	IM 45 50 25	0.069 0.152
	45 1.7717	60 2.3622	25 0.984		0.65 0.026	IM 45 50 25 R6	0.069 0.152
50	50 1.9685	55 2.1654	20.4 0.803		0.65 0.026	IM 50 55 20.4 R6	0.062 0.137
	50 1.9685	55 2.1654	20.4 0.803		0.65 0.026	IM 50 55 20.4	0.062 0.137

[1] single 2 mm dia. thru hole

INNER RINGS FOR FULL COMPLEMENT NEEDLE ROLLER BEARINGS

METRIC SERIES



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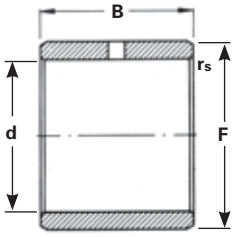

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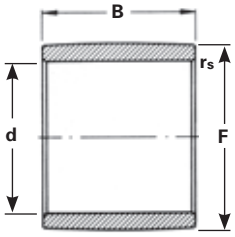


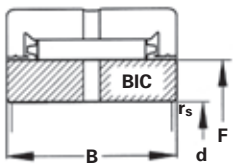
IM…R6

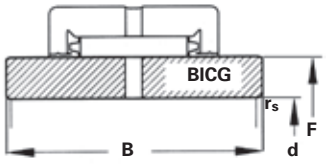
Shaft Diameter	Dimensions mm/in.				Bearing Designation	Wt. kg/lbs.
mm	d	F	B	$r_{s\ min}$		
17	17 0.6693	20 0.7874	27.5 1.083	0.2 0.01	IM 19017	0.019 0.042
	17 0.6693	20 0.7874	32 1.240	0.2 0.01	IM 20617	0.021 0.046
	17 0.6693	22 0.8665	13 0.512	0.35 0.014	IM 4903[1]	0.015 0.033
20	20 0.7874	25 0.9843	27.5 1.083	0.35 0.014	IM 19020	0.038 0.084
	20 0.7874	25 0.9843	32 1.240	0.35 0.014	IM 20620	0.044 0.097
25	25 0.9843	30 1.1811	27.5 1.083	0.35 0.014	IM 19025	0.042 0.093
	25 0.9843	30 1.1811	32 1.240	0.35 0.014	IM 20625	0.052 0.115
30	30 1.1811	35 1.3785	17 0.669	0.35 0.014	IM 4906[1]	0.033 0.072
	30 1.1811	35 1.3780	27.5 1.083	0.35 0.014	IM 19030	0.053 0.117
	30 1.1811	35 1.3780	32 1.240	0.35 0.014	IM 20630	0.061 0.134
35	35 1.3780	40 1.5748	27.5 1.083	0.35 0.014	IM 19035	0.063 0.139
	35 1.3780	40 1.5748	32 1.240	0.35 0.014	IM 20635	0.072 0.159
40	40 1.5748	45 1.7717	27.5 1.083	0.35 0.014	IM 19040	0.069 0.152
	40 1.5748	45 1.7717	32 1.240	0.35 0.014	IM 20640	0.080 0.176
45	45 1.7717	50 1.9685	30.5 1.201	0.65 0.026	IM 19045	0.085 0.187
	45 1.7717	50 1.9685	35 1.358	0.65 0.026	IM 20645	0.096 0.212
	45 1.7717	52 2.0476	22 0.866	0.85 0.033	IM 4909[1]	0.087 0.192

[1] 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	$r_{s\ min}$		
12	12 0.4724	17.6 0.6929	15 0.591	1 0.04	BIC 1012	0.016 0.035
	12 0.4724	17.6 0.6929	20 0.787	1 0.04	BIP 1012	0.020 0.044
15	15 0.5906	20.8 0.8189	15 0.591	1 0.04	BIC 1015	0.018 0.040
	15 0.5906	22.1 0.8701	22 0.866	1 0.04	BIC 2015	0.035 0.077
17	17 0.6693	23.9 0.9409	15 0.591	1 0.04	BIC 1017	0.026 0.057
20	20 0.7874	28.7 1.1299	18 0.709	1 0.04	BIC 1020	0.046 0.101
	20 0.7874	28.7 1.1299	22 0.866	1 0.04	BIC 2020	0.056 0.123
	20 0.7874	28.7 1.1299	22 0.866	1 0.04	BIP 1020	0.056 0.123
25	25 0.9843	33.5 1.3189	18 0.709	1 0.04	BIC 1025	0.054 0.119
	25 0.9843	33.5 1.3189	22 0.866	1 0.04	BIC 2025	0.065 0.143
	25 0.9843	33.5 1.3189	30 1.181	1 0.04	BIC 22025	0.500 1.102
	25 0.9843	33.5 1.3189	32 1.260	1 0.04	BIG 2025	0.095 0.209
	25 0.9843	33.5 1.3189	42 1.654	1 0.04	BIK 2025	0.125 0.276
30	30 1.1811	38.2 1.5039	18 0.709	1 0.04	BIC 1030	0.060 0.132
	30 1.1811	38.2 1.5039	22 0.866	1 0.04	BIC 2030	0.074 0.163
	30 1.1811	44.0 1.7323	30 1.181	1 0.04	BIC 3030	0.188 0.414
	30 1.1811	38.2 1.5039	32 1.260	1 0.04	BIG 2030	0.108 0.238
	30 1.1811	44.0 1.7323	40 1.575	1 0.04	BIG 3030	0.247 0.545
35	35 1.3780	44.0 1.7323	18 0.709	1 0.04	BIC 1035	0.077 0.170
	35 1.3780	44.0 1.7323	22 0.866	1 0.04	BIC 2035	0.093 0.205
	35 1.3780	44.0 1.7323	32 1.260	1 0.04	BIG 2035	0.135 0.298
40	40 1.5748	49.7 1.9567	18 0.709	1.5 0.06	BIC 1040	0.094 0.207
	40 1.5748	49.7 1.9567	22 0.866	1.5 0.06	BIC 2040	0.115 0.254
	40 1.5748	55.4 2.1811	36 1.417	1.5 0.06	BIC 3040	0.321 0.708
	40 1.5748	49.7 1.9567	32 1.260	1.5 0.06	BiG 2040	0.170 0.375
	40 1.5748	49.7 1.9567	22 0.866	1.5 0.06	BIP 1040	0.115 0.254
45	45 1.7717	55.4 2.1811	18 0.709	1.5 0.06	BIC 1045	0.113 0.249

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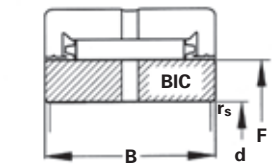
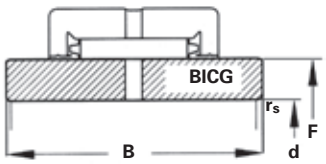
EXTRA WIDE INNER RINGS — *continued*

METRIC SERIES





Shaft Diameter	Dimensions mm/in.				Bearing Designation	Wt. kg/lbs.
mm	d	F	B	$r_{s\ min}$		
45	45 1.7717	55.4 2.1811	22 0.866	1.5 0.06	BIC 2045	0.139 0.306
	45 1.7717	62.1 2.4449	38 1.496	1.5 0.06	BIC 3045	0.422 0.930
	45 1.7717	55.4 2.1811	32 1.260	1.5 0.06	BIG 2045	0.210 0.463
50	50 1.9685	62.1 2.4449	20 0.787	2 0.08	BIC 1050	0.163 0.359
	50 1.9685	62.1 2.4449	24 0.945	2 0.08	BIC 11050	0.196 0.432
	50 1.9685	62.1 2.4449	28 1.102	2 0.08	BIC 2050	0.228 0.503
	50 1.9685	68.8 2.7087	38 1.496	2 0.08	BIC 3050	0.515 1.135
	50 1.9685	62.1 2.4449	38 1.496	2 0.08	BIG 2050	0.312 0.688
	50 1.9685	62.1 2.4449	28 1.102	2 0.08	BIP 1050	0.228 0.503
55	55 2.1654	68.8 2.7087	20 0.787	2 0.08	BIC 1055	0.205 0.452
	55 2.1654	72.6 2.8583	38 1.496	2 0.08	BIC 3055	0.525 1.157
	55 2.1654	72.6 2.8583	48 1.890	2 0.08	BICG 3055	0.660 1.455
	55 2.1654	68.8 2.7087	38 1.496	2 0.08	BIG 2055	0.390 0.860
	55 2.1654	68.8 2.7087	28 1.102	2 0.08	BIP 1055	0.288 0.635
60	60 2.3622	72.6 2.8583	28 1.102	2 0.08	BIC 2060	0.282 0.622
	60 2.3622	78.3 3.0827	38 1.496	2 0.08	BIC 3060	0.583 1.285
	60 2.3622	72.6 2.8583	38 1.496	2 0.08	BICG 2060	0.385 0.849
	60 2.3622	72.6 2.8583	38 1.496	2 0.08	BIG 2060	0.385 0.849
65	65 2.5591	83.1 3.2717	38 1.496	2 0.08	BIC 3065	0.623 1.373
	65 2.5591	78.3 3.0827	38 1.496	2 0.08	BIG 2065	0.437 0.963
70	70 2.7559	88.0 3.4646	38 1.496	2 0.08	BIC 3070	0.662 1.459
	70 2.7559	88.0 3.4646	48 1.890	2 0.08	BIG 3070	0.820 1.808
	70 2.7559	88.0 3.4646	58 2.283	2 0.08	BIK 3070	1.010 2.227
75	75 2.9528	88.0 3.4646	32 1.260	2 0.08	BIC 2075	0.410 0.904
	75 2.9528	88.0 3.4646	42 1.654	2 0.08	BIG 2075	0.538 1.186
	75 2.9528	96.0 3.7795	58 2.283	2 0.08	BIK 3075	1.260 2.778
80	80 3.1496	96.0 3.7795	24 0.945	2 0.08	BIC 1080	0.410 0.904

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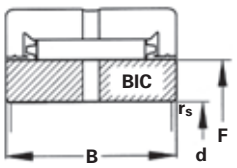
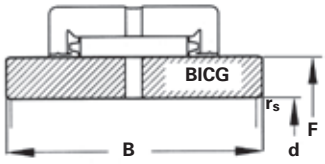
EXTRA WIDE INNER RINGS — *continued*

METRIC SERIES

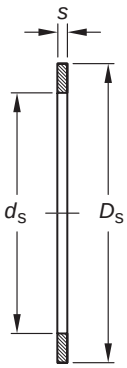




Shaft Diameter	Dimensions mm/in.				Bearing Designation	Wt. kg/lbs.
mm	d	F	B	$r_{s\ min}$		
80	80 3.1496	96.0 3.7795	32 1.260	2 0.08	BIC 2080	0.545 1.202
	80 3.1496	99.5 3.9173	38 1.496	2 0.08	BIC 3080	0.805 1.775
	80 3.1496	96.0 3.7795	42 1.654	2 0.08	BIG 2080	0.714 1.574
90	90 3.5433	104.7 4.1220	32 1.260	2 0.08	BIC 2090	0.531 1.171
	90 3.5433	109.1 4.2953	43 1.693	2 0.08	BIC 3090	0.990 2.183
	90 3.5433	109.1 4.2953	53 2.087	2 0.08	BIG 3090	1.220 2.690
	90 3.5433	109.1 4.2953	63 2.480	2 0.08	BIK 3090	1.480 3.263
95	95 3.7402	109.1 4.2953	32 1.260	2 0.08	BIC 2095	0.548 1.208
	95 3.7402	114.7 4.5157	43 1.693	2 0.08	BIC 3095	1.075 2.370
	95 3.7402	114.7 4.5157	63 2.480	2 0.08	BIK 3095	1.585 3.494
100	100 3.9370	119.2 4.6929	43 1.693	2 0.08	BIC 3100	1.090 2.403
	100 3.9370	114.7 4.5157	42 1.654	2 0.08	BIG 2100	0.800 1.764
105	105 4.1339	119.2 4.6929	32 1.260	2 0.08	BIC 2105	0.615 1.356
	105 4.1339	124.7 4.9094	55 2.165	2 0.08	BIG 3105	1.505 3.318
110	110 4.3307	124.7 4.9094	34 1.339	2 0.08	BIC 2110	0.705 1.554
	110 4.3307	124.7 4.9094	44 1.732	2 0.08	BIG 2110	0.920 2.028
125	125 4.9213	142.5 5.6102	44 1.732	2 0.08	BICG 2125	1.340 2.954
	125 4.9213	142.5 5.6102	44 1.732	2 0.08	BIG 2125	1.325 2.921
130	130 5.1181	158.0 6.2205	52 2.047	2 0.08	BIC 3130	2.530 5.578

END WASHERS

METRIC SERIES



SNSH

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

NOTES