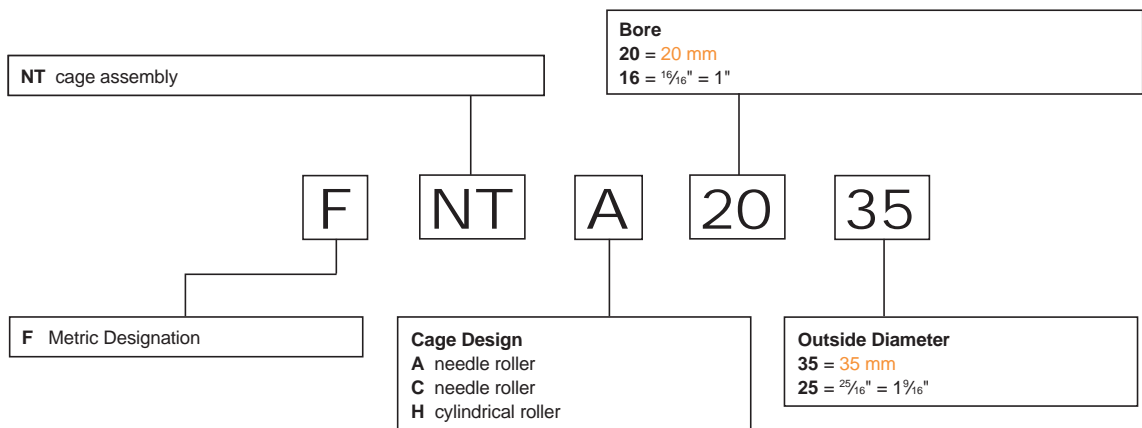


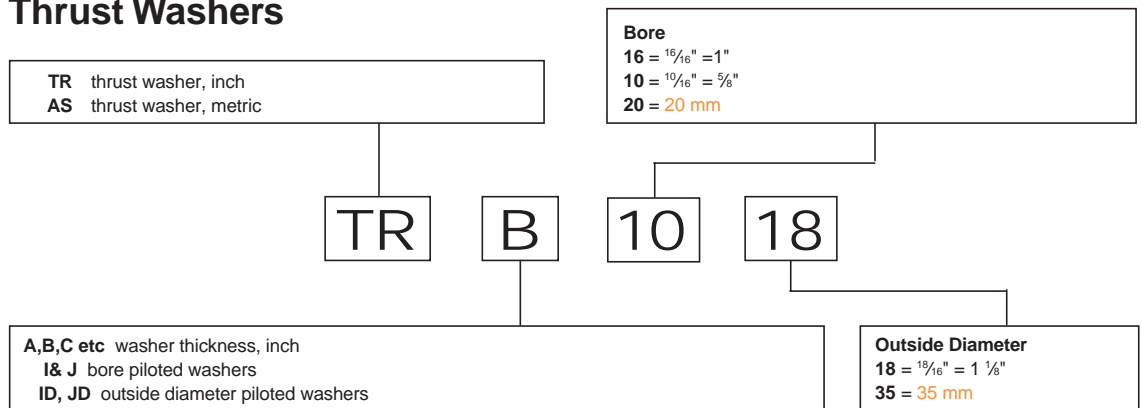
Thrust Bearings

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Thrust Bearings



Thrust Washers





INTRODUCTION

Before selecting specific cage assemblies or complete bearings, the general 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
- lubrication
- limiting speeds
- effect of raceway hardness

In addition to these general considerations, review the material which follows when selecting thrust needle roller and cage assemblies or thrust cylindrical roller and cage assemblies.

IDENTIFICATION

The prefix letters in the bearing designation of the Torrington thrust needle roller and cage assemblies, thrust cylindrical and cage assemblies and their corresponding thrust washers denote whether they are made to inch or metric nominal dimensions, and their major construction features.

A roller and cage assembly or washer with metric nominal dimensions is indicated by the code letter **F** in the prefix. Absence of the letter **F** in the prefix of the bearing designation indicates inch nominal dimensions.

NTA is the complete prefix code for an assembly with inch nominal dimensions and **FNT** and **FNTA** are the complete prefix codes for thrust needle roller and cage assemblies with metric nominal dimensions. Thrust needle roller and cage assemblies use needle rollers of the smallest practical diameter.

Thrust cylindrical roller and cage assemblies identified by the prefix letters **NTH** use large diameter rollers to obtain higher load ratings. These assemblies are available only in inch nominal dimensions.

Thrust washers of inch nominal dimensions are identified by the prefix letters **TR**, followed by another letter such as **A, B, C**, etc. indicating washer thickness. **TRA** is the complete prefix code for the thinnest thrust washer made to inch nominal dimensions. Thrust washers of metric nominal dimensions are identified by the prefix letters **AS** for 1.0 mm thickness. Metric washers of other thickness are also available.

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.

Thrust cylindrical roller 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.

Thrust Bearings

Needle Roller and Cage Assembly



Type FNT

Types NTA and FNTA

Cylindrical Roller and Cage Assembly



Type NTH

Thrust Washers



Types AS and TR

Cylindrical roller Thrust Bearings



Type NTHA



CONSTRUCTION

Torrington thrust needle roller and cage assemblies (NTA, FNT and FNTA) 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 unique Torrington construction minimizes cage stress and assures that the roller retaining function of the cage is unaffected by normal wear. Rollers are precision ground and lapped to close tolerance for optimum load distribution.

Thrust washers for 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 thrust cylindrical roller and cage 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

Pages 480-487 list the nominal outside diameter, bore diameter, and roller diameter for both the inch and the metric series thrust needle roller and cage assemblies and their thrust washers.

Thickness tolerances for both inch and metric thrust washers appear in the tabular data.

Tolerances for nominal outside and bore diameters of nominal inch thrust assemblies are given in Table 1 and metric thrust assemblies in Tables 2 and 2A.

Inch-metric conversions given in the following tolerance tables are approximate and are for the convenience of the user. The controlling dimensions are in inches for the nominal inch assemblies and washers, and millimeters for nominal metric assemblies and washers.

Needle rollers in NTA assemblies are ground and lapped to a total diameter tolerance of -0.0002 inch (-0.0051mm) from nominal.

Needle rollers in FNT and FNTA assemblies are ground and lapped to a total diameter tolerance of -0.003mm (-0.00012) inch from nominal.

Table 1
Tolerances for bore (D_{c1}) and outside (D_c) diameters of nominal inch (NTA) thrust needle roller and cage assemblies.

Needle Roller Diameter Dw (nominal)		Deviations							
		Bore Diameter D _{c1}				Outside Diameter D _c			
		inch		mm (approx)		inch		mm (approx)	
inch	mm	low	high	low	high	high	low	high	low
0.0781	1.984	+0.002	+0.007	+0.05	+0.18	-0.010	-0.020	-0.25	-0.50
0.1250	3.175	+0.002	+0.010	+0.05	+0.25	-0.010	-0.025	-0.25	-0.63

Table 2
Tolerances for o.d. (D_c) of nominal metric (FNT and FNTA) thrust needle roller and cage assemblies.

Nominal O.D.				Deviations (c12)			
mm		inch		mm		inch (approx)	
over	incl	over	incl.	high	low	high	low
18	30	0.71	1.19	-0.110	-0.320	-0.004	-0.012
30	40	1.19	1.58	-0.120	-0.370	-0.005	-0.015
40	50	1.58	1.97	-0.130	-0.380	-0.005	-0.015
50	65	1.97	2.56	-0.140	-0.440	-0.006	-0.018
65	80	2.56	3.15	-0.150	-0.450	-0.006	-0.018
80	100	3.15	3.94	-0.170	-0.520	-0.007	-0.021
100	120	3.94	4.73	-0.180	-0.530	-0.007	-0.021
120	140	4.73	5.52	-0.200	-0.600	-0.008	-0.024

Table 2A
Tolerances for bore diameter (D_{c1}) of nominal metric (FNT and FNTA) thrust needle roller and cage assemblies.

Nominal Bore Diameter				Deviations (E11)			
mm		inch		mm		inch (approx)	
over	incl	over	incl	low	high	low	high
3	6	0.12	0.24	+0.020	+0.095	+0.001	+0.004
6	10	0.24	0.40	+0.025	+0.115	+0.001	+0.005
10	18	0.40	0.71	+0.032	+0.142	+0.001	+0.005
18	30	0.71	1.19	+0.040	+0.170	+0.002	+0.007
30	50	1.19	1.97	+0.050	+0.210	+0.002	+0.008
50	80	1.97	3.15	+0.060	+0.250	+0.002	+0.009
80	120	3.15	4.73	+0.072	+0.292	+0.003	+0.012

BORE INSPECTION PROCEDURE FOR ASSEMBLY

The bore diameter (D_{c1}) of the assembly should be checked with “go” and “no go” plug gauges. The “go” plug gauge size is the minimum bore diameter of the assembly. The “no go” plug gauge size is the maximum bore diameter of the assembly.

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



DIMENSIONAL ACCURACY (continued)

Tolerances for outside and bore diameters of nominal inch thrust washers are given in Tables 3 and 3A and of nominal metric thrust washers in Tables 4 and 4A.

The tolerances for cylindrical roller and cage assemblies, their corresponding washers and the bearings made up of these components appear in the tabular data.

Table 3
Tolerances for outside diameter (d_1) of nominal inch (TRA, TRB, etc.) thrust washers.

Nominal O.D.				Deviations			
inch		mm		inch		mm (approx.)	
over	incl.	over	incl.	high	low	high	low
0.24	5.25	6.0	133.4	-0.010	-0.030	-0.25	-0.76

Table 3A
Tolerances for bore diameter (d) of nominal inch (TRA, TRB, etc.) thrust washers.

Nominal Bore Diameter				Deviations			
inch		mm		inch		mm (approx.)	
over	incl.	over	incl.	low	high	low	high
0.24	2.25	6.0	57.2	+0.002	+0.012	+0.05	+0.30
2.25	5.25	57.2	133.4	+0.002	+0.017	+0.05	+0.43

Table 4
Tolerances for o.d. (d_1) of nominal metric (AS) thrust washers.

Nominal O.D.				Deviations (e13)			
mm		inch		mm		inch (approx.)	
over	incl.	over	incl.	high	low	high	low
18	30	0.71	1.19	-0.040	-0.370	-0.002	-0.015
30	50	1.19	1.97	-0.050	-0.440	-0.002	-0.017
50	80	1.97	3.15	-0.060	-0.520	-0.002	-0.020
80	120	3.15	4.73	-0.072	-0.612	-0.003	-0.024
120	180	4.73	7.09	-0.085	-0.715	-0.003	-0.028

Table 4A
Tolerances for bore diameter (d) of nominal metric (AS) thrust washers.

Nominal Bore Diameter				Deviations (E12)			
mm		inch		mm		inch (approx.)	
over	incl.	over	incl.	low	high	low	high
3	6	0.12	0.24	+0.020	+0.140	+0.001	+0.006
6	10	0.24	0.40	+0.025	+0.175	+0.001	+0.007
10	18	0.40	0.71	+0.032	+0.212	+0.001	+0.008
18	30	0.71	1.19	+0.040	+0.250	+0.002	+0.010
30	50	1.19	1.97	+0.050	+0.300	+0.002	+0.012
50	80	1.97	3.15	+0.060	+0.360	+0.002	+0.014
80	120	3.15	4.73	+0.072	+0.422	+0.003	+0.017

BORE INSPECTION PROCEDURE FOR THRUST WASHER

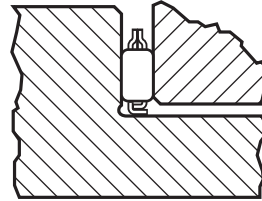
The bore diameter (d) of the thrust washer should be checked with “go” and “no go” plug gauges. The “go” plug gauge size is the minimum bore diameter of the thrust washer. The “no go” plug gauge size is the maximum bore diameter of the thrust washer.

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

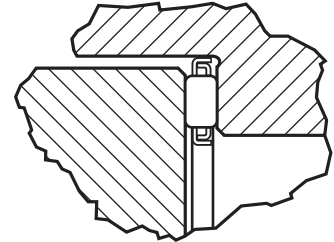
PILOTING AND LOCATING

Thrust needle roller and cage assemblies

On types **NTA** and **FNTA** assemblies the cage bore has a larger contact area and a closer tolerance than the outside diameter. Therefore, bore piloting is preferred for these bearings. The type **FNT** assembly cage has a relatively large contact area on both the bore and outside diameter. Thus, these assemblies can be piloted by either the shaft or the housing. To reduce wear, it is recommended that the piloting surface for the cage be hardened to an equivalent of at least 55 HRC.



BORE PILOTED ARRANGEMENT
USING TYPE NTA OR FNTA ASSEMBLY



O.D. PILOTED ARRANGEMENT
USING TYPE FNT ASSEMBLY

Where design requirements prevent bore piloting, the **NTA** and **FNTA** thrust needle roller and cage assemblies may be piloted on the outside diameters. Note: the “diameter to clear washer o.d.” given in the tabular data is not suitable for o.d. piloting. Consult your Torrington Engineering Sales Office for recommendations when an application of **NTA**, **FNTA**, or **FNT** assemblies requires o.d. piloting.

Thrust washers for use with 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, consult your Torrington Engineering Sales Office for design recommendations.

Thrust cylindrical roller and cage assemblies:

The 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 recommended 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 cage outside diameter 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. Please note that mounting dimensions are given in the tabular data for both shaft and housing piloting.

Thrust washers for use with thrust cylindrical roller and cage assemblies:

Types **TRID** and **TRJD** washers for thrust roller and cage assemblies are designed to pilot from the housing and to clear the shaft, Types **TRI** and **TRJ** washers are designed to pilot from the shaft and to clear the housing. The 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. When application requirements are such that thrust washers must be employed in another manner, consult your Torrington Engineering Sales Office for design recommendations.

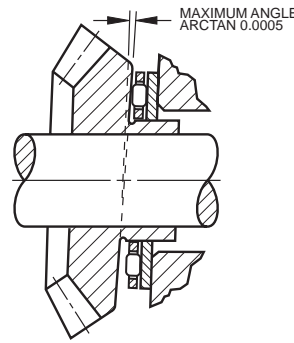


BACK UP SURFACES

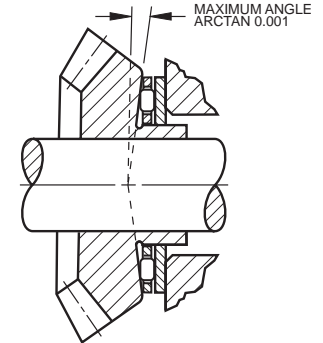
In some applications, it is desirable to use the back up surfaces as raceways for rollers of the thrust assemblies. When this is done, these surfaces must be hardened to an equivalent of at least 58 HRC. If this hardness cannot be achieved, and thrust washers cannot be used, the load ratings must be reduced as explained in the general engineering section of this catalog.

Thrust raceway surfaces must be ground to a surface finish of 20 microinches a.a. (0.5µm Ra). When this requirement cannot be met, thrust washers must be used.

The raceways against which the rollers operate, or the surface against which the 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 and coning are illustrated in Figures 1 and 2.



OUT OF SQUARE SURFACE
Figure 1



DISHED OR CONED SURFACE
Figure 2

TYPE NTHA THRUST CYLINDRICAL ROLLER BEARING

The NTHA 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 bearing when the shaft rotates is shown in Figure 3. 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 proper fit in the housing.

The NTHA roller thrust bearing cage is normally shaft piloted. In the event it is necessary to pilot the cage by the housing, Figure 4 illustrates a possible mounting arrangement. When other mounting arrangements are dictated by the application, contact your Torrington Engineering sales office for recommendations.

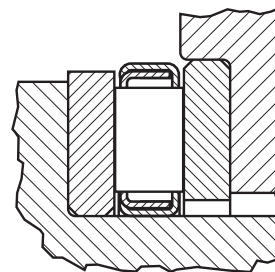


Figure 3

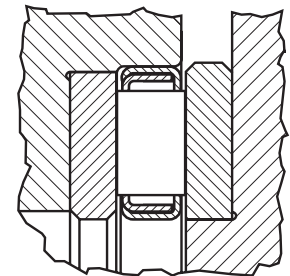


Figure 4

COEFFICIENT OF FRICTION

The coefficient of friction of a thrust bearing (consisting of caged roller assembly and washers) is defined as the friction torque divided by the product of the applied load and the pitch radius. This coefficient of friction is not a consistent 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 $8 \cdot 10^{-3}$ be used as a conservative estimate.

LUBRICATION

Oil is the preferred lubricant and an ample oil flow is absolutely necessary for high speeds, or for moderate speeds where the load is high.

When the application must utilize grease lubrication, the assemblies should be ordered pregreased. When speeds are low and rotation is not continuous the initial charge of grease may be ample for the life of the application. When 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

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

Thrust needle roller and cage assemblies are particularly adapted to low cost integral combination with special thrust washers, or even with radial bearings. When the use of such special designs seems indicated, consult with your Torrington Engineering Sales Office for evaluation of proposed designs and the quantities that will warrant special tooling.

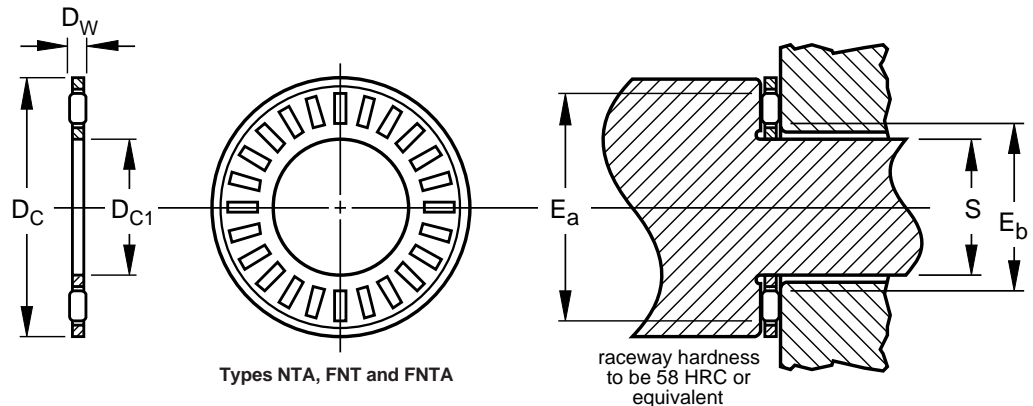


Thrust Needle Roller and Cage Assemblies

Check for Availability

Inch - metric conversions given are for the convenience of the user.

The controlling dimensions are in inches for nominal inch bearings and in millimeters for nominal metric bearing.



Types NTA, FNT and FNTA

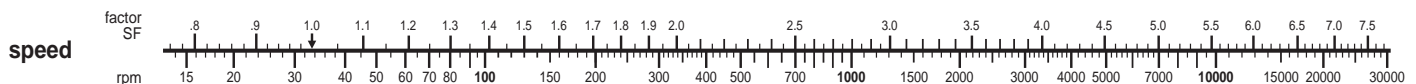
ASSEMBLY DIMENSIONS AND LOAD RATINGS

D _{c1} Bore (nom)	D _c O.D. (nom.)	Assembly Designation	D _w Roller Diameter (nom)	E _b Raceway Contact I.D. (nom)	E _a Raceway Contact O.D. (nom)	Load Ratings		Limiting Speed
						Basic Dynamic Load Rating C _a	Basic Static Load Rating C _{0a} ISO 76	
inch mm	inch mm		inch mm	inch mm	inch mm	lbf	lbf	
0.236 6	0.748 19	FNT-619	0.0787 2	0.31 8,0	0.71 18,0	1 270	3 120	23 000
0.250 6,35	0.687 17,45	NTA-411	0.0781 1,984	0.34 8,6	0.58 14,7	925	2 060	28 000
0.312 7,92	0.750 19,05	NTA-512	0.0781 1,984	0.40 10,2	0.64 16,3	1 050	2 510	25 000
0.315 8	0.827 21	FNT-821	0.0787 2	0.39 10,0	0.79 20,0	1 430	3 810	21 000
0.375 9,52	0.812 20,62	NTA-613	0.0781 1,984	0.46 11,7	0.71 18,0	1 090	2 740	23 000
0.394 10	0.945 24	FNT-1024	0.0787 2	0.47 12,0	0.91 23,0	1 720	5 080	18 000
0.472 12	1.024 26	FNT-1226	0.0787 2	0.55 14,0	0.98 25,0	1 870	5 860	17 000
0.500 12,70	0.937 23,80	NTA-815	0.0781 1,984	0.59 15,0	0.83 21,1	1 290	3 660	19 000
0.562 14,27	1.000 25,40	NTA-916	0.0781 1,984	0.65 16,5	0.89 22,6	1 390	4 110	18 000
0.591 15	1.102 28	FNT-1528	0.0787 2	0.67 17,0	1.06 27,0	1 900	6 230	16 000
0.625 15,88	1.125 28,58	NTA-1018	0.0781 1,984	0.71 18,0	1.02 25,9	1 590	5 070	16 000
0.669 17	1.181 30	FNT-1730	0.0787 2	0.75 19,0	1.14 29,0	2 010	6 920	14 000

Limiting speeds listed are based on adequate oil lubrication. See page 479 for lubrication information.

Required Basic Dynamic Load Rating (C_a) = Applied Load • SF • LF • HF (See page E75).

The Basic Dynamic Load Rating, C_a, is to be used in load-life calculations taking into consideration the application guidelines and limitations given in this catalog. Applications involving dynamic loads approaching this rating should be referred to your Torrington Engineering Sales Office before final selection is made. Load ratings are based on a minimum raceway hardness of 58 HRC or equivalent.



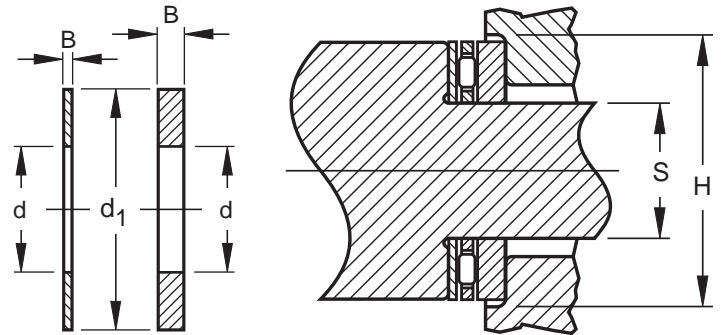


Thrust Washers

Dimensions for bore and o.d. of thrust needle roller and cage assemblies and thrust washers are nominal. Inspection dimensions are shown in the tolerance tables on pages 477-478.

Thrust washers are burnished for at least one-quarter of the bore area with the remainder a rough breakaway finish. The o.d. of the washers will be as blanked. Due to distortion in the hardening, the thinner washers may be out of flat in the free state but can be expected to flatten under load.

See pages 478-479 for discussion of piloting and back-up surfaces.

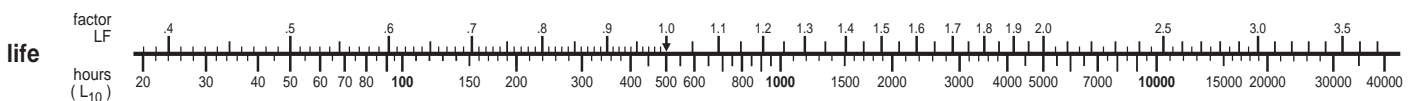


THRUST WASHER DIMENSIONS									PILOTING DIMENSIONS						
Thrust Washer Designation	d Bore		d ₁ O.D.		B Washer Thickness				Matching Assembly Designation	S [■] Shaft Pilot Diameter				H _Δ Diameter to Clear Washer O.D.	
	(nom)		(nom)		min.	max.	min.	max.		min.	max.	min.	max.	(minimum)	
	inch	mm	inch	mm	inch	inch	mm	mm		inch	inch	mm	mm	inch	mm
AS-619	0.236	6	0.748	19	0.037	0.041	0.95	1.05	FNT-619	0.234	0.236	5.95	6.00	0.787	20.00
TRA-411	0.250	6.35	0.687	17.45	0.030	0.032	0.76	0.81	NTA-411	0.247	0.250	6.27	6.35	0.719	18.26
TRB-411	0.250	6.35	0.687	17.45	0.060	0.063	1.52	1.60	NTA-411	0.247	0.250	6.27	6.35	0.719	18.26
TRC-411	0.250	6.35	0.687	17.45	0.092	0.095	2.34	2.42	NTA-411	0.247	0.250	6.27	6.35	0.719	18.26
TRA-512	0.312	7.92	0.750	19.05	0.030	0.032	0.76	0.81	NTA-512	0.309	0.312	7.84	7.92	0.781	19.84
TRB-512	0.312	7.92	0.750	19.05	0.060	0.063	1.52	1.60	NTA-512	0.309	0.312	7.84	7.92	0.781	19.84
AS-821	0.315	8	0.827	21	0.037	0.041	0.95	1.05	FNT-821	0.313	0.315	7.94	8.00	0.866	22.00
TRA-613	0.375	9.52	0.812	20.62	0.030	0.032	0.76	0.81	NTA-613	0.372	0.375	9.44	9.52	0.844	21.44
TRB-613	0.375	9.52	0.812	20.62	0.060	0.063	1.52	1.60	NTA-613	0.372	0.375	9.44	9.52	0.844	21.44
TRC-613	0.375	9.52	0.812	20.62	0.092	0.095	2.34	2.42	NTA-613	0.372	0.375	9.44	9.52	0.844	21.44
AS-1024	0.394	10	0.945	24	0.037	0.041	0.95	1.05	FNT-1024	0.392	0.394	9.94	10.00	0.984	25.00
AS-1226	0.472	12	1.024	26	0.037	0.041	0.95	1.05	FNT-1226	0.469	0.472	11.93	12.00	1.063	27.00
TRA-815	0.500	12.70	0.937	23.80	0.030	0.032	0.76	0.81	NTA-815	0.497	0.500	12.62	12.70	0.969	24.61
TRB-815	0.500	12.70	0.937	23.80	0.060	0.063	1.52	1.60	NTA-815	0.497	0.500	12.62	12.70	0.969	24.61
TRC-815	0.500	12.70	0.937	23.80	0.092	0.095	2.34	2.42	NTA-815	0.497	0.500	12.62	12.70	0.969	24.61
TRA-916	0.562	14.27	1.000	25.40	0.030	0.032	0.76	0.81	NTA-916	0.559	0.562	14.19	14.27	1.031	26.19
TRB-916	0.562	14.27	1.000	25.40	0.060	0.063	1.52	1.60	NTA-916	0.559	0.562	14.19	14.27	1.031	26.19
TRC-916	0.562	14.27	1.000	25.40	0.092	0.095	2.34	2.42	NTA-916	0.559	0.562	14.19	14.27	1.031	26.19
AS-1528	0.591	15	1.102	28	0.037	0.041	0.95	1.05	FNT-1528	0.588	0.591	14.93	15.00	1.142	29.00
TRA-1018	0.625	15.88	1.125	28.58	0.030	0.032	0.76	0.81	NTA-1018	0.622	0.625	15.80	15.88	1.156	29.36
TRB-1018	0.625	15.88	1.125	28.58	0.060	0.063	1.52	1.60	NTA-1018	0.622	0.625	15.80	15.88	1.156	29.36
TRC-1018	0.625	15.88	1.125	28.58	0.092	0.095	2.34	2.42	NTA-1018	0.622	0.625	15.80	15.88	1.156	29.36
TRD-1018	0.625	15.88	1.125	28.58	0.123	0.126	3.12	3.20	NTA-1018	0.622	0.625	15.80	15.88	1.156	29.36
TRE-1018	0.625	15.88	1.125	28.58	0.154	0.157	3.91	3.99	NTA-1018	0.622	0.625	15.80	15.88	1.156	29.36
AS-1730	0.669	17	1.181	30	0.037	0.041	0.95	1.05	FNT-1730	0.666	0.669	16.93	17.00	1.220	31.00

Consult your Torrington Engineering Sales Office for recommendations when an application requires o.d. piloting.

■ When a shaft below the minimum recommended diameter is required, consult your Torrington Engineering Sales Office.

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.



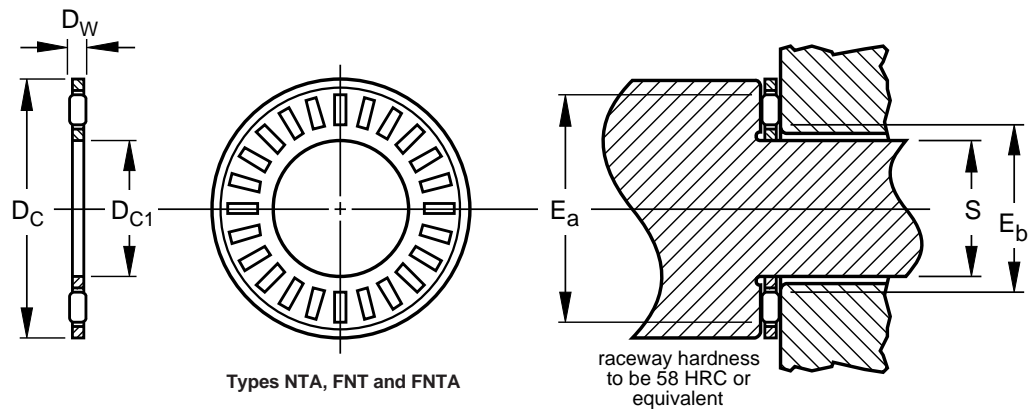


Thrust Needle Roller and Cage Assemblies

Check for Availability

Inch-metric conversions given are for the convenience of the user.

The controlling dimensions are in inches for nominal inch bearings and in millimeters for nominal metric bearing.



Types NTA, FNT and FNTA

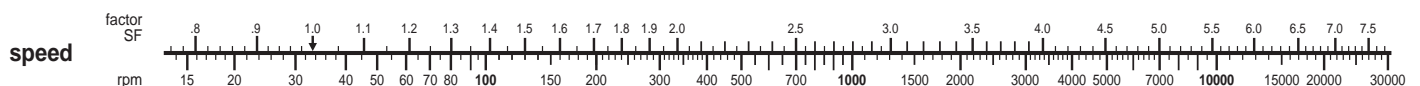
ASSEMBLY DIMENSIONS AND LOAD RATINGS

D _{c1} Bore (nom)	D _c O.D. (nom.)		Assembly Designation	D _w Roller Diameter (nom)		E _b Raceway Contact I.D. (nom)		E _a Raceway Contact O.D. (nom)		Load Ratings		Limiting Speed rpm	
	inch	mm		inch	mm	inch	mm	inch	mm	Basic Dynamic Load Rating C _a	Basic Static Load Rating C _{0a} ISO 76		
0.750	19,05	1.250	31,75	NTA-1220	0.0781	1,984	0.84	21,3	1.14	29,0	1 770	6 090	14 000
0.787	20	1.378	35	FNTA-2035	0.0787	2	0.87	22,0	1.34	34,0	2 600	10 200	13 000
0.875	22,22	1.437	36,50	NTA-1423	0.0781	1,984	0.96	24,4	1.33	33,8	2 350	9 210	12 000
0.875	22,22	1.687	42,85	NTC-1427	0.0781	1,984	1.02	25,9	1.57	39,9	3 430	15 500	10 000
0.984	25	1.654	42	FNT-2542	0.0787	2	1.06	27,0	1.61	41,0	3 470	15 600	10 000
1.000	25,40	1.562	39,67	NTA-1625	0.0781	1,984	1.09	27,7	1.45	36,8	2 420	9 870	11 000
1.125	28,58	1.750	44,45	NTA-1828	0.0781	1,984	1.21	30,7	1.64	41,7	3 040	13 700	9 800
1.181	30	1.850	47	FNTA-3047	0.0787	2	1.26	32,0	1.81	46,0	3 560	16 900	9 100
1.250	31,75	1.937	49,20	NTA-2031	0.0781	1,984	1.34	34,0	1.82	46,2	3 690	18 200	8 800

Limiting speeds listed are based on adequate oil lubrication. See page 479 for lubrication information.

Required Basic Dynamic Load Rating (C_a) = Applied Load • SF • LF • HF (See page E75).

The Basic Dynamic Load Rating, C_a, is to be used in load-life calculations taking into consideration the application guidelines and limitations given in this catalog. Applications involving dynamic loads approaching this rating should be referred to your Torrington Engineering Sales Office before final selection is made. Load ratings are based on a minimum raceway hardness of 58 HRC or equivalent.



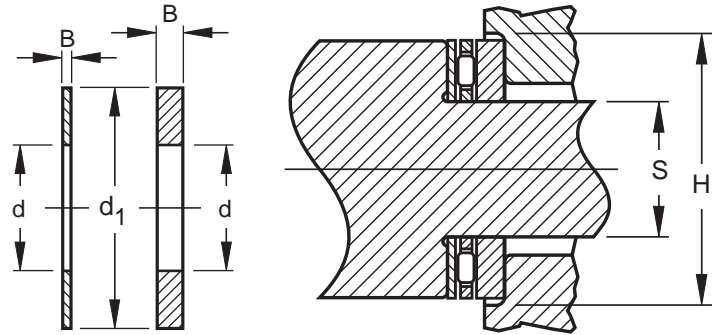


Thrust Washers

Dimensions for bore and o.d. of thrust needle roller and cage assemblies and thrust washers are nominal. Inspection dimensions are shown in the tolerance tables on pages 477-478.

Thrust washers are burnished for at least one-quarter of the bore area with the remainder a rough breakaway finish. The o.d. of the washers will be as blanked. Due to distortion in the hardening, the thinner washers may be out of flat in the free state but can be expected to flatten under load.

See pages 478-479 for discussion of piloting and back-up surfaces.

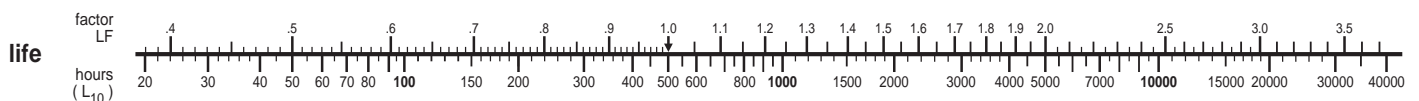


THRUST WASHER DIMENSIONS									PILOTING DIMENSIONS						
Thrust Washer Designation	d Bore		d ₁ O.D.		B Washer Thickness				Matching Assembly Designation	S [■] Shaft Pilot Diameter				H _Δ Diameter to Clear Washer O.D.	
	(nom)		(nom)		min.	max.	min.	max.		min.	max.	min.	max.	(minimum)	
	inch	mm	inch	mm	inch	inch	mm	mm		inch	inch	mm	mm	inch	mm
TRA-1220	0.750	19,05	1.250	31,75	0.030	0.032	0,76	0,81	NTA-1220	0.747	0.750	18,97	19,05	1.281	32,54
TRB-1220	0.750	19,05	1.250	31,75	0.060	0.063	1,52	1,60	NTA-1220	0.747	0.750	18,97	19,05	1.281	32,54
TRC-1220	0.750	19,05	1.250	31,75	0.092	0.095	2,34	2,42	NTA-1220	0.747	0.750	18,97	19,05	1.281	32,54
TRD-1220	0.750	19,05	1.250	31,75	0.123	0.126	3,12	3,20	NTA-1220	0.747	0.750	18,97	19,05	1.281	32,54
TRE-1220	0.750	19,05	1.250	31,75	0.154	0.157	3,91	3,99	NTA-1220	0.747	0.750	18,97	19,05	1.281	32,54
AS-2035	0.787	20,00	1.378	35,00	0.037	0.041	0,95	1,05	FNTA-2035	0.784	0.787	19,92	20,00	1.417	36,00
TRA-1423	0.875	22,22	1.437	36,50	0.030	0.032	0,76	0,81	NTA-1423	0.872	0.875	22,14	22,22	1.469	37,31
TRB-1423	0.875	22,22	1.437	36,50	0.060	0.063	1,52	1,60	NTA-1423	0.872	0.875	22,14	22,22	1.469	37,31
TRC-1423	0.875	22,22	1.437	36,50	0.092	0.095	2,34	2,42	NTA-1423	0.872	0.875	22,14	22,22	1.469	37,31
TRD-1423	0.875	22,22	1.437	36,50	0.123	0.126	3,12	3,20	NTA-1423	0.872	0.875	22,14	22,22	1.469	37,31
TRA-1427	0.875	22,22	1.687	42,85	0.060	0.063	1,52	1,60	NTC-1427	0.872	0.875	22,14	22,22	1.719	43,66
TRC-1427	0.875	22,22	1.687	42,85	0.092	0.095	2,34	2,42	NTC-1427	0.872	0.875	22,14	22,22	1.719	43,66
TRD-1427	0.875	22,22	1.687	42,85	0.123	0.126	3,12	3,20	NTC-1427	0.872	0.875	22,14	22,22	1.719	43,66
AS-2542	0.984	25,00	1.654	42,00	0.037	0.041	0,95	1,05	FNT-2542	0.981	0.984	24,92	25,00	1.693	43,00
TRA-1625	1.000	25,40	1.562	39,67	0.030	0.032	0,76	0,81	NTA-1625	0.997	1.000	25,32	25,40	1.594	40,49
TRB-1625	1.000	25,40	1.562	39,67	0.060	0.063	1,52	1,60	NTA-1625	0.997	1.000	25,32	25,40	1.594	40,49
TRC-1625	1.000	25,40	1.562	39,67	0.092	0.095	2,34	2,42	NTA-1625	0.997	1.000	25,32	25,40	1.594	40,49
TRD-1625	1.000	25,40	1.562	39,67	0.123	0.126	3,12	3,20	NTA-1625	0.997	1.000	25,32	25,40	1.594	40,49
TRE-1625	1.000	25,40	1.562	39,67	0.154	0.157	3,91	3,99	NTA-1625	0.997	1.000	25,32	25,40	1.594	40,49
TRA-1828	1.125	28,58	1.750	44,45	0.030	0.032	0,76	0,81	NTA-1828	1.122	1.125	28,50	28,58	1.781	45,24
TRB-1828	1.125	28,58	1.750	44,45	0.060	0.063	1,52	1,60	NTA-1828	1.122	1.125	28,50	28,58	1.781	45,24
TRC-1828	1.125	28,58	1.750	44,45	0.092	0.095	2,34	2,42	NTA-1828	1.122	1.125	28,50	28,58	1.781	45,24
TRD-1828	1.125	28,58	1.750	44,45	0.123	0.126	3,12	3,20	NTA-1828	1.122	1.125	28,50	28,58	1.781	45,24
AS-3047	1.181	30,00	1.850	47,00	0.037	0.041	0,95	1,05	FNTA-3047	1.178	1.181	29,92	30,00	1.890	48,00
TRA-2031	1.250	31,75	1.937	49,20	0.030	0.032	0,76	0,81	NTA-2031	1.247	1.250	31,67	31,75	1.969	50,01
TRB-2031	1.250	31,75	1.937	49,20	0.060	0.063	1,52	1,60	NTA-2031	1.247	1.250	31,67	31,75	1.969	50,01
TRC-2031	1.250	31,75	1.937	49,20	0.092	0.095	2,34	2,42	NTA-2031	1.247	1.250	31,67	31,75	1.969	50,01
TRD-2031	1.250	31,75	1.937	49,20	0.123	0.126	3,12	3,20	NTA-2031	1.247	1.250	31,67	31,75	1.969	50,01
TRF-2031	1.250	31,75	1.937	49,20	0.185	0.188	4,70	4,78	NTA-2031	1.247	1.250	31,67	31,75	1.969	50,01

Consult your Torrington Engineering Sales Office for recommendations when an application requires o.d. piloting.

■ When a shaft below the minimum recommended diameter is required, consult your Torrington Engineering Sales office.

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.



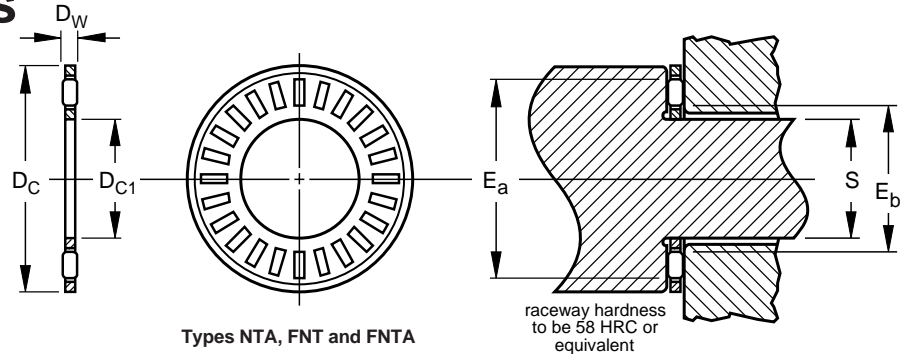


Thrust Needle Roller and Cage Assemblies

Check for Availability

Inch-metric conversions given are for the convenience of the user.

The controlling dimensions are in inches for nominal inch bearings and in millimeters for nominal metric bearing.



Types NTA, FNT and FNTA

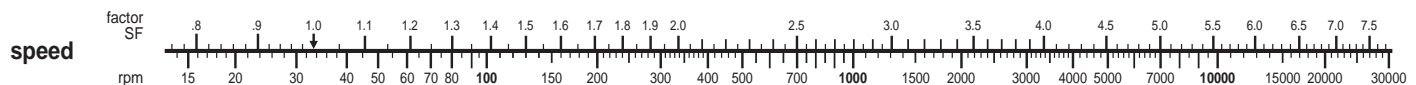
ASSEMBLY DIMENSIONS AND LOAD RATINGS

D _{c1} Bore (nom)		D _c O.D. (nom.)		Assembly Designation	D _w Roller Diameter (nom)		E _b Raceway Contact I.D. (nom)		E _a Raceway Contact O.D. (nom)		Load Ratings		Limiting Speed rpm
inch	mm	inch	mm		inch	mm	inch	mm	inch	mm	Basic Dynamic Load Rating C _a	Basic Static Load Rating C _{0a} ISO 76	
1.375	34,92	2.062	52,37	NTA-2233	0.0781	1,984	1.46	37,1	1.95	49,5	3 910	20 100	8 200
1.378	35	2.047	52	FNT-3552	0.0787	2	1.46	37,0	2.01	51,0	4 160	21 600	8 000
1.500	38,10	2.187	55,55	NTA-2435	0.0781	1,984	1.59	40,4	2.07	52,6	4 250	23 000	7 700
1.575	40	2.362	60	FNT-4060	0.1181	3	1.69	43	2.24	57	6 000	27 200	7 200
1.750	44,45	2.500	63,50	NTA-2840	0.0781	1,984	1.84	46,7	2.32	58,9	4 640	26 900	6 900
1.772	45	2.559	65	FNT-4565	0.1181	3	1.85	47,0	2.48	63,0	7 150	35 200	6 500
1.968	50	2.756	70	FNT-5070	0.1181	3	2.05	52,0	2.68	68,0	7 430	38 000	6 000
2.000	50,80	2.750	69,85	NTA-3244	0.0781	1,984	2.09	53,1	2.57	65,3	4 400	25 900	6 200
2.125	53,98	2.875	73,02	NTA-3446	0.0781	1,984	2.22	56,4	2.70	68,6	4 470	26 900	5 900
2.165	55	3.071	78	FNT-5578	0.1181	3	2.24	57,0	2.99	76,0	9 360	52 900	5 300
2.250	57,15	3.000	76,20	NTA-3648	0.0781	1,984	2.34	59,4	2.82	71,6	4 540	27 800	5 700

Limiting speeds listed are based on adequate oil lubrication. See page 479 for lubrication information.

Required Basic Dynamic Load Rating (C_a) = Applied Load • SF • LF • HF (See page E75).

The Basic Dynamic Load Rating, C_a, is to be used in load-life calculations taking into consideration the application guidelines and limitations given in this catalog. Applications involving dynamic loads approaching this rating should be referred to your Torrington Engineering Sales Office before final selection is made. Load ratings are based on a minimum raceway hardness of 58 HRC or equivalent.



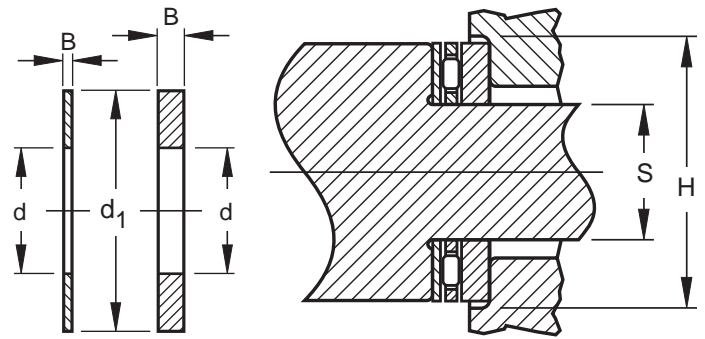


Thrust Washers

Dimensions for bore and o.d. of thrust needle roller and cage assemblies and thrust washers are nominal. Inspection dimensions are shown in the tolerance tables on pages 477-478.

Thrust washers are burnished for at least one-quarter of the bore area with the remainder a rough breakaway finish. The o.d. of the washers will be as blanked. Due to distortion in the hardening, the thinner washers may be out of flat in the free state but can be expected to flatten under load.

See pages 478-479 for discussion of piloting and back-up surfaces.

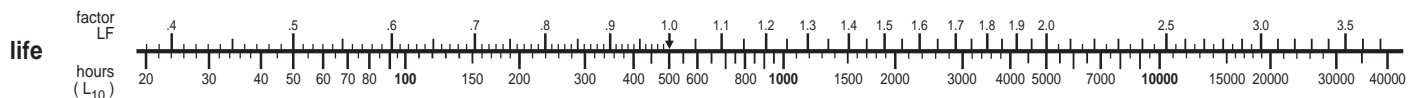


THRUST WASHER DIMENSIONS								PILOTING DIMENSIONS							
Thrust Washer Designation	d Bore		d ₁ O.D.		B Washer Thickness				Matching Assembly Designation	S ^Δ Shaft Pilot Diameter				HA Diameter to Clear Washer O.D.	
	(nom)		(nom)		min.	max.	min.	max.		min.	max.	min.	max.	(minimum)	
	inch	mm	inch	mm	inch	inch	mm	mm		inch	inch	mm	mm	inch	mm
TRA-2233	1.375	34,92	2.062	52,37	0.030	0.032	0,76	0,81	NTA-2233	1.372	1.375	34,84	34,92	2.094	53,19
TRB-2233	1.375	34,92	2.062	52,37	0.060	0.063	1,52	1,60	NTA-2233	1.372	1.375	34,84	34,92	2.094	53,19
TRC-2233	1.375	34,92	2.062	52,37	0.092	0.095	2,34	2,42	NTA-2233	1.372	1.375	34,84	34,92	2.094	53,19
TRD-2233	1.375	34,92	2.062	52,37	0.123	0.126	3,12	3,20	NTA-2233	1.372	1.375	34,84	34,92	2.094	53,19
TRE-2233	1.375	34,92	2.062	52,37	0.154	0.157	3,91	3,99	NTA-2233	1.372	1.375	34,84	34,92	2.094	53,19
TRF-2233	1.375	34,92	2.062	52,37	0.185	0.188	4,70	4,78	NTA-2233	1.372	1.375	34,84	34,92	2.094	53,19
AS-3552	1.378	35	2.047	52	0.037	0.041	0,95	1,05	FNT-3552	1.374	1.378	34,90	35	2.087	53
TRA-2435	1.500	38,10	2.187	55,55	0.030	0.032	0,76	0,81	NTA-2435	1.497	1.500	38,02	38,10	2.219	56,36
TRB-2435	1.500	38,10	2.187	55,55	0.060	0.063	1,52	1,60	NTA-2435	1.497	1.500	38,02	38,10	2.219	56,36
TRC-2435	1.500	38,10	2.187	55,55	0.092	0.095	2,34	2,42	NTA-2435	1.497	1.500	38,02	38,10	2.219	56,36
TRD-2435	1.500	38,10	2.187	55,55	0.123	0.126	3,12	3,20	NTA-2435	1.497	1.500	38,02	38,10	2.219	56,36
TRF-2435	1.500	38,10	2.187	55,55	0.185	0.188	4,70	4,78	NTA-2435	1.497	1.500	38,02	38,10	2.219	56,36
AS-4060	1.575	40	2.362	60	0.037	0.041	0,95	1,05	FNT-4060	1.571	1.575	39,90	40	2.402	61
TRA-2840	1.750	44,45	2.500	63,50	0.030	0.032	0,76	0,81	NTA-2840	1.747	1.750	44,37	44,45	2.531	64,29
TRB-2840	1.750	44,45	2.500	63,50	0.060	0.063	1,52	1,60	NTA-2840	1.747	1.750	44,37	44,45	2.531	64,29
TRC-2840	1.750	44,45	2.500	63,50	0.092	0.095	2,34	2,42	NTA-2840	1.747	1.750	44,37	44,45	2.531	64,29
TRD-2840	1.750	44,45	2.500	63,50	0.123	0.126	3,12	3,20	NTA-2840	1.747	1.750	44,37	44,45	2.531	64,29
TRF-2840	1.750	44,45	2.500	63,50	0.185	0.188	4,70	4,78	NTA-2840	1.747	1.750	44,37	44,45	2.531	64,29
AS-4565	1.772	45	2.559	65	0.037	0.041	0,95	1,05	FNT-4565	1.768	1.772	44,90	45	2.598	66
AS-5070	1.968	50	2.756	70	0.037	0.041	0,95	1,05	FNT-5070	1.965	1.969	49,90	50	2.795	71
TRA-3244	2.000	50,80	2.750	69,85	0.030	0.032	0,76	0,81	NTA-3244	1.997	2.000	50,72	50,80	2.781	70,64
TRB-3244	2.000	50,80	2.750	69,85	0.060	0.063	1,52	1,60	NTA-3244	1.997	2.000	50,72	50,80	2.781	70,64
TRC-3244	2.000	50,80	2.750	69,85	0.092	0.095	2,34	2,42	NTA-3244	1.997	2.000	50,72	50,80	2.781	70,64
TRD-3244	2.000	50,80	2.750	69,85	0.123	0.126	3,12	3,20	NTA-3244	1.997	2.000	50,72	50,80	2.781	70,64
TRF-3244	2.000	50,80	2.750	69,85	0.185	0.188	4,70	4,78	NTA-3244	1.997	2.000	50,72	50,80	2.781	70,64
TRA-3446	2.125	53,98	2.875	73,02	0.030	0.032	0,76	0,81	NTA-3446	2.122	2.125	53,90	53,98	2.906	73,81
TRB-3446	2.125	53,98	2.875	73,02	0.060	0.063	1,52	1,60	NTA-3446	2.122	2.125	53,90	53,98	2.906	73,81
TRC-3446	2.125	53,98	2.875	73,02	0.092	0.095	2,34	2,42	NTA-3446	2.122	2.125	53,90	53,98	2.906	73,81
TRD-3446	2.125	53,98	2.875	73,02	0.123	0.126	3,12	3,20	NTA-3446	2.122	2.125	53,90	53,98	2.906	73,81
AS-5578	2.165	55	3.071	78	0.037	0.041	0,95	1,05	FNT-5578	2.160	2.165	54,88	55	3.110	79
TRA-3648	2.250	57,15	3.000	76,20	0.030	0.032	0,76	0,81	NTA-3648	2.247	2.250	57,07	57,15	3.031	76,99
TRB-3648	2.250	57,15	3.000	76,20	0.060	0.063	1,52	1,60	NTA-3648	2.247	2.250	57,07	57,15	3.031	76,99
TRC-3648	2.250	57,15	3.000	76,20	0.092	0.095	2,34	2,42	NTA-3648	2.247	2.250	57,07	57,15	3.031	76,99
TRD-3648	2.250	57,15	3.000	76,20	0.123	0.126	3,12	3,20	NTA-3648	2.247	2.250	57,07	57,15	3.031	76,99
TRF-3648	2.250	57,15	3.000	76,20	0.185	0.188	4,70	4,78	NTA-3648	2.247	2.250	57,07	57,15	3.031	76,99

Consult your Torrington Engineering Sales Office for recommendations when an application requires o.d. piloting.

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.

- When a shaft below the minimum recommended diameter is required, consult your Torrington Engineering Sales Office.



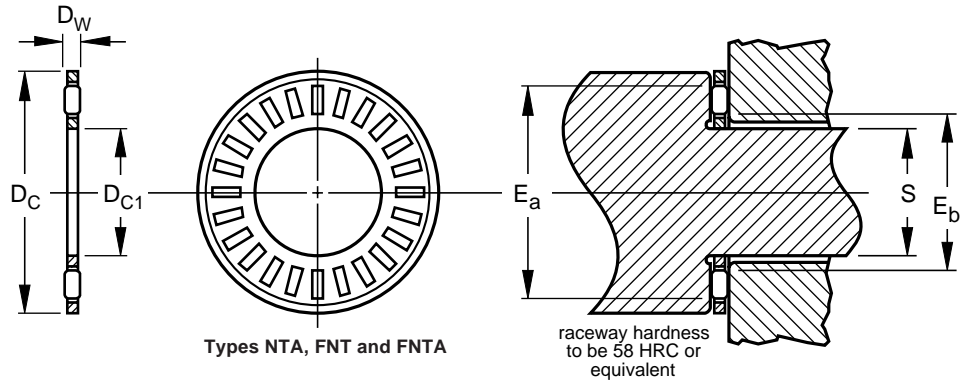


Thrust Needle Roller and Cage Assemblies

Check for Availability

Inch-metric conversions given are for the convenience of the user.

The controlling dimensions are in inches for nominal inch bearings and in millimeters for nominal metric bearing.



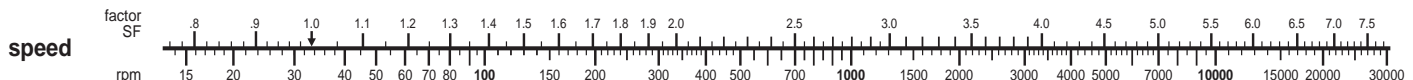
ASSEMBLY DIMENSIONS AND LOAD RATINGS

D _{c1} Bore (nom)	D _c O.D. (nom.)	Assembly Designation	D _w Roller Diameter (nom)	E _b Raceway Contact I.D. (nom)	E _a Raceway Contact O.D. (nom)	Load Ratings		Limiting Speed
						Basic Dynamic Load Rating C _a	Basic Static Load Rating C _{0a} ISO 76	
inch mm	inch mm		inch mm	inch mm	inch mm	lbf	lbf	rpm
2.250 57,15	3.125 79,38	NTA-3650	0.1250 3,175	2.36 59,9	2.96 75,2	7 400	37 800	5 300
2.362 60	3.346 85	FNTA-6085*	0.1181 3	2.44 62,0	3.27 83,0	9 480	55 000	4 900
2.500 63,50	3.250 82,55	NTA-4052	0.0781 1,984	2.59 65,8	3.07 78,0	4 670	29 700	5 200
2.559 65	3.543 90	FNTA-6590*	0.1181 3	2.64 67,0	3.46 88,0	9 930	59 800	4 600
2.750 69,85	3.625 92,08	NTA-4458	0.1250 3,175	2.86 72,6	3.46 87,9	9 380	54 500	4 600
2.756 70	3.740 95	FNTA-7095*	1.5750 4	2.87 73,0	3.66 93,0	12 900	70 200	4 400
2.953 75	3.937 100	FNT-75100*	0.1575 4	3.07 78,0	3.86 98,0	13 600	78 300	4 100
3.000 76,20	3.750 95,25	NTA-4860	0.0781 1,984	3.09 78,5	3.57 90,7	4 940	33 600	4 500
3.150 80	4.134 105	FNTA-80105*	0.1575 4	3.27 83,0	4.06 103,0	13 900	79 700	4 000
3.250 82,55	4.125 104,78	NTA-5266	0.1250 3,175	3.36 85,3	3.96 100,6	10 100	62 900	4 000
3.346 85	4.331 110	FNTA-85110*	0.1575 4	3.46 88,0	4.25 108,0	14 100	82 900	3 800
3.543 90	4.724 120	FNTA-90120*	0.1575 4	3.66 93,0	4.65 118,0	17 700	113 000	3 400
3.750 95,25	4.625 117,48	NTA-6074	0.1250 3,175	3.86 98,0	4.46 113,3	11 000	73 400	3 500
3.937 100	5.315 135	FNTA-100135*	0.1575 4	4.06 103,0	5.24 133,0	21 900	154 000	3 000
4.125 104,78	5.062 128,57	NTA-6681	0.1250 3,175	4.23 107,4	4.90 124,5	12 500	88 900	3 200

Limiting speeds listed are based on adequate oil lubrication. See page 479 for lubrication information. Required Basic Dynamic Load Rating (C_a) = Applied Load • SF • LF • HF (See page E75).

*Construction may be FNT or FNTA, depending on availability. Applications using these bearings must be reviewed by the Torrington Engineering Department.

The Basic Dynamic Load Rating, C_a, is to be used in load-life calculations taking into consideration the application guidelines and limitations given in this catalog. Applications involving dynamic loads approaching this rating should be referred to your Torrington Engineering Sales Office before final selection is made. Load ratings are based on a minimum raceway hardness of 58 HRC or equivalent.



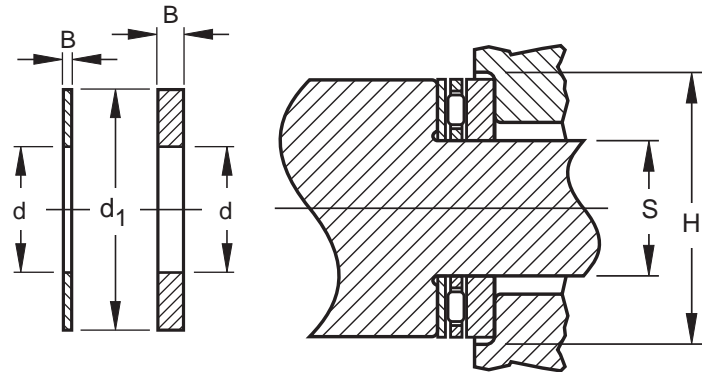


Thrust Washers

Dimensions for bore and o.d. of thrust needle roller and cage assemblies and thrust washers are nominal. Inspection dimensions are shown in the tolerance tables on pages 477-478.

Thrust washers are burnished for at least one-quarter of the bore area with the remainder a rough breakaway finish. The o.d. of the washers will be as blanked. Due to distortion in the hardening, the thinner washers may be out of flat in the free state but can be expected to flatten under load.

See pages 478-479 for discussion of piloting and back-up surfaces.

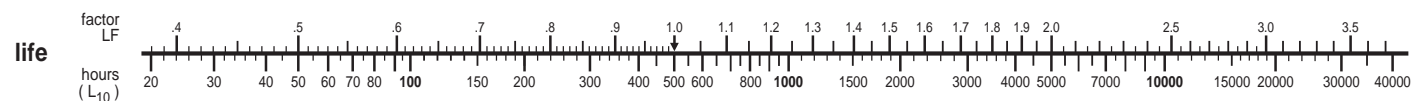


THRUST WASHER DIMENSIONS								PILOTING DIMENSIONS							
Thrust Washer Designation	d Bore		d ₁ O.D.		B Washer Thickness				Matching Assembly Designation	S* Shaft Pilot Diameter				HΔ Diameter to Clear Washer O.D.	
	(nom)		(nom)		min.	max.	min.	max.		min.	max.	min.	max.	(minimum)	
	inch	mm	inch	mm	inch	inch	mm	mm		inch	inch	mm	mm	inch	mm
—	—	—	—	—	—	—	—	—	NTA-3650	2.247	2.250	57,07	57,15	3.156	80,16
AS-6085	2.362	60	3.346	85	0.037	0.041	0,95	1,05	FNTA-6085	2.357	2.362	59,88	60,00	3.386	86,00
TRA-4052	2.500	63,50	3.250	82,55	0.030	0.032	0,76	0,81	NTA-4052	2.497	2.500	63,42	63,50	3.281	83,34
TRB-4052	2.500	63,50	3.250	82,55	0.060	0.063	1,52	1,60	NTA-4052	2.497	2.500	63,42	63,50	3.281	83,34
TRC-4052	2.500	63,50	3.250	82,55	0.092	0.095	2,34	2,42	NTA-4052	2.497	2.500	63,42	63,50	3.281	83,34
TRD-4052	2.500	63,50	3.250	82,55	0.123	0.126	3,12	3,20	NTA-4052	2.497	2.500	63,42	63,50	3.281	83,34
AS-6590	2.559	65	3.543	90	0.037	0.041	0,95	1,05	FNTA-6590	2.554	2.559	64,88	65,00	3.583	91,00
TRA-4458	2.750	69,85	3.625	92,08	0.030	0.032	0,76	0,81	NTA-4458	2.747	2.750	69,77	69,85	3.656	92,86
TRB-4458	2.750	69,85	3.625	92,08	0.060	0.063	1,52	1,60	NTA-4458	2.747	2.750	69,77	69,85	3.656	92,86
TRC-4458	2.750	69,85	3.625	92,08	0.092	0.095	2,34	2,42	NTA-4458	2.747	2.750	69,77	69,85	3.656	92,86
TRD-4458	2.750	69,85	3.625	92,08	0.123	0.126	3,12	3,20	NTA-4458	2.747	2.750	69,77	69,85	3.656	92,86
TRF-4458	2.750	69,85	3.625	92,08	0.185	0.188	4,70	4,78	NTA-4458	2.747	2.750	69,77	69,85	3.656	92,86
AS-7095	2.756	70	3.740	95	0.037	0.041	0,95	1,05	FNTA-7095	2.751	2.756	69,88	70,00	3.780	96,00
AS-75100	2.953	75	3.937	100	0.037	0.041	0,95	1,05	FNT-75100	2.948	2.953	74,88	75,00	3.976	101,00
TRA-4860	3.000	76,20	3.750	95,25	0.030	0.032	0,76	0,81	NTA-4860	2.997	3.000	76,12	76,20	3.781	96,04
TRB-4860	3.000	76,20	3.750	95,25	0.060	0.063	1,52	1,60	NTA-4860	2.997	3.000	76,12	76,20	3.781	96,04
TRD-4860	3.000	76,20	3.750	95,25	0.123	0.126	3,12	3,20	NTA-4860	2.997	3.000	76,12	76,20	3.781	96,04
AS-80105	3.150	80	4.134	105	0.037	0.041	0,95	1,05	FNTA-80105	3.145	3.150	79,88	80,00	4.173	106,00
TRA-5266	3.250	82,55	4.125	104,78	0.030	0.032	0,76	0,81	NTA-5266	3.247	3.250	82,47	82,55	4.156	105,56
TRD-5266	3.250	82,55	4.125	104,78	0.123	0.126	3,12	3,20	NTA-5266	3.247	3.250	82,47	82,55	4.156	105,56
AS-85110	3.346	85	4.331	110	0.037	0.041	0,95	1,05	FNTA-85110	3.340	3.346	84,86	85,00	4.370	111,00
AS-90120	3.543	90	4.724	120	0.037	0.041	0,95	1,05	FNTA-90120	3.537	3.543	89,86	90,00	4.764	121,00
TRA-6074	3.750	95,25	4.625	117,48	0.030	0.032	0,76	0,81	NTA-6074	3.747	3.750	95,17	95,25	4.656	118,26
TRB-6074	3.750	95,25	4.625	117,48	0.060	0.063	1,52	1,60	NTA-6074	3.747	3.750	95,17	95,25	4.656	118,26
TRC-6074	3.750	95,25	4.625	117,48	0.092	0.095	2,34	2,42	NTA-6074	3.747	3.750	95,17	95,25	4.656	118,26
TRD-6074	3.750	95,25	4.625	117,48	0.123	0.126	3,12	3,20	NTA-6074	3.747	3.750	95,17	95,25	4.656	118,26
AS-100135	3.937	100	5.315	135	0.037	0.041	0,95	1,05	FNTA-100135	3.931	3.937	99,86	100,00	5.354	136,00
TRA-6681	4.125	104,78	5.062	128,57	0.030	0.032	0,76	0,81	NTA-6681	4.122	4.125	104,7	104,78	5.094	129,39
TRC-6681	4.125	104,78	5.062	128,57	0.092	0.095	2,34	2,42	NTA-6681	4.122	4.125	104,7	104,78	5.094	129,39
TRD-6681	4.125	104,78	5.062	128,57	0.123	0.126	3,12	3,20	NTA-6681	4.122	4.125	104,7	104,78	5.094	129,39
TRF-6681	4.125	104,78	5.062	128,57	0.185	0.188	4,70	4,78	NTA-6681	4.122	4.125	104,7	104,78	5.094	129,39

Consult your Torrington Engineering Sales Office for recommendations when an application requires o.d. piloting.

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.

■ When a shaft below the minimum recommended diameter is required, consult your Torrington Engineering Sales Office.





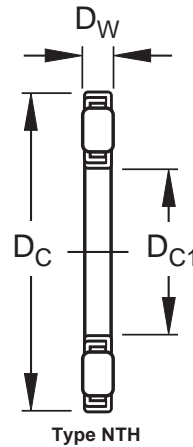
Thrust Cylindrical Roller and Cage Assemblies

Check for availability.

Thrust cylindrical roller and cage assemblies are manufactured to inch nominal dimensions only.

Inch-metric conversions are given for the convenience of the user. The controlling dimensions are in inches.

See page 478-479 for discussion of piloting and back-up surfaces.



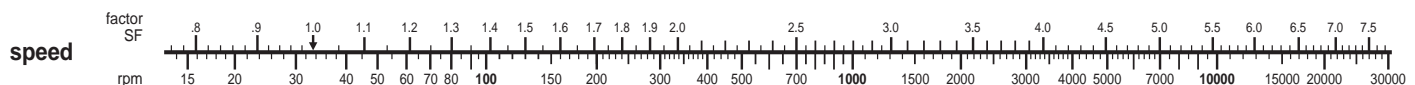
ASSEMBLY DIMENSIONS AND LOAD RATINGS

D _{c1} Bore		D _c O.D.		Assembly Designation	D _w Roller Diameter		Load Ratings		Limiting Speed
							Basic Dynamic Load Rating C _a	Basic Static Load Rating C _{0a} ISO 76	
+0.015 -0.000	+0.38 -0.00	-0.005 -0.020	-0.13 -0.52		+0.0000 -0.0002	+0.000 -0.005			
inch	mm	inch	mm		inch	mm	lbf	lbf	rpm
1.502	38,15	2.970	75,44	NTH-2448	0.2500	6,350	16 200	60 600	5 700
2.002	50,85	3.595	91,31	NTH-3258	0.3750	9,525	25 700	88 500	4 700
2.127	54,03	3.720	94,49	NTH-3460	0.3750	9,525	26 600	94 100	4 600
2.252	57,20	3.845	97,66	NTH-3662	0.3750	9,525	27 500	99 600	4 400
2.377	60,38	3.970	100,84	NTH-3864	0.3750	9,525	28 400	105 000	4 300
2.502	63,55	4.095	104,01	NTH-4066	0.3750	9,525	29 200	111 000	4 100
2.627	66,73	4.315	109,60	NTH-4270	0.3750	9,525	31 100	122 000	3 900
2.755	69,98	4.440	112,78	NTH-4472	0.3750	9,525	32 000	128 000	3 800
3.005	76,33	4.690	119,13	NTH-4876	0.3750	9,525	33 800	140 000	3 600
3.255	82,68	4.940	125,48	NTH-5280	0.3750	9,525	35 400	152 000	3 400
3.505	89,03	5.207	132,26	NTH-5684	0.3750	9,525	36 700	162 000	3 200

Limiting speeds listed are based on adequate oil lubrication. See page 479 for lubrication information. Required Basic Dynamic Load Rating (C_a) = Applied Load • SF • LF • HF (See page E75).

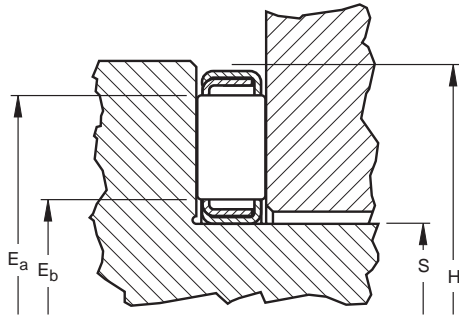
Load ratings are given in pounds-force: 1 lbf = 0.454 kgf = 4.448 N

The Basic Dynamic Load Rating, C_a, is to be used in load-life calculations taking into consideration the application guidelines and limitations given in this catalog. Applications involving dynamic loads approaching this rating should be referred to your Torrington Engineering Sales Office before final selection is made. Load ratings are based on a minimum raceway hardness of 58 HRC or equivalent.

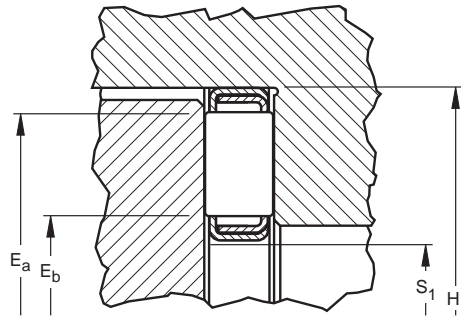




Raceway Hardness 58 HRC or Equivalent



Bore Piloted Assembly

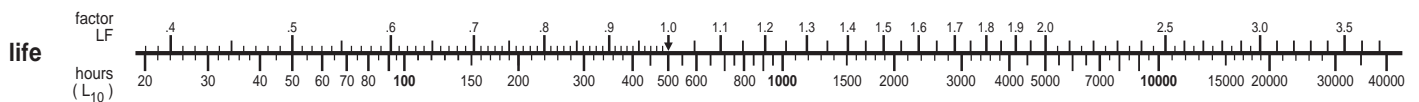


O.D. Piloted Assembly

PILOTING DIMENSIONS

Assembly Designation	Bore Piloted Assembly				O.D. Piloted Assembly				Raceway Contact			
	S Shaft Pilot Diameter		H Diameter to Clear Assembly O.D. (minimum)		S ₁ Diameter to Clear Assembly Bore (maximum)		H ₁ Housing Pilot Diameter		E _b I.D. (nominal)		E _a O.D. (nominal)	
	+0.000 -0.005	+0.00 -0.13					+0.005 -0.000	+0.13 -0.00				
	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
NTH-2448	1.500	38,10	3.030	76,96	1.442	36,63	2.975	75,56	1.76	44,7	2.71	68,8
NTH-3258	2.000	50,80	3.655	92,84	1.942	49,33	3.600	91,44	2.26	57,4	3.32	84,3
NTH-3460	2.125	53,98	3.780	96,01	2.067	52,50	3.725	94,62	2.39	60,7	3.44	87,4
NTH-3662	2.250	57,15	3.905	99,19	2.192	55,68	3.850	97,79	2.51	63,8	3.57	90,7
NTH-3864	2.375	60,32	4.030	102,36	2.317	58,85	3.975	100,96	2.64	67,1	3.69	93,7
NTH-4066	2.500	63,50	4.155	105,54	2.442	62,03	4.100	104,14	2.76	70,1	3.82	97
NTH-4270	2.625	66,68	4.375	111,12	2.567	65,20	4.320	109,73	2.89	73,4	4.03	102,4
NTH-4472	2.750	69,85	4.500	114,30	2.695	68,45	4.445	112,90	3.01	76,5	4.16	105,7
NTH-4876	3.000	76,20	4.750	120,65	2.945	74,80	4.695	119,25	3.26	82,8	4.41	112
NTH-5280	3.250	82,55	5.000	127,00	3.195	81,15	4.945	125,60	3.51	89,2	4.66	118,4
NTH-5684	3.500	88,90	5.267	133,78	3.445	87,50	5.212	132,38	3.77	95,8	4.95	125,7

Required Basic Dynamic Load Rating (C_a) = Applied Load • SF • LF • HF (See page E75)





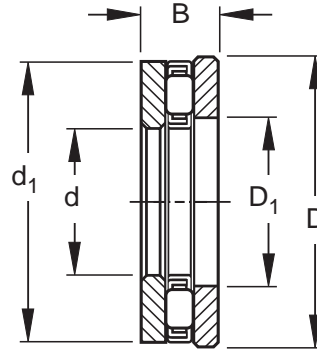
Thrust Cylindrical Roller Bearings

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.

Inch-metric conversions are given for the convenience of the user. The controlling dimensions are in inches.

Load ratings given are identical to the corresponding NTH thrust cylindrical roller and cage assembly.

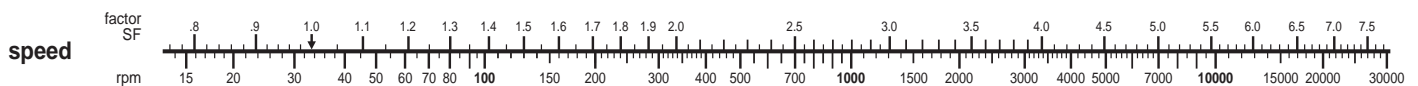


Type NTHA

BEARING DIMENSIONS

Bearing Designation	Shaft Piloted Washer				Housing Piloted Washer				B Bearing Thickness					
	d Bore		d ₁ O.D.	D O.D.		D ₁ Bore								
	inch	mm	(nominal)	inch	mm	inch	mm	inch	mm					
NTHA-2448	1.4993	1.5000	38,082	38,100	2 15/16	74,61	3.0007	3.0000	76,218	76,200	1 1/16	39,69	0.812	20,62
NTHA-3258	1.9990	2.0000	50,775	50,800	3 1/16	90,49	3.6259	3.6250	92,098	92,075	2 1/16	52,39	1.000	25,40
NTHA-3460	2.1240	2.1250	53,950	53,975	3 11/16	93,66	3.7511	3.7500	95,278	95,250	2 3/16	55,56	1.000	25,40
NTHA-3662	2.2489	2.2500	57,122	57,150	3 13/16	96,84	3.8761	3.8750	98,453	98,425	2 5/16	58,74	1.000	25,40
NTHA-3864	2.3739	2.3750	60,297	60,325	3 15/16	100,01	4.0011	4.0000	101,628	101,600	2 7/16	61,91	1.000	25,40
NTHA-4066	2.4989	2.5000	63,472	63,500	4 1/16	103,19	4.1263	4.1250	104,808	104,775	2 9/16	65,09	1.000	25,40
NTHA-4270	2.6238	2.6250	66,645	66,675	4 9/32	108,74	4.3443	4.3430	110,345	110,312	2 11/16	68,26	1.000	25,40
NTHA-4472	2.7488	2.7500	69,820	69,850	4 13/32	111,92	4.4693	4.4680	113,520	113,487	2 13/16	71,44	1.000	25,40
NTHA-4876	2.9988	3.0000	76,170	76,200	4 21/32	118,27	4.7195	4.7180	119,875	119,837	3 1/16	77,79	1.000	25,40
NTHA-5280	3.2487	3.2500	82,517	82,550	4 29/32	124,62	4.9695	4.9680	126,225	126,187	3 3/16	84,14	1.000	25,40
NTHA-5684	3.4987	3.5000	88,867	88,900	5 5/32	130,97	5.2195	5.2180	132,575	132,537	3 5/16	90,49	1.000	25,40

Load Ratings are given in pound force: 1lbf = 0.454kgf = 4.448 N.

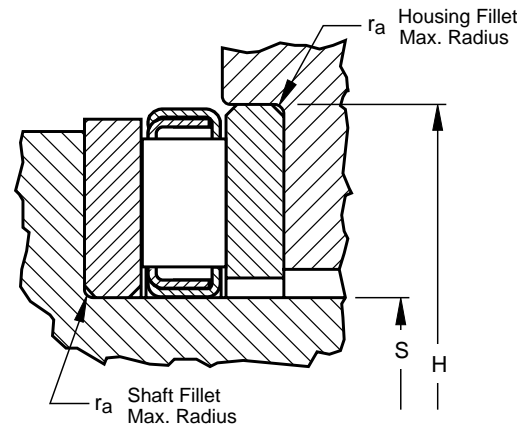




It is recommended that the cage and roller assembly be bore piloted when applying **NTHA** bearings. When different arrangements of piloting are required, please contact your Torrington Engineering Sales Office.

Back-up surfaces should be flat and square with the center line of the shaft.

To order individual thrust washers see washer designation below.



LOAD RATINGS AND PILOTING DIMENSIONS

Bearing Designation	Load Ratings		Limiting Speed	S Shaft Pilot Diameter		H Housing Pilot Fillet Diameter		ra Thrust Radii		Thrust Washer Designation	Thrust Washer Thickness	
	Basic Dynamic Load Rating Ca	Basic Static Load Rating Coa ISO 76		+0.0000 -0.0050	+0.000 -0.130	+0.0050 -0.0000	+0.130 -0.000	(max.)			+0.0000 -0.0030	+0.000 -0.076
NTHA-2448	16 200	60 600	5 700	1.4993	38,082	3.0007	76,218	0.032	0.8	TRI-2448 TRID-2448	0.2810	7,137
NTHA-3258	25 700	88 500	4 700	1.9990	50,775	3.6259	92,098	0.062	1.6	TRJ-3258 TRJD-3258	0.3125	7,938
NTHA-3460	26 600	94 100	4 600	2.1240	53,950	3.7511	95,278	0.062	1.6	TRJ-3460 TRJD-3460	0.3125	7,938
NTHA-3662	27 500	99 600	4 400	2.2489	57,122	3.8761	98,453	0.062	1.6	TRJ-3662 TRJD-3662	0.3125	7,938
NTHA-3864	28 400	105 000	4 300	2.3739	60,297	4.0011	101,628	0.062	1.6	TRJ-3864 TRJD-3864	0.3125	7,938
NTHA-4066	29 200	111 000	4 100	2.4989	63,472	4.1263	104,808	0.062	1.6	TRJ-4066 TRJD-4066	0.3125	7,938
NTHA-4270	31 100	122 000	3 900	2.6238	66,645	4.3443	110,345	0.062	1.6	TRJ-4270 TRJD-4270	0.3125	7,938
NTHA-4472	32 000	128 000	3 800	2.7488	69,820	4.4693	113,520	0.062	1.6	TRJ-4472 TRJD-4472	0.3125	7,938
NTHA-4876	33 800	140 000	3 600	2.9988	76,170	4.7195	119,875	0.062	1.6	TRJ-4876 TRJD-4876	0.3125	7,938
NTHA-5280	35 400	152 000	3 400	3.2487	82,517	4.9695	126,225	0.062	1.6	TRJ-5280 TRJD-5280	0.3125	7,938
NTHA-5684	36 700	162 000	3 200	3.4987	88,867	5.2195	132,575	0.062	1.6	TRJ-5684 TRJD-5684	0.3125	7,938

Required Basic Dynamic Load Rating (Ca) = Applied Load • SF • LF • HF (See page E75).

The Basic Dynamic Load Rating, Ca, is to be used in load-life calculations taking into consideration the application guidelines and limitations given in this catalog. Applications involving dynamic loads approaching this rating should be referred to your Torrington Engineering Sales Office before final selection is made. Load ratings are based on a minimum raceway hardness of 58 HRC or equivalent.

