

**THRUST NEEDLE ROLLER AND CAGE ASSEMBLIES AND THRUST WASHERS**

**METRIC SERIES**

Thrust needle roller and cage assemblies are available in a variety of sizes. They all have very small cross sections. This catalog includes the most popular, standardized designs.

**REFERENCE STANDARDS ARE:**

- **ISO 3031** – rolling bearings – thrust needle roller and cage assemblies, thrust washers – dimensions and tolerances.
- **DIN 5405 Part 2** – rolling bearings – needle roller bearings – thrust needle roller and cage assemblies.
- **DIN 5405 Part 3** – rolling bearings – needle roller bearings – thrust washers.
- **ANSI/ABMA Std. 21.1-1988** – thrust needle roller and cage assemblies and thrust washers – metric design.
- **JIS B 1536** – roller bearings – boundary dimensions and tolerances of needle roller bearings.

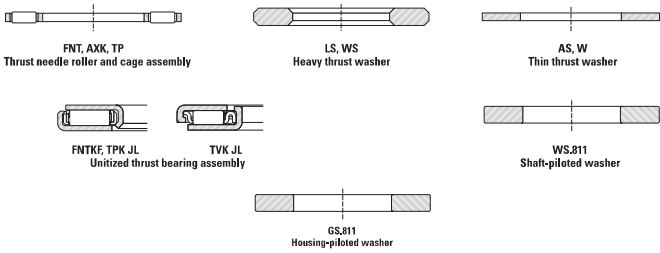


Fig. B6-1. Types of metric series thrust needle roller and cage assemblies and thrust washers

**CONSTRUCTION**

**THRUST NEEDLE ROLLER AND CAGE ASSEMBLIES**

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

AXK series thrust needle roller and cage 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 backup surface raceways, their section may be 2,000 to 5,000 mm (0.0787 to 0.1969 in) – equivalent to the diameter of the needle rollers used.

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

**UNITIZED THRUST BEARING ASSEMBLIES**

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

Each FNTK, FNTF, FNTKF, TPK and TVK assembly consists of a FNT, TP or TV thrust needle roller and cage assembly – with one or two special-lipped washers that snap over the cage to produce a unitized thrust bearing assembly. The FNTK, FNTF, TPK J, TPK L, TVK J and TVK L assembly has one such washer. The FNTKF, TPK JL and TVK JL 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 Fig. B6-2 on page B-6-10. Oil is the preferred lubricant for these assemblies. However they also are available pre-greased for applications that do not allow for oil lubrication.

**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 and others may be piloted by their outer diameter.

**THIN THRUST WASHERS (AS, W)**

The metric series thin thrust washers are made of hardened spring steel. Thin washers are used when the supporting or backing members cannot be adequately prepared as raceways for the needle rollers. These washers are only 1,000 mm (0.0394 in) thick, 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 the application.

**HEAVY THRUST WASHERS (LS, WS)**

These metric series thrust washers are made of bearing quality steel, hardened and precision-ground on the flat raceway surfaces. Their bores and outer 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, lapped-flat raceway surfaces. The bore and outer diameter tolerances for shaft-piloted washers and housing-piloted washers are shown in Table B6-8 and B6-9 on page B-6-28.

**DIMENSIONAL ACCURACY**

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

Pages B-6-12 to B-6-19 list the nominal outer diameter, bore diameter and needle roller diameter for the FNT, AXK and TP series of thrust needle roller and cage assemblies and also the nominal outer diameter and bore diameter of the series AS, LS, WS.811, GS.811, W and WS thrust washers. Thickness tolerances for the AS and LS thrust washers also are included.

Tolerances for the outer and bore diameters of series FNT, AXK and TP thrust needle roller and cage assemblies are given in Table B6-1 on page B-6-7, Table B6-2 on page B-6-8 and Table B6-6 on page B-6-9. Table B6-1. Tolerances for outer diameter (D<sub>o</sub>) and bore diameter (D<sub>i</sub>) of series FNT and TP thrust needle roller and cage assemblies

D <sub>o</sub>		Deviations of max. outside diameter (e <sub>s</sub> )		D <sub>i</sub>		Deviations of min. bore diameter (E <sub>1</sub> )	
>	≤	Max.	Min.	>	≤	Max.	Min.
mm	in	mm	in	mm	in	mm	in
18,000	30,000	-0.110	-0.320	3,000	5,000	+0.095	+0.020
0.687	1.181	-0.0043	-0.0126	0.1181	0.2362	-0.0037	-0.0008
30,000	40,000	-0.120	-0.370	6,000	10,000	+0.115	+0.025
1.181	1.5748	-0.0047	-0.0146	0.2362	0.3937	-0.0045	-0.0010
40,000	50,000	-0.130	-0.380	10,000	18,000	+0.142	+0.032
1.5748	1.9685	-0.0051	-0.0150	0.3937	0.7087	-0.0056	-0.0013
50,000	65,000	-0.140	-0.440	18,000	30,000	+0.170	+0.040
1.9685	2.5591	-0.0055	-0.0173	0.7087	1.181	-0.0067	-0.0016
65,000	80,000	-0.150	-0.450	30,000	50,000	+0.210	+0.050
2.5591	3.1496	-0.0059	-0.0177	1.181	1.9685	-0.0083	-0.0020
80,000	100,000	-0.170	-0.520	50,000	80,000	+0.250	+0.060
3.1496	3.9370	-0.0067	-0.0205	1.9685	3.1496	-0.0098	-0.0024
100,000	120,000	-0.180	-0.530	80,000	120,000	+0.292	+0.072
3.9370	4.7244	-0.0071	-0.0209	3.1496	4.7244	-0.0115	-0.0028
120,000	140,000	-0.200	-0.600	120,000	190,000	+0.335	+0.085
4.7244	5.5118	-0.0079	-0.0236	4.7244	7.0865	-0.0132	-0.0033
140,000	160,000	-0.210	-0.610				
5.5118	6.2992	-0.0083	-0.0250				
160,000	180,000	-0.230	-0.630				
6.2992	7.0865	-0.0091	-0.0248				
180,000	200,000	-0.240	-0.700				
7.0865	7.8749	-0.0094	-0.0276				

**Table B6-2. Tolerances for outer diameter (D<sub>e</sub>) and bore diameter (D<sub>i</sub>) of series AXK thrust needle roller and cage assemblies**

D <sub>e</sub>				D <sub>i</sub>			
>		≤		>		≤	
mm	in	mm	in	mm	in	mm	in
18,000	30,000	-0.110	-0.440	3,000	6,000	+0.140	+0.600
0.7087	1.1811	-0.0043	-0.0173	0.1181	0.2362	+0.0055	+0.0008
30,000	40,000	-0.120	-0.510	6,000	10,000	+0.175	+0.025
1.1811	1.5748	-0.0047	-0.0201	0.2362	0.3937	+0.0069	+0.0010
40,000	50,000	-0.130	-0.520	10,000	16,000	+0.212	+0.052
1.5748	1.9685	-0.0051	-0.0205	0.3937	0.7087	+0.0083	+0.0012
50,000	65,000	-0.140	-0.600	18,000	30,000	+0.250	+0.400
1.9685	2.5591	-0.0055	-0.0236	0.7087	1.1811	+0.0098	+0.0016
65,000	80,000	-0.150	-0.610	30,000	50,000	+0.300	+0.450
2.5591	3.1496	-0.0059	-0.0240	1.1811	1.9685	+0.0118	+0.0020
80,000	100,000	-0.170	-0.710	50,000	80,000	+0.350	+0.600
3.1496	3.9370	-0.0067	-0.0280	1.9685	3.1496	+0.0130	+0.0024
100,000	120,000	-0.180	-0.720	80,000	120,000	+0.422	+0.072
3.9370	4.7244	-0.0071	-0.0283	3.1496	4.7244	+0.0156	+0.0028
120,000	140,000	-0.200	-0.830	120,000	180,000	+0.485	+0.085
4.7244	5.5118	-0.0079	-0.0327	4.7244	7.8866	+0.0191	+0.0033
140,000	160,000	-0.210	-0.800				
5.5118	6.2992	-0.0083	-0.0331				
160,000	180,000	-0.230	-0.860				
6.2992	7.0866	-0.0091	-0.0339				
180,000	200,000	-0.240	-0.860				
7.0866	7.8740	-0.0094	-0.0370				

**BORE INSPECTION PROCEDURE FOR ASSEMBLY**

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

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

**TOLERANCES FOR THRUST WASHERS**

Tolerances for the outer and bore diameters of series AS thrust washers are given in Table B6-3 on page B-6-9. Thickness tolerance for series AS thrust washers is ±0.050 mm (±0.0020 in).

Tolerances for the outer and bore diameters of series LS heavy thrust washers are given in Table B6-4 on page B-6-9.

Thickness tolerance for series LS heavy thrust washers is given in Table B6-5 on page B-6-9.

**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 B6-3. Tolerances for outer diameter (d<sub>1</sub>) and bore diameter (d) of series AS thrust washers**

d <sub>1</sub>				d			
>		≤		>		≤	
mm	in	mm	in	mm	in	mm	in
18,000	30,000	-0.040	-0.270	3,000	6,000	+0.200	+0.020
0.7087	1.1811	-0.0016	-0.0146	0.1181	0.2362	+0.0079	+0.0008
30,000	50,000	-0.050	-0.400	6,000	10,000	+0.245	+0.025
1.1811	1.9685	-0.0020	-0.0173	0.2362	0.3937	+0.0096	+0.0010
50,000	80,000	-0.060	-0.520	10,000	18,000	+0.292	+0.032
1.9685	3.1496	-0.0024	-0.0209	0.3937	0.7087	+0.0119	+0.0013
80,000	120,000	-0.072	-0.612	18,000	30,000	+0.370	+0.040
3.1496	4.7244	-0.0028	-0.0241	0.7087	1.1811	+0.0146	+0.0016
120,000	180,000	-0.085	-0.715	30,000	50,000	+0.440	+0.060
4.7244	7.8866	-0.0034	-0.0282	1.1811	1.9685	+0.0173	+0.0020
180,000	250,000	-0.100	-0.820	50,000	80,000	+0.520	+0.060
7.0866	9.8425	-0.0039	-0.0323	1.9685	3.1496	+0.0205	+0.0024
				80,000	120,000	+0.612	+0.072
				120,000	180,000	+0.715	+0.085
				4.7244	7.8866	+0.0281	+0.0034

**Table B6-4. Tolerances for outer diameter (d<sub>1</sub>) and bore diameter (d) of series LS heavy thrust washers**

d <sub>1</sub>				d			
>		≤		>		≤	
mm	in	mm	in	mm	in	mm	in
18,000	30,000	-0.200	-0.510	3,000	6,000	+0.140	+0.020
0.7087	1.1811	-0.0118	-0.0201	0.1181	0.2362	+0.0055	+0.0008
30,000	40,000	-0.310	-0.560	6,000	10,000	+0.175	+0.025
1.1811	1.5748	-0.0122	-0.0221	0.2362	0.3937	+0.0069	+0.0010
40,000	50,000	-0.320	-0.570	10,000	18,000	+0.212	+0.052
1.5748	1.9685	-0.0126	-0.0224	0.3937	0.7087	+0.0084	+0.0013
50,000	65,000	-0.340	-0.640	18,000	30,000	+0.250	+0.400
1.9685	2.5591	-0.0134	-0.0252	0.7087	1.1811	+0.0098	+0.0016
65,000	80,000	-0.360	-0.660	30,000	50,000	+0.300	+0.450
2.5591	3.1496	-0.0142	-0.0260	1.1811	1.9685	+0.0118	+0.0020
80,000	100,000	-0.380	-0.730	50,000	80,000	+0.360	+0.600
3.1496	3.9370	-0.0150	-0.0290	1.9685	3.1496	+0.0142	+0.0024
100,000	120,000	-0.410	-0.760	80,000	120,000	+0.422	+0.072
3.9370	4.7244	-0.0161	-0.0299	3.1496	4.7244	+0.0166	+0.0028
120,000	140,000	-0.460	-0.860	120,000	180,000	+0.485	+0.085
4.7244	5.5118	-0.0181	-0.0339	4.7244	7.8866	+0.0191	+0.0034
140,000	160,000	-0.520	-0.820				
5.5118	6.2992	-0.0205	-0.0362				
160,000	180,000	-0.580	-0.880				
6.2992	7.0866	-0.0228	-0.0386				
180,000	200,000	-0.660	-1.120				
7.0866	7.8740	-0.0260	-0.0441				

**Table B6-5. Thickness tolerance for series LS heavy thrust washers**

h		Tolerance	
>	≤	Max.	Min.
mm	in	mm	in
0	3	0	-0.060
0	0.1181	0	-0.0024
3	6	0	-0.075
0.118	0.2362	0	-0.0030
6	10	0	-0.200
0.236	0.3937	0	-0.0083

**Table B6-6. W/WS series thrust washer tolerances and unitized thrust bearing assembly (TPK/TVK series) tolerances -JIS B 0401-**

(1) Outer diameter				(2) Bore diameter			
Nominal outer diameter d <sub>1</sub>		Maximum actually measured outer diameter tolerance (E12)		Nominal bore diameter d		Minimum actually measured bore diameter tolerance (E12)	
>	≤	Max.	Min.	>	≤	Max.	Min.
mm	mm	μm	μm	mm	mm	μm	μm
18	30	-40	-260	6	10	+175	+25
30	50	-50	-300	10	15	+212	+32
50	80	-60	-360	15	30	+250	+40
80	120	-72	-422	30	50	-300	+50
120	180	-85	-485	50	80	-360	+60
				80	120	+422	+72

\* These values correspond to the W and WS series thickness (h, h1) tolerances and to JIS B 0401-2 tolerance zone class j12.

\* These values correspond to the W and WS series thickness (h, h1) tolerances and to JIS B 0401-2 tolerance zone class j12.

**Table B6-7. Mounting tolerances for shafts and housings for metric series components**

Bearing components	Shaft tolerance (shaft rotating)	Housing tolerance (housing rotating)
Needle roller and cage assembly, Types: AXK, FNT and TP	h8	H8
Thin thrust washer, Types: AS and W	h8	H8
Heavy thrust washer, Types: LS and WS	h8	H8
Shaft-ribbed thrust washer, Type: WS.811	h6/g6	Clearance
Housing-ribbed thrust washer, Type: GS.811	Clearance	H7 (K7)
Unlubricated thrust bearing assembly, Types: FNTK (FNTK, FNTF) and TPK/TK series	h8	H8

**MOUNTING TOLERANCES**

**THRUST NEEDLE ROLLER AND CAGE ASSEMBLIES – METRIC SERIES**

On FNT and AXK series thrust needle roller and cage assemblies, the cage bore has a closer tolerance than the outer 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 thrust needle roller and cage assemblies may be piloted on the outer diameters. For such cases, suitable O.D. piloting dimensions should be determined. Mounting tolerances are given in Table B6-7 on page B-6-10.

**THRUST WASHERS**

The mounting tolerances for series AS, W, LS, WS, WS.811 and GS.811 thrust washers for use with thrust needle roller and cage assemblies are given in Table B6-7 on page B-6-10.

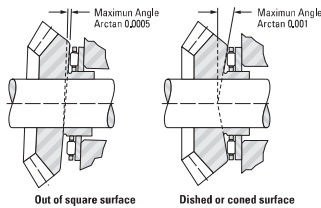
To reduce the wear in the FNT and AXK series thrust assemblies, the piloting surface for the thrust washers should also be hardened to an equivalent of at least 55 HRC.

**BACKUP SURFACES**

In some applications, it is desirable to use the backup surfaces as raceways for the needle rollers of the thrust needle roller and cage 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 of this catalog.

Thrust raceway surfaces must be ground to a surface finish of 0.2 µm Ra (8 µin Ra). 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 of the thrust washer must not be dished or coned. The permissible limits of out-of-squareness and dishing or coning are shown in the figures below.



**Fig. B6-2. Permissible limits**

For the thin series washers AS thrust washers, full backup should be provided across the whole area of circulation of the rolling elements.

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:

- Possess a suitable surface finish 0.2 µm Ra (8 µin Ra) and sufficient hardness in relation to the load to be supported. A minimum hardness of 58 HRC, enables thrust bearings to carry their full load capacity. Lower hardness values reduce the capacities shown in the tables of dimensions (see tabulated sizes).

**LOAD RATINGS**

**MINIMUM AXIAL LOAD**

Slippage can occur if the applied axial load is too light and the operating speed of the thrust needle roller and cage assembly is high – particularly if accompanied by inadequate lubrication. For satisfactory operation, a certain minimum load must be applied to a thrust needle roller and cage assembly which can be calculated from:

$$F_{a \text{ min}} = C_{0a}/2200 \text{ [kN]}$$

Where:

- $C_{0a}$  = static load rating [kN]
- $F_{a \text{ min}}$  = minimum axial load [kN]

**LUBRICATION**

Oil is the preferred lubricant for thrust needle roller and cage assemblies and an ample oil flow is absolutely necessary for high speeds or for moderate speeds when the load is relatively high.

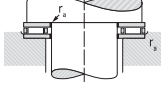
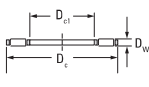
**SPECIAL DESIGNS**

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

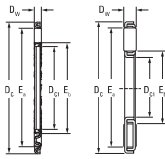
Thrust needle roller and cage assemblies are particularly adaptable to low-cost integral combination with special thrust washers. When the use of such special designs is considered, the following pages should be reviewed for evaluation of proposed arrangements.

**NEEDLE ROLLER BEARINGS**

**THRUST NEEDLE ROLLER AND CAGE ASSEMBLIES, THRUST WASHERS**  
**METRIC SERIES**  
**AXK, FNT SERIES**



**CAGE DESIGN**

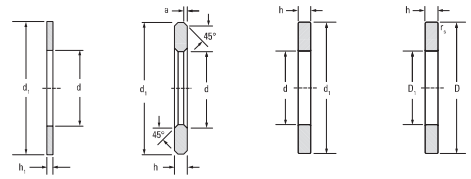


**AXK**

**FNT**

Shaft Dia.	D <sub>1</sub>	D <sub>2</sub>	D <sub>m</sub>	E <sub>1</sub>	E <sub>2</sub>	r <sub>max.</sub>	Assembly Designation	Load Ratings		Fatigue Load Limit C <sub>10</sub>	Speed Rating G1	Approx. Wt.
								Dynamic C	Static C <sub>0</sub>			
mm	mm	mm	mm	mm	mm	mm		kN	kN	min <sup>-1</sup>	kg	
6	6	19	2	15.0	7.0	0.3	AXK0819TN	6.37	14.3	1.43	23000	0.001
				0.292	0.7480	0.0787		0.665	0.307	0.012		14.2
8	8	21	2	18.0	8.0	0.3	FNT-619	6.82	15.6	1.50	21000	0.002
				0.3150	0.3260	0.0767		0.709	0.315	0.012		15.0
10	10	24	2	22.5	11.0	0.3	AXK1024	9.32	25.9	2.90	17000	0.003
				0.3937	0.9449	0.0767		0.886	0.433	0.012		21.00
12	12	26	2	23.0	12.0	0.3	FNT-1024	9.14	25.2	2.40	17000	0.002
				0.4724	1.0236	0.0767		0.909	0.472	0.012		23.90
15	15	28	2	24.5	13.0	0.3	AXK1226	10.8	32.3	3.40	15000	0.004
				0.5906	1.1004	0.0767		0.965	0.512	0.012		24.90
17	17	30	2	25.0	14.0	0.3	FNT-1226	9.92	29.0	2.75	15000	0.004
				0.6693	1.1811	0.0767		1.063	0.551	0.012		22.30
20	20	35	2	27.0	17.0	0.3	AXK1528	14.1	35.2	3.25	15000	0.004
				0.7874	1.3780	0.0767		1.063	0.669	0.012		22.90
25	25	42	2	27.0	17.0	0.3	FNT-1528	14.2	31.3	3.00	15000	0.004
				0.9843	1.6525	0.0767		1.142	0.746	0.012		22.90
30	30	47	2	28.7	18.3	0.3	AXK1730TN	17.7	38.7	3.70	14000	0.004
				1.1811	1.8504	0.0767		1.133	0.721	0.012		25.30
35	35	52	2	29.0	19.0	0.3	FNT-1730	16.8	34.8	3.25	14000	0.004
				1.3780	2.0472	0.0767		1.239	0.866	0.012		24.90
40	40	55	2	34.0	22.0	0.3	AXK2035	22.8	45.4	4.40	12000	0.006
				1.5748	2.1653	0.0767		1.239	0.866	0.012		29.80
45	45	60	2	34.0	22.0	0.3	FNTA-2035	13.8	50.7	4.80	12000	0.005
				1.7480	2.3812	0.0767		1.239	0.866	0.012		31.00
50	50	65	2	41.0	25.0	0.6	AXK2542	14.3	56.3	5.50	10000	0.007
				1.9685	2.5590	0.0767		1.614	1.142	0.024		31.00
55	55	70	2	41.0	25.0	0.6	FNT-2542	16.0	55.3	6.05	9700	0.008
				2.1653	2.8347	0.0767		1.814	1.032	0.024		40.90
60	60	75	2	46.0	30.0	0.6	AXK3047	16.0	68.1	6.60	9000	0.009
				2.3812	3.1496	0.0767		1.911	1.376	0.024		39.00
65	65	80	2	46.0	30.0	0.6	FNTA-3047	18.0	82.4	8.65	8900	0.009
				2.6047	3.5433	0.0767		1.911	1.292	0.024		41.90
70	70	85	2	51.0	35.0	0.6	AXK3552	17.4	75.5	7.70	8100	0.010
				2.8347	3.9370	0.0767		2.008	1.575	0.024		39.10
75	75	90	2	51.0	35.0	0.6	FNT-3552	21.7	104.0	11.1	7900	0.010
				3.1496	4.3307	0.0767		2.008	1.497	0.024		48.80

**Needle Roller Thrust Bearings, Assemblies, Washers**



**AS**  
(h<sub>1</sub> = 1.0)

**LS**

**WS.811**

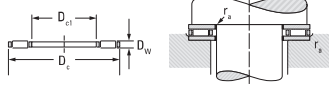
**GS.811**

Washer Dimensions				Thin		Heavy (LS)				Heavy					
d	D <sub>1</sub>	D <sub>2</sub>	h <sub>1</sub>	Washer Designation	Approx. Wt.	h	a	Washer Designation	Approx. Wt.	h	r <sub>max.</sub>	Washer Designation	Approx. Wt.		
mm	mm	mm	mm		kg	mm	mm		kg	mm	mm	Shaft Ploated	Housing Ploated		
6	19	1.00	0.0384	AS0019	0.001	0.002									
				0.292	0.7480	0.002	0.004								
8	21	1.00	0.0384	AS0821	0.002	2.75	0.30	LS0821	0.004	0.004					
				0.3150	0.8268	0.002	0.004	0.108	0.012						
10	24	1.00	0.0384	AS1024	0.003	2.75	0.50	LS1024	0.008	0.008					
				0.3937	0.9449	0.003	0.007	0.108	0.020						
12	26	1.00	0.0384	AS1226	0.003	2.75	0.50	LS1226	0.009	0.009					
				0.4724	1.0236	0.003	0.007	0.108	0.020						
15	28	1.00	0.0384	AS1528	0.003	2.75	0.50	LS1528	0.010	0.010	2.75	0.30	WS.81102	GS.81102	0.010
				0.5906	1.1024	0.003	0.007	0.108	0.020			0.108	0.012		
17	30	1.00	0.0384	AS1730	0.003	2.75	0.50	LS1730	0.011	0.011	2.75	0.30	WS.81103	GS.81103	0.011
				0.6693	1.1811	0.003	0.007	0.108	0.020			0.108	0.012		
20	35	1.00	0.0384	AS2035	0.005	2.75	0.50	LS2035	0.014	0.014	2.75	0.30	WS.81104	GS.81104	0.014
				0.7874	1.3780	0.005	0.011	0.108	0.020			0.108	0.012		
25	42	1.00	0.0384	AS2542	0.007	3.00	1.00	LS2542	0.021	0.021	3.00	0.60	WS.81105	GS.81105	0.021
				0.9843	1.6525	0.007	0.015	0.118	0.039			0.118	0.024		
30	47	1.00	0.0384	AS3047	0.008	3.00	1.00	LS3047	0.023	0.023	3.00	0.60	WS.81106	GS.81106	0.023
				1.1811	1.8504	0.008	0.015	0.118	0.039			0.118	0.024		
35	52	1.00	0.0384	AS3552	0.009	3.50	1.00	LS3552	0.030	0.030	3.50	0.60	WS.81107	GS.81107	0.030
				1.3780	2.0472	0.009	0.020	0.138	0.039			0.138	0.024		

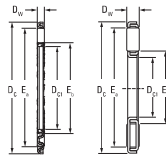
Continued on next page.

**NEEDLE ROLLER BEARINGS**

**THRUST NEEDLE ROLLER AND CAGE ASSEMBLIES, THRUST WASHERS**  
**METRIC SERIES**  
**AXK, FNT SERIES**



**CAGE DESIGN**

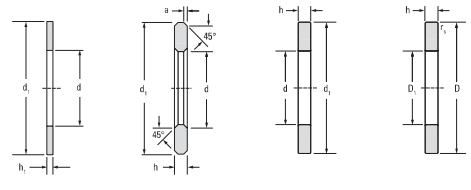


**AXK**

**FNT**

Shaft Dia.	D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>	E <sub>4</sub>	E <sub>5</sub>	r <sub>max.</sub>	Assembly Designation	Load Ratings		Fatigue Load Limit C <sub>10</sub>	Speed Rating G1	Approx. Wt.
								Dynamic C	Static C <sub>0</sub>			
mm	mm	mm	mm	mm	mm	mm		kN	lbf	kN	min <sup>-1</sup>	kg lbs
40	40	60	3	50.0	45.0	0.6	AXK4080	31.1	110.0	11.9	7000	0.216
							FNT-4080	31.5	132.0	14.6	7100	0.220
45	45	65	3	63.0	50.0	0.6	AXK4565	29.0	124.0	13.4	6500	0.220
							FNT-4565	31.5	172.0	18.5	6400	0.224
50	50	70	3	68.0	55.0	0.6	AXK5070	30.8	137.0	14.3	6000	0.220
							FNT-5070	37.0	179.0	19.1	5900	0.228
55	55	75	3	76.0	60.0	0.6	AXK5578	30.4	195.0	20.5	5300	0.226
							FNT-5578	48.5	254.0	26.3	5300	0.233
60	60	85	3	82.0	65.0	0.6	AXK6085	44.5	234.0	24.7	4900	0.235
							FNT-6085	100.0	310.0	35.0	4800	0.241
65	65	90	3	88.0	70.0	0.6	AXK6590	46.7	254.0	26.8	4600	0.238
							FNT-6590	109.0	317.0	35.3	4500	0.245
70	70	95	4	93.0	74.0	0.6	AXK7095	53.8	253.0	28.0	4400	0.255
							FNTA-7095	121.0	333.0	35.3	4400	0.267
75	75	100	4	98.0	78.0	0.6	AXK75100	55.1	296.0	29.4	4200	0.268
							FNT-75100	71.6	378.0	39.7	4100	0.284
80	80	105	4	103.0	82.0	0.6	AXK80105	56.4	279.0	30.8	4000	0.282
							FNTA-80105	71.3	379.0	40.1	3900	0.282
85	85	110	4	108.0	85.0	0.6	AXK85110	57.6	291.0	32.2	3800	0.283
							FNT-85110	72.5	405.0	43.0	3500	0.281
90	90	120	4	118.0	92.0	0.6	AXK90120	72.5	405.0	43.0	3500	0.281
							FNT-90120	160.0	510.0	56.4	3100	0.284
100	100	135	4	133.0	105.0	0.6	AXK100135	90.2	552.0	56.4	3100	0.284
							FNT-100135	160.0	610.0	59.0	2800	0.258
110	110	145	4	143.0	115.0	0.6	AXK110145	93.2	591.0	59.0	2800	0.258
							FNT-110145	210.0	750.0	80.0	2500	0.258

**Needle Roller Thrust Bearings, Assemblies, Washers**



**AS (h<sub>1</sub> = 1.0)**

**LS**

**WS.811**

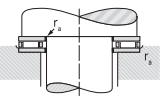
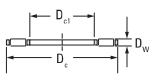
**GS.811**

Washer Dimensions				Thin		Heavy (LS)				Heavy				
d	D <sub>1</sub>	D <sub>2</sub>	h <sub>1</sub>	Washer Designator	Approx. Wt.	h	a	Washer Designator	Approx. Wt.	h	r <sub>max.</sub>	Washer Designation	Approx. Wt.	
mm	mm	mm	mm		kg lbs	mm	mm		kg lbs	mm	mm	Shaft Piloted	Housing Piloted	kg lbs
40	60	42	1.00	AS4060	0.212	3.50	1.00	LS4060	0.241	3.50	0.60	WS.81108	GS.81108	0.243
				AS4060	0.208	0.138	0.209	0.250	0.138	0.250	0.250	0.138	0.250	0.250
45	65	47	1.00	AS4565	0.213	4.00	1.00	LS4565	0.252	4.00	0.60	WS.81109	GS.81109	0.254
				AS4565	0.209	0.157	0.209	0.255	0.157	0.255	0.255	0.157	0.255	0.255
50	70	52	1.00	AS5070	0.214	4.50	1.00	LS5070	0.256	4.50	0.60	WS.81110	GS.81110	0.256
				AS5070	0.211	0.157	0.209	0.258	0.157	0.258	0.258	0.157	0.258	0.258
55	75	57	1.00	AS5578	0.218	5.00	1.00	LS5578	0.2910	5.00	0.60	WS.81111	GS.81111	0.294
				AS5578	0.218	0.197	0.209	0.2910	0.197	0.2910	0.2910	0.197	0.2910	0.2910
60	85	62	1.00	AS6085	0.222	4.75	1.00	LS6085	0.292	4.75	0.60	WS.81112	GS.81112	0.294
				AS6085	0.219	0.209	0.209	0.292	0.209	0.292	0.292	0.209	0.292	0.292
65	90	67	1.00	AS6590	0.223	5.25	1.00	LS6590	0.321	5.25	0.60	WS.81113	GS.81113	0.325
				AS6590	0.221	0.207	0.209	0.321	0.207	0.321	0.321	0.207	0.321	0.321
70	95	72	1.00	AS7095	0.225	5.25	1.50	LS7095	0.328	5.25	0.60	WS.81114	GS.81114	0.333
				AS7095	0.225	0.207	0.209	0.328	0.207	0.328	0.328	0.207	0.328	0.328
75	100	77	1.00	AS75100	0.227	5.75	1.50	LS75100	0.350	5.75	0.60	WS.81115	GS.81115	0.342
				AS75100	0.226	0.207	0.209	0.350	0.207	0.350	0.350	0.207	0.350	0.350
80	105	82	1.00	AS80105	0.228	5.75	1.50	LS80105	0.358	5.75	0.60	WS.81116	GS.81116	0.364
				AS80105	0.228	0.207	0.209	0.358	0.207	0.358	0.358	0.207	0.358	0.358
85	110	87	1.00	AS85110	0.228	5.75	1.50	LS85110	0.366	5.75	0.60	WS.81117	GS.81117	0.373
				AS85110	0.228	0.207	0.209	0.366	0.207	0.366	0.366	0.207	0.366	0.366
90	120	92	1.00	AS90120	0.238	6.50	1.50	LS90120	0.426	6.50	0.60	WS.81118	GS.81118	0.433
				AS90120	0.234	0.207	0.209	0.426	0.207	0.426	0.426	0.207	0.426	0.426
100	135	100	1.00	AS100135	0.250	7.00	1.50	LS100135	0.450	7.00	0.60			
				AS100135	0.250	0.207	0.209	0.450	0.207	0.450	0.450	0.207	0.450	0.450
110	145	108	1.00	AS110145	0.255	7.00	1.50	LS110145	0.473	7.00	0.60			
				AS110145	0.255	0.207	0.209	0.473	0.207	0.473	0.473	0.207	0.473	0.473

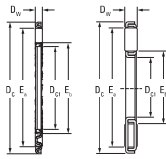
Continued on next page.

**NEEDLE ROLLER BEARINGS**

**THRUST NEEDLE ROLLER AND CAGE ASSEMBLIES, THRUST WASHERS**  
**METRIC SERIES**  
**AXK, FNT SERIES**



**CAGE DESIGN**

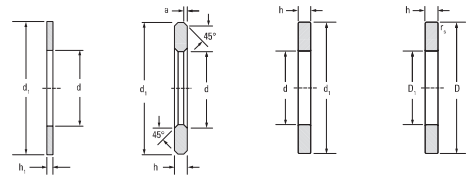


**AXK**

**FNT**

Shaft Dia.	D <sub>c1</sub>	D <sub>c</sub>	D <sub>c2</sub>	E <sub>3</sub>	E <sub>5</sub>	r <sub>max.</sub>	Assembly Designation	Load Ratings		Fatigue Load Limit C <sub>10</sub>	Speed Rating G1	Approx. Wt.
								Dynamic C	Static C <sub>0</sub>			
								mm	mm	mm	mm	mm
120	120 4.7244	155 6.1024	4 0.1575	153.0 6.024	152.0 4.921	0.6 0.024	AXK120155	98.5 22100	650 145000	63.5	2700	0.126 0.278
130	130 5.1181	170 6.6929	5 0.1969	167.0 6.575	136.0 5.354	0.6 0.024	AXK130170	132 29700	829 189000	78.7	2400	0.198 0.437
140	140 5.5118	180 7.0866	5 0.1969	177.0 6.969	140.0 5.745	0.6 0.024	AXK140180	138 30600	887 199000	82.5	2300	0.221 0.467
150	150 5.9055	190 7.4803	5 0.1969	187.0 7.362	156.0 6.142	0.6 0.024	AXK150190	141 31700	940 212000	86.2	2200	0.235 0.496
160	160 6.2992	200 7.8740	5 0.1969	197.0 7.756	166.0 6.535	0.6 0.024	AXK160200	146 32900	1000 225000	89.9	2100	0.249 0.549

**Needle Roller Thrust Bearings, Assemblies, Washers**



**AS**  
(h<sub>1</sub> = 1.0)

**LS**

**WS.811**

**GS.811**

Washer Dimensions				Thin		Heavy (LS)				Heavy				
d	D	d <sub>1</sub>	D <sub>1</sub>	h <sub>1</sub>	Washer Designation	Approx. Wt.	h	a	Washer Designation	Approx. Wt.	h	r <sub>max.</sub>	Washer Designation	Approx. Wt.
mm	mm	mm	mm	mm		kg	mm	mm		kg	mm	mm	Shaft Plotted	Housing Plotted
120	155			1.00	AS120155	0.259								
4.7244	6.1024			0.0394		0.130								
130	170			1.00	AS130170	0.274	5.00	1.50	LS130170	0.649				
5.1181	6.6929			0.0394		0.163	0.354	0.059		1.431				
140	180			1.00	AS140180	0.278								
5.5118	7.0866			0.0394		0.152								
150	190			1.00	AS150190	0.283								
5.9055	7.4803			0.0394		0.183								
160	200			1.00	AS160200	0.289								
6.2992	7.8740			0.0394		0.196								