THRUST ASSEMBLIES AND THRUST BEARINGS – INCH SERIES

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 backup 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.

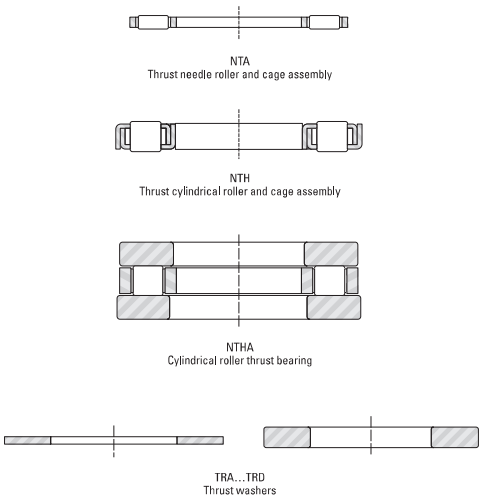


Fig. B6-5. Types of inch series thrust assemblies, thrust bearings and thrust washers

IDENTIFICATION

NTA is the complete prefix code for a thrust needle roller and cage assembly with inch nominal dimensions using needle rollers of the smallest practical diameter.

Thrust cylindrical roller and cage 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 outer 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 outer 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 outer-diameter piloted washer.

Because 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

Thrust needle roller and cage assemblies (NTA) and thrust cylindrical roller and cage 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 thrust needle roller and cage 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 thrust cylindrical roller and cage assemblies are available in both bore-piloted and outer-diameter piloted types. Their piloting surfaces are ground and raceway surfaces are ground and lapped.

DIMENSIONAL ACCURACY

TOLERANCES FOR THRUST NEEDLE ROLLER AND CAGE ASSEMBLIES

Pages B-6-38 to B-6-47, list the nominal outer diameter, bore diameter and the needle roller diameter for the inch thrust needle roller and cage assemblies and their corresponding thrust washers appear in the bearing tables.

Tolerances for the bore diameters and outer diameters of inch thrust assemblies are given in Table B6-14.

Table B6-14. Tolerances for bore (D_{c1}) and outer (D_c) diameters of nominal inch thrust needle (NTA) and cylindrical (NTH) roller and cage assemblies

NTA thrust needle roller and cage assemblies				
Needle roller diameter (nominal)	Deviations			
	Bore diameter		Outer diameter	
	D_{c1}		D_c	
D_w	Max.	Min.	Max.	Min.
mm in	mm in	mm in	mm in	mm in
1.984 **0.0781**	+0.178 **+0.007**	+0.051 **+0.002**	-0.254 **-0.010**	-0.508 **-0.020**
3.175 **0.1250**	+0.254 **+0.010**	+0.051 **+0.002**	-0.254 **-0.010**	-0.635 **-0.025**
NTH thrust cylindrical roller and cage assemblies				
All diameters	+0.381 **+0.015**	0.000 **0.000**	-0.127 **-0.005**	-0.508 **-0.020**

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 must fall freely from the "go" plug gage under its own free weight. 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 diameters and bore diameters of nominal inch thrust washers are given in Tables B6-15 and B6-16.

Table B6-15. Tolerances for outer diameter (d_1) of nominal inch (TRA, TRB, etc.) thrust washers

d_1:Nominal outer diameter				Deviations			
>		≤		Max.		Min.	
mm	in	mm	in	mm	in	mm	in
6.000	**0.24**	133.400	**5.25**	-0.254	**-0.010**	-0.762	**-0.030**

Table B6-16. Tolerances for bore diameter (d) of nominal inch (TRA, TRB, etc.) thrust washers

d:Nominal bore diameter				Deviations			
>		≤		Max.		Min.	
mm	in	mm	in	mm	in	mm	in
6.000	**0.24**	57.200	**2.25**	+0.300	**+0.012**	+0.050	**+0.002**
57.200	**2.25**	133.400	**5.25**	+0.430	**+0.017**	+0.050	**+0.002**

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 bearing tables.

MOUNTING TOLERANCES

THRUST NEEDLE ROLLER AND CAGE ASSEMBLIES

On NTA inch type thrust needle roller and cage assemblies, the cage bore has a larger contact area and 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 NTA thrust needle roller and cage assemblies may be piloted on the outer diameters. It should be noted that the "diameter to clear washer O.D." given in the bearing tables is not suitable for outer diameter piloting. For such cases, suitable O.D. piloting dimensions should be determined in consultation with your representative.

THRUST WASHERS FOR USE WITH NTA THRUST NEEDLE ROLLER AND CAGE 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 representative.

THRUST CYLINDRICAL ROLLER AND CAGE ASSEMBLIES

Type NTH assembly cage has a relatively large contact area on both the bore and the outer diameter. Thus, these assemblies can be piloted by either the shaft or the housing. In order 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 outer 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. The mounting dimensions are given in the bearing tables for both shaft and housing piloting. Bore inspection procedure for the assembly given on page B-6-35 should be used for checking the bore of NTH assemblies.

THRUST WASHERS FOR USE WITH THRUST CYLINDRICAL ROLLER AND CAGE ASSEMBLIES

Types TRID and TRJD thrust washers for use with thrust cylindrical roller and cage 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 backup 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 Ra (0,20 µm Ra). 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 the figures below.

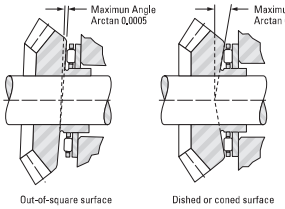


Fig. B6-6. Permissible limits

TYPE NTHA CYLINDRICAL ROLLER THRUST BEARING

The NTHA cylindrical roller thrust bearing consists of the NTH thrust cylindrical roller and cage assembly and two thrust washers. This bearing is sold as a unit.

A typical mounting of the thrust bearing on a rotating shaft is shown in Fig. B6-7. The bore of the rotating shaft supported thrust washer is ground for an accurate fit on the shaft. The outer 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 – Fig. B6-8 illustrates a possible mounting arrangement. When other mounting arrangements are dictated by the application, they should be determined in consultation with your representative.

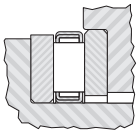


Fig. B6-7. Typical mounting of a thrust bearing when the shaft rotates

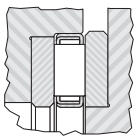


Fig. B6-8. NTHA possible mounting arrangement

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:

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

Where:

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

LUBRICATION

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

SPECIAL DESIGNS

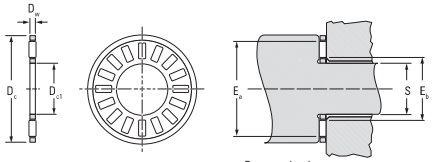
Thrust needle roller and cage assemblies and thrust washers are also made to special dimensions and configurations, as well as from special materials – when quantities permit economical manufacture.

Thrust needle roller and cage assemblies are particularly adaptable to low-cost integral 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.

THRUST NEEDLE ROLLER AND CAGE ASSEMBLIES, THRUST WASHERS

INCH SERIES

- Dimensions for bore and O.D. of thrust assemblies and washers are nominal.
- See page B-6-36 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.

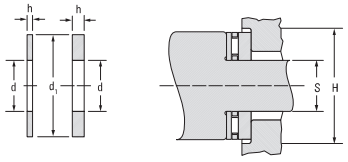


NTA

Raceway hardness to be 58 HRC or equivalent

Shaft Dia.	Assembly Dimensions					Assembly Designation	Load Ratings		Fatigue Load Limit C_u	Speed Rating[1]
	D_{c1}	D_c	D_w	E_b	E_a		Dynamic	Static		
							C	C_0		
in	mm in	mm in	mm in	mm in	mm in		kN lbf		kN	min^{-1}
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	1.05	26000
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	1.30	24000
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	1.40	22000
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	1.85	19000
5/8	14,275 0.562	25,40 1.000	1,984 0.0781	16,51 0.650	22,606 0.890	NTA-916	7,70 1730	21,53 4840	2.10	18000
3/4	15,88 0.625	28,575 1.125	1,984 0.0781	18,03 0.710	25,908 1.020	NTA-1018	9,79 2200	30,38 6830	2.85	15000

[1]Speed ratings listed are based on adequate oil lubrication. See page B-6-37 for lubrication information. Suggestions for an application requiring O.D. piloting should be determined in consultation with your representative.



Approx. Wt.	Thrust Washer Designation	Washer Dimensions				Piloting Dimensions		Dia. To Clear O.D.	Washer Wt.	Shaft Dia.
		d	d_1	h		S				
				Max.	Min.	Max.	Min.	H [2]		
kg lbs		mm in	mm in	mm in	mm in	mm in	mm in	mm in	kg lbs	in
0,001 0.003	TRA-411	6,35 0.250	17,45 0.687	0,81 0.032	0,76 0.030	6,35 0.250	6,27 0.247	18,26 0.719	0,001 0.003	1/4
	TRB-411	6,35 0.250	17,45 0.687	1,60 0.063	1,52 0.060	6,35 0.250	6,27 0.247	18,26 0.719	0,002 0.005	
	TRC-411	6,35 0.250	17,45 0.687	2,41 0.095	2,34 0.092	6,35 0.250	6,27 0.247	18,26 0.719	0,004 0.008	
0,002 0.004	TRA-512	7,92 0.312	19,05 0.750	0,81 0.032	0,76 0.030	7,92 0.312	7,85 0.309	19,84 0.781	0,001 0.003	5/16
	TRB-512	7,92 0.312	19,05 0.750	1,60 0.063	1,52 0.060	7,92 0.312	7,85 0.309	19,84 0.781	0,003 0.006	
0,002 0.004	TRA-613	9,53 0.375	20,62 0.812	0,81 0.032	0,76 0.030	9,53 0.375	9,45 0.372	21,44 0.844	0,001 0.003	3/8
	TRB-613	9,53 0.375	20,62 0.812	1,60 0.063	1,52 0.060	9,53 0.375	9,45 0.372	21,44 0.844	0,003 0.006	
	TRC-613	9,53 0.375	20,62 0.812	2,41 0.095	2,34 0.092	9,53 0.375	9,45 0.372	21,44 0.844	0,004 0.009	
0,002 0.005	TRA-815	12,70 0.500	23,80 0.937	0,81 0.032	0,76 0.030	12,70 0.500	12,62 0.497	24,61 0.969	0,002 0.004	1/2
	TRB-815	12,70 0.500	23,80 0.937	1,60 0.063	1,52 0.060	12,70 0.500	12,62 0.497	24,61 0.969	0,004 0.008	
	TRC-815	12,70 0.500	23,80 0.937	2,41 0.095	2,34 0.092	12,70 0.500	12,62 0.497	24,61 0.969	0,005 0.012	
0,003 0.006	TRA-916	14,27 0.562	25,40 1.000	0,81 0.032	0,76 0.030	14,27 0.562	14,20 0.559	26,19 1.031	0,002 0.005	5/8
	TRB-916	14,27 0.562	25,40 1.000	1,60 0.063	1,52 0.060	14,27 0.562	14,20 0.559	26,19 1.031	0,004 0.008	
	TRC-916	14,27 0.562	25,40 1.000	2,41 0.095	2,34 0.092	14,27 0.562	14,20 0.559	26,19 1.031	0,006 0.013	
0,003 0.007	TRA-1018	15,88 0.625	28,58 1.125	0,81 0.032	0,76 0.030	15,88 0.625	15,80 0.622	29,36 1.156	0,003 0.006	3/4
	TRB-1018	15,88 0.625	28,58 1.125	1,60 0.063	1,52 0.060	15,88 0.625	15,80 0.622	29,36 1.156	0,005 0.012	
	TRC-1018	15,88 0.625	28,58 1.125	2,41 0.095	2,34 0.092	15,88 0.625	15,80 0.622	29,36 1.156	0,008 0.018	
	TRD-1018	15,88 0.625	28,58 1.125	3,20 0.126	3,12 0.123	15,88 0.625	15,80 0.622	29,36 1.156	0,011 0.024	
	TRE-1018	15,88 0.625	28,58 1.125	3,99 0.157	3,91 0.154	15,88 0.625	15,80 0.622	29,36 1.156	0,013 0.029	

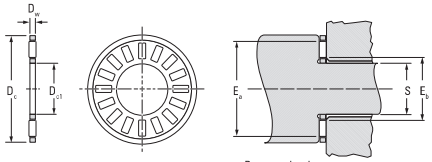
Continued on next page.

[2]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.

THRUST NEEDLE ROLLER AND CAGE ASSEMBLIES, THRUST WASHERS

INCH SERIES

- Dimensions for bore and O.D. of thrust assemblies and washers are nominal.
- See page B-6-36 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.

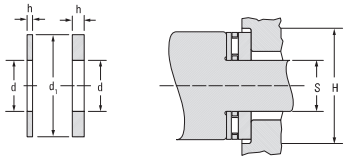


NTA

Raceway hardness to be 58 HRC or equivalent

Shaft Dia.	Assembly Dimensions					Assembly Designation	Load Ratings		Fatigue Load Limit C_u	Speed Rating[1]
	D_{c1}	D_c	D_w	E_b	E_a		Dynamic	Static		
							C	C_0		
in	mm in	mm in	mm in	mm in	mm in		kN lbf		kN	min^{-1}
3/4	19,05 0.750	31,75 1.250	1,984 0.0781	21,34 0.840	28,956 1.140	NTA-1220	10,00 2450	36,48 8200	3.40	14000
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	4.65	12000
1 1/8	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	8.05	9800
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	5.00	11000
1 1/8	28,58 1.125	44,45 1.75	1,984 0.0781	30,73 1.210	41,656 1.640	NTA-1828	16,68 3750	71,17 16000	7.30	9600

[1]Speed ratings listed are based on adequate oil lubrication. See page B-6-37 for lubrication information. Suggestions for an application requiring O.D. piloting should be determined in consultation with your representative.



Approx. Wt.	Thrust Washer Designation	Washer Dimensions				Piloting Dimensions		Dia. To Clear O.D.	Washer Wt.	Shaft Dia.
		d	d_1	h		S				
				Max.	Min.	Max.	Min.	H [2]		
kg lbs		mm in	mm in	mm in	mm in	mm in	mm in	mm in	kg lbs	in
0,004 0.009	TRA-1220	19,05 0.750	31,75 1.250	0,81 0.032	0,76 0.030	19,05 0.750	18,97 0.747	32,54 1.281	0,003 0.007	3/4
	TRB-1220	19,05 0.750	31,75 1.250	1,60 0.063	1,52 0.060	19,05 0.750	18,97 0.747	32,54 1.281	0,006 0.013	
	TRC-1220	19,05 0.750	31,75 1.250	2,41 0.095	2,34 0.092	19,05 0.750	18,97 0.747	32,54 1.281	0,010 0.021	
	TRD-1220	19,05 0.750	31,75 1.250	3,20 0.126	3,12 0.123	19,05 0.750	18,97 0.747	32,54 1.281	0,012 0.026	
	TRE-1220	19,05 0.750	31,75 1.250	3,99 0.157	3,91 0.154	19,05 0.750	18,97 0.747	32,54 1.281	0,015 0.033	
0,005 0.011	TRA-1423	22,23 0.875	36,50 1.437	0,81 0.032	0,76 0.030	22,23 0.875	22,15 0.872	37,31 1.469	0,004 0.009	7/8
	TRB-1423	22,23 0.875	36,50 1.437	1,60 0.063	1,52 0.060	22,23 0.875	22,15 0.872	37,31 1.469	0,008 0.017	
	TRC-1423	22,23 0.875	36,50 1.437	2,41 0.095	2,34 0.092	22,23 0.875	22,15 0.872	37,31 1.469	0,012 0.026	
	TRD-1423	22,23 0.875	36,50 1.437	3,20 0.126	3,12 0.123	22,23 0.875	22,15 0.872	37,31 1.469	0,015 0.034	
0,008 0.017	TRB-1427	22,23 0.875	42,86 1.688	1,60 0.063	1,52 0.060	22,23 0.875	22,15 0.872	43,66 1.719	0,013 0.029	
	TRC-1427	22,23 0.875	42,86 1.688	2,41 0.095	2,34 0.092	22,23 0.875	22,15 0.872	43,66 1.719	0,020 0.044	
	TRD-1427	22,23 0.875	42,86 1.688	3,20 0.126	3,12 0.123	22,23 0.875	22,15 0.872	43,66 1.719	0,026 0.057	
0,006 0.013	TRA-1625	25,40 1.000	39,67 1.562	0,81 0.032	0,76 0.030	25,40 1.000	25,32 0.997	40,49 1.594	0,005 0.010	1
	TRB-1625	25,40 1.000	39,67 1.562	1,60 0.063	1,52 0.060	25,40 1.000	25,32 0.997	40,49 1.594	0,009 0.019	
	TRD-1625	25,40 1.000	39,67 1.562	3,20 0.126	3,12 0.123	25,40 1.000	25,32 0.997	40,49 1.594	0,017 0.038	
	TRE-1625	25,40 1.000	39,67 1.562	3,99 0.157	3,91 0.154	25,40 1.000	25,32 0.997	40,49 1.594	0,021 0.047	
0,009 0.019	TRA-1828	28,58 1.125	44,45 1.750	0,81 0.032	0,76 0.030	28,58 1.125	28,50 1.122	45,24 1.781	0,006 0.013	1 1/8
	TRB-1828	28,58 1.125	44,45 1.750	1,60 0.063	1,52 0.060	28,58 1.125	28,50 1.122	45,24 1.781	0,011 0.024	
	TRC-1828	28,58 1.125	44,45 1.750	2,41 0.095	2,34 0.092	28,58 1.125	28,50 1.122	45,24 1.781	0,017 0.037	

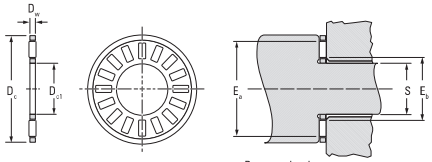
Continued on next page.

[2]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.

THRUST NEEDLE ROLLER AND CAGE ASSEMBLIES, THRUST WASHERS

INCH SERIES

- Dimensions for bore and O.D. of thrust assemblies and washers are nominal.
- See page B-6-36 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.

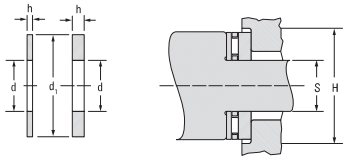


NTA

Raceway hardness to be 58 HRC or equivalent

Shaft Dia.	Assembly Dimensions					Assembly Designation	Load Ratings		Fatigue Load Limit C_u	Speed Rating[1]
	D_{c1}	D_c	D_w	E_b	E_a		Dynamic C	Static C_0		
in	mm in	mm in	mm in	mm in	mm in		kN lbf		kN	min^{-1}
1 1/4	31,75 1.250	49,20 1.937	1,984 0.0781	34,04 1.340	46,228 1.820	NTA-2031	20,15 4530	93,41 21000	9.55	8600
1 3/8	34,93 1.375	52,375 2.062	1,984 0.0781	37,08 1.460	49,53 1.950	NTA-2233	21,35 4800	103,20 23200	10.5	8000
1 1/2	38,10 1.500	55,55 2.187	1,984 0.0781	40,39 1.590	52,578 2.070	NTA-2435	23,22 5220	117,88 26500	12.0	7600
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	14.0	6800

[1]Speed ratings listed are based on adequate oil lubrication. See page B-6-37 for lubrication information. Suggestions for an application requiring O.D. piloting should be determined in consultation with your representative.



Approx. Wt.	Thrust Washer Designation	Washer Dimensions				Piloting Dimensions		Dia. To Clear O.D.	Washer Wt.	Shaft Dia.
		d	d_1	h		S				
				Max.	Min.	Max.	Min.	H [2]		
kg lbs		mm in	mm in	mm in	mm in	mm in	mm in	mm in	kg lbs	in
	TRD-1828	28,58 1.125	44,45 1.750	3,20 0.126	3,12 0.123	28,58 1.125	28,50 1.122	45,24 1.781	0,022 0.048	
0,010 0.021	TRA-2031	31,75 1.250	49,20 1.937	0,81 0.032	0,76 0.030	31,75 1.250	31,67 1.247	50,01 1.969	0,007 0.015	1 1/4
	TRB-2031	31,75 1.250	49,20 1.937	1,60 0.063	1,52 0.060	31,75 1.250	31,67 1.247	50,01 1.969	0,014 0.030	
	TRC-2031	31,75 1.250	49,20 1.937	2,41 0.095	2,34 0.092	31,75 1.250	31,67 1.247	50,01 1.969	0,020 0.044	
	TRD-2031	31,75 1.250	49,20 1.937	3,20 0.126	3,12 0.123	31,75 1.250	31,67 1.247	50,01 1.969	0,026 0.058	
	TRF-2031	31,75 1.250	49,20 1.937	4,78 0.188	4,70 0.185	31,75 1.250	31,67 1.247	50,01 1.969	0,041 0.090	
0,010 0.023	TRA-2233	34,93 1.375	52,37 2.062	0,81 0.032	0,76 0.030	34,93 1.375	34,85 1.372	53,19 2.094	0,007 0.016	1 3/8
	TRB-2233	34,93 1.375	52,37 2.062	1,60 0.063	1,52 0.060	34,93 1.375	34,85 1.372	53,19 2.094	0,015 0.033	
	TRC-2233	34,93 1.375	52,37 2.062	2,41 0.095	2,34 0.092	34,93 1.375	34,85 1.372	53,19 2.094	0,018 0.040	
	TRD-2233	34,93 1.375	52,37 2.062	3,20 0.126	3,12 0.123	34,93 1.375	34,85 1.372	53,19 2.094	0,029 0.065	
	TRE-2233	34,93 1.375	52,37 2.062	3,99 0.157	3,91 0.154	34,93 1.375	34,85 1.372	53,19 2.094	0,037 0.081	
	TRF-2233	34,93 1.375	52,37 2.062	4,78 0.188	4,70 0.185	34,93 1.375	34,85 1.372	53,19 2.094	0,044 0.097	
0,011 0.025	TRA-2435	38,10 1.500	55,55 2.187	0,81 0.032	0,76 0.030	38,10 1.500	38,02 1.497	56,36 2.219	0,008 0.017	1 1/2
	TRB-2435	38,10 1.500	55,55 2.187	1,60 0.063	1,52 0.060	38,10 1.500	38,02 1.497	56,36 2.219	0,015 0.034	
	TRC-2435	38,10 1.500	55,55 2.187	2,41 0.095	2,34 0.092	38,10 1.500	38,02 1.497	56,36 2.219	0,023 0.050	
	TRD-2435	38,10 1.500	55,55 2.187	3,20 0.126	3,12 0.123	38,10 1.500	38,02 1.497	56,36 2.219	0,030 0.067	
	TRF-2435	38,10 1.500	55,55 2.187	4,78 0.188	4,70 0.185	38,10 1.500	38,02 1.497	56,36 2.219	0,045 0.100	
0,014 0.031	TRA-2840	44,45 1.750	63,50 2.500	0,81 0.032	0,76 0.030	44,45 1.750	44,37 1.747	64,29 2.531	0,010 0.021	1 3/4
	TRB-2840	44,45 1.750	63,50 2.500	1,60 0.063	1,52 0.060	44,45 1.750	44,37 1.747	64,29 2.531	0,020 0.044	

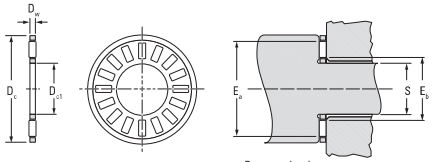
Continued on next page.

[2]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.

THRUST NEEDLE ROLLER AND CAGE ASSEMBLIES, THRUST WASHERS

INCH SERIES

- Dimensions for bore and O.D. of thrust assemblies and washers are nominal.
- See page B-6-36 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.

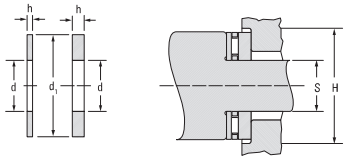


NTA

Raceway hardness to be 58 HRC or equivalent

Shaft Dia.	Assembly Dimensions					Assembly Designation	Load Ratings		Fatigue Load Limit C_u	Speed Rating[1]
	D_{c1}	D_c	D_w	E_b	E_a		Dynamic C	Static C_0		
in	mm in	mm in	mm in	mm in	mm in		kN lbf		kN	min^{-1}
2	50,80 2.000	69,85 2.750	1,984 0.0781	53,09 2.090	65,278 2.570	NTA-3244	24,02 5400	132,56 29800	13.5	6100
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	14.0	5800
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	14.6	5600
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	18.6	5300
2 1/2	63,50 2.500	82,55 3.250	1,984 0.0781	65,79 2.590	77,978 3.070	NTA-4052	25,53 5740	152,13 34200	15.6	5100

[1]Speed ratings listed are based on adequate oil lubrication. See page B-6-37 for lubrication information.
Suggestions for an application requiring O.D. piloting should be determined in consultation with your representative.



Approx. Wt.	Thrust Washer Designation	Washer Dimensions				Piloting Dimensions		Dia. To Clear O.D.	Washer Wt.	Shaft Dia.
		d	d_1	h		S				
				Max.	Min.	Max.	Min.	H [2]		
kg lbs		mm in	mm in	mm in	mm in	mm in	mm in	mm in	kg lbs	in
	TRC-2840	44,45 1.750	63,50 2.500	2,41 0.095	2,34 0.092	44,45 1.750	44,37 1.747	64,29 2.531	0,029 0.063	
	TRD-2840	44,45 1.750	63,50 2.500	3,20 0.126	3,12 0.123	44,45 1.750	44,37 1.747	64,29 2.531	0,038 0.084	
	TRF-2840	44,45 1.750	63,50 2.500	4,78 0.188	4,70 0.185	44,45 1.750	44,37 1.747	64,29 2.531	0,057 0.126	
0,015 0.033	TRA-3244	50,80 2.000	69,85 2.750	0,81 0.032	0,76 0.030	50,80 2.000	50,72 1.997	70,64 2.781	0,011 0.024	2
	TRB-3244	50,80 2.000	69,85 2.750	1,60 0.063	1,52 0.060	50,80 2.000	50,72 1.997	70,64 2.781	0,022 0.048	
	TRC-3244	50,80 2.000	69,85 2.750	2,41 0.095	2,34 0.092	50,80 2.000	50,72 1.997	70,64 2.781	0,033 0.072	
	TRD-3244	50,80 2.000	69,85 2.750	3,20 0.126	3,12 0.123	50,80 2.000	50,72 1.997	70,64 2.781	0,044 0.096	
	TRF-3244	50,80 2.000	69,85 2.750	4,78 0.188	4,70 0.185	50,80 2.000	50,72 1.997	70,64 2.781	0,066 0.145	
0,016 0.035	TRA-3446	53,98 2.125	73,03 2.875	0,81 0.032	0,76 0.030	53,98 2.125	53,90 2.122	73,81 2.906	0,012 0.026	2 1/8
	TRB-3446	53,98 2.125	73,03 2.875	1,60 0.063	1,52 0.060	53,98 2.125	53,90 2.122	73,81 2.906	0,024 0.052	
	TRC-3446	53,98 2.125	73,03 2.875	2,41 0.095	2,34 0.092	53,98 2.125	53,90 2.122	73,81 2.906	0,035 0.078	
	TRD-3446	53,98 2.125	73,03 2.875	3,20 0.126	3,12 0.123	53,98 2.125	53,90 2.122	73,81 2.906	0,047 0.103	
0,017 0.038	TRA-3648	57,15 2.250	76,20 3.000	0,81 0.032	0,76 0.030	57,15 2.250	57,07 2.247	76,99 3.031	0,012 0.026	2 1/4
	TRB-3648	57,15 2.250	76,20 3.000	1,60 0.063	1,52 0.060	57,15 2.250	57,07 2.247	76,99 3.031	0,022 0.048	
	TRC-3648	57,15 2.250	76,20 3.000	2,41 0.095	2,34 0.092	57,15 2.250	57,07 2.247	76,99 3.031	0,037 0.081	
	TRD-3648	57,15 2.250	76,20 3.000	3,20 0.126	3,12 0.123	57,15 2.250	57,07 2.247	76,99 3.031	0,048 0.105	
	TRF-3648	57,15 2.250	76,20 3.000	4,78 0.188	4,70 0.185	57,15 2.250	57,07 2.247	76,99 3.031	0,071 0.157	
0,029 0.064	TRC-3650	57,15 2.250	79,38 3.125	2,41 0.095	2,34 0.092	57,15 2.250	57,07 2.247	80,16 3.156	0,043 0.095	2 1/4
0,019 0.041	TRA-4052	63,50 2.500	82,55 3.250	0,81 0.032	0,76 0.030	63,50 2.500	63,42 2.497	83,34 3.281	0,013 0.029	2 1/2
	TRB-4052	63,50 2.500	82,55 3.250	1,60 0.063	1,52 0.060	63,50 2.500	63,42 2.497	83,34 3.281	0,027 0.059	

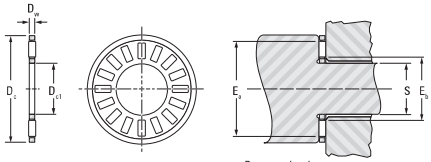
Continued on next page.

[2]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.

THRUST NEEDLE ROLLER AND CAGE ASSEMBLIES, THRUST WASHERS

INCH SERIES

- Dimensions for bore and O.D. of thrust assemblies and washers are nominal.
- See page B-6-36 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.

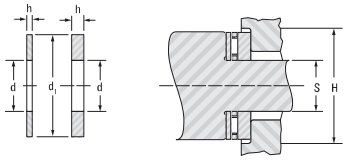


NTA

Raceway hardness to be 58 HRC or equivalent

Shaft Dia.	Assembly Dimensions					Assembly Designation	Load Ratings		Fatigue Load Limit C_u	Speed Rating[1]
	D_{c1}	D_c	D_w	E_b	E_a		Dynamic	Static		
							C	C_0		
in	mm in	mm in	mm in	mm in	mm in		kN lbf		kN	min^{-1}
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	255,0 57500	26.8	4600
3	76,20 3.000	95,25 3.750	1,984 0.0781	78,49 3.090	90,678 3.570	NTA-4860	26,36 6060	172,1 38700	17.8	4400
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	294,0 66300	30.9	4000
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	35.5	3500
4 1/8	104,78 4.125	128,57 5.062	3,175 0.1250	107,44 4.230	124,46 4.900	NTA-6881	63,01 14300	414,6 93200	41.3	3200

[1]Speed ratings listed are based on adequate oil lubrication. See page B-6-37 for lubrication information. Suggestions for an application requiring O.D. piloting should be determined in consultation with your representative.



Approx. Wt.	Thrust Washer Designation	Washer Dimensions				Piloting Dimensions		Dia. To Clear O.D.	Washer Wt.	Shaft Dia.
		d	d_1	h		S				
				Max.	Min.	Max.	Min.	H [2]		
kg lbs		mm in	mm in	mm in	mm in	mm in	mm in	mm in	kg lbs	in
	TRC-4052	63,50 2.500	82,55 3.250	2,41 0.095	2,34 0.092	63,50 2.500	63,42 2.497	83,34 3.281	0,041 0.09	
	TRD-4052	63,50 2.500	82,55 3.250	3,20 0.126	3,12 0.123	63,50 2.500	63,42 2.497	83,34 3.281	0,054 0.119	
0,037 0.082	TRA-4458	69,85 2.750	92,08 3.625	0,81 0.032	0,76 0.030	69,85 2.750	69,77 2.747	92,86 3.656	0,018 0.039	2 3/4
	TRB-4458	69,85 2.750	92,08 3.625	1,60 0.063	1,52 0.060	69,85 2.750	69,77 2.747	92,86 3.656	0,035 0.077	
	TRC-4458	69,85 2.750	92,08 3.625	2,41 0.095	2,34 0.092	69,85 2.750	69,77 2.747	92,86 3.656	0,051 0.113	
	TRD-4458	69,85 2.750	92,08 3.625	3,20 0.126	3,12 0.123	69,85 2.750	69,77 2.747	92,86 3.656	0,069 0.152	
	TRF-4458	69,85 2.750	92,08 3.625	4,78 0.188	4,70 0.185	69,85 2.750	69,77 2.747	92,86 3.656	0,104 0.229	
0,022 0.048	TRA-4860	76,20 3.000	95,25 3.750	0,81 0.032	0,76 0.030	76,20 3.000	76,12 2.997	96,04 3.781	0,015 0.034	3
	TRB-4860	76,20 3.000	95,25 3.750	1,60 0.063	1,52 0.060	76,20 3.000	76,12 2.997	96,04 3.781	0,032 0.07	
	TRD-4860	76,20 3.000	95,25 3.750	3,20 0.126	3,12 0.123	76,20 3.000	76,12 2.997	96,04 3.781	0,061 0.135	
0,042 0.092	TRA-5266	82,55 3.250	104,78 4.125	0,81 0.032	0,76 0.030	82,55 3.250	82,47 3.247	105,56 4.156	0,020 0.044	3 1/4
	TRD-5266	82,55 3.250	104,78 4.125	3,20 0.126	3,12 0.123	82,55 3.250	82,47 3.247	105,56 4.156	0,080 0.176	
0,050 0.11	TRA-6074	95,25 3.750	117,48 4.625	0,81 0.032	0,76 0.030	95,25 3.750	95,17 3.747	118,26 4.656	0,023 0.05	3 3/4
	TRB-6074	95,25 3.750	117,48 4.625	1,60 0.063	1,52 0.060	95,25 3.750	95,17 3.747	118,26 4.656	0,046 0.101	
	TRC-6074	95,25 3.750	117,48 4.625	2,41 0.095	2,34 0.092	95,25 3.750	95,17 3.747	118,26 4.656	0,069 0.152	
	TRD-6074	95,25 3.750	117,48 4.625	3,20 0.126	3,12 0.123	95,25 3.750	95,17 3.747	118,26 4.656	0,092 0.202	
0,062 0.136	TRA-6881	104,78 4.125	128,57 5.062	0,81 0.032	0,76 0.030	104,78 4.125	104,70 4.122	129,39 5.094	0,027 0.059	4 1/8
	TRC-6881	104,78 4.125	128,57 5.062	2,41 0.095	2,34 0.092	104,78 4.125	104,70 4.122	129,39 5.094	0,081 0.178	
	TRD-6881	104,78 4.125	128,57 5.062	3,20 0.126	3,12 0.123	104,78 4.125	104,70 4.122	129,39 5.094	0,109 0.24	
	TRF-6881	104,78 4.125	128,57 5.062	4,78 0.188	4,70 0.185	104,78 4.125	104,70 4.122	129,39 5.094	0,161 0.354	

[2]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.