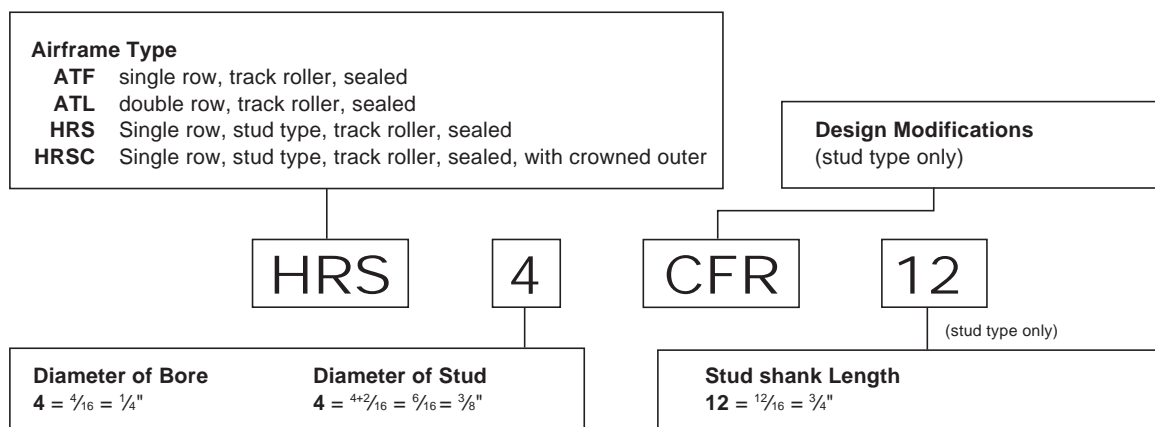
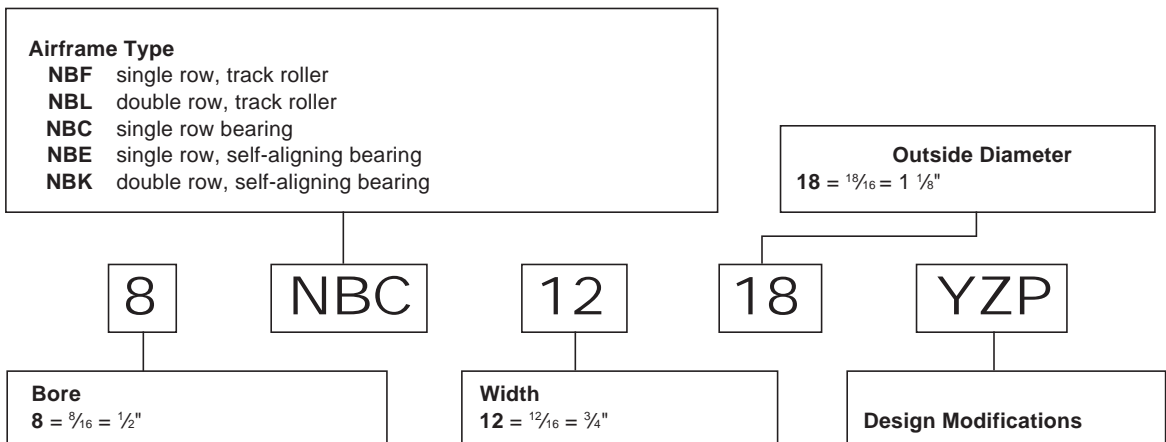


Airframe Needle Roller Bearings

Nomenclature	Page
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TYPES ATF, ATL	136-137
TYPES NBF, NBL	138-139
TYPE NBC	140-141
TYPES NBE, NBK	142-143
TYPES HRS, HRSC	144-145
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Airframe Needle Roller Bearings





INTRODUCTION

The bearings described in this section of the catalog have been designed to meet the specific needs of the airframe industry. Most of these bearing conform to military and national standards current at the time of publication of the catalog. Included are the bearings approved by the International Standards organization (ISO).

Before selecting specific airframe needle roller bearings, the Engineering Section of this catalog should be reviewed for detailed information concerning:

- bearing life and reliability
- definition of load ratings
- lubrication

IDENTIFICATION

The code letters **ATF** denote a sealed airframe track roller bearing with a single row of needle rollers, internal thrust washers and a crowned o.d.

The code letters **ATL** denote a sealed airframe track roller bearing with two rows of needle rollers and internal thrust washers.

The code letters **NBF** denote an airframe track roller bearing with a single row of needle rollers.

The code letters **NBL** denote an airframe track roller bearing with two rows of needle rollers.

The code letters **NBC** denote an airframe bearing with a single row of needle rollers. Type **NBC** bearings must be mounted in supporting housings.

The code letters **NBE** denote a self-aligning airframe needle roller bearing with a single row of needle rollers. The code letters **NBK** denote an airframe bearing similar to type **NBE** but with two rows of needle rollers. Both types **NBE** and **NBK** bearings must be mounted in supporting housings.

The code letters **HRS** denote a stud type airframe track roller bearing with a single row of needle rollers. This bearing can be sealed.

The code letters **HRSC** denote a sealed, stud type airframe track roller bearing with a single row of needle rollers and a crowned o.d.

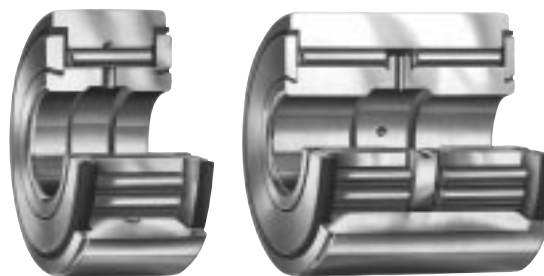
All of these various types of airframe needle roller bearings meet the requirements of U.S Military Specification MIL-B-3990 and the following Military Standards:

bearing type	military standard	bearing type	military standard
ATF	MS21438	NBC	MS24461
ATL	MS21439	NBE	MS24463
NBF	MS24465	NBK	MS24464
NBL	MS24466	HRS	MS21432
		HRSC	MS21447

Most of the types and sizes are also covered by ISO 1002 and British Standard SP.89

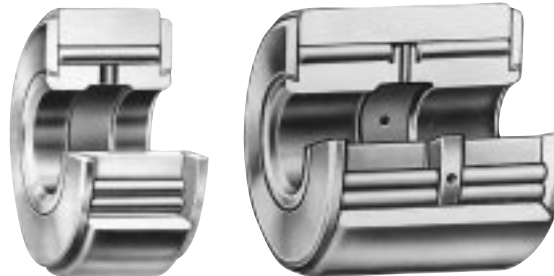
Torrington airframe needle roller bearings are permanently marked with the bearing designation (which includes the bearing type code) and the military standard number as listed in the tabular pages.

Since these bearings are quite often supplied prelubricated to meet special requirements, the airframe manufacturer's parts list or another reliable source should always be consulted when ordering bearings for service or field replacement, to make certain that bearings with the correct lubricant are used.



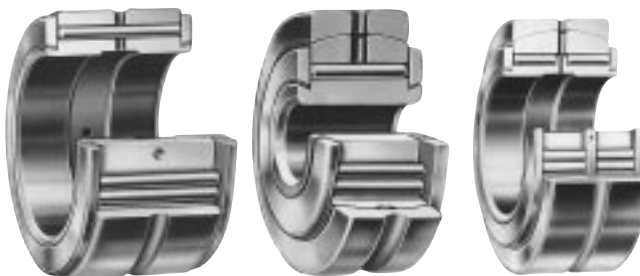
ATF

ATL



NBF

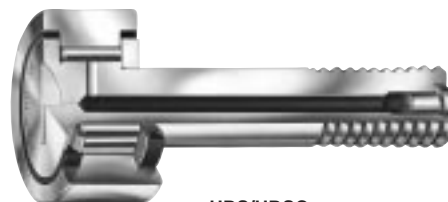
NBL



NBC

NBE

NBK



HRS/HRSC



BEARING TYPE SELECTION

Types **ATF** and **NBF** bearings are designed for use as track rollers to withstand heavy rolling loads. If their full radial capacity is to be realized, they should be mounted on high strength bolts. Also, the initial alignment between the bearing centerline and the surface of the track should be very good. To prevent deflections under load that would cause poor load distribution along the length of the rolling elements, the bearing should be straddle mounted in a rigid housing, and the track should be rigidly supported.

Types **ATF** and **NBF** bearings are sometimes cantilever mounted on high strength bolts. In this case, the deflection of the supporting member, the mounting bolt and the track should be balanced as carefully as possible to improve the load distribution. If this cannot be accomplished, the track should be crowned, or preference should be given to the type **ATF** which has a crowned outer ring.

Types **ATL** and **NBL** bearings are intended to carry rolling loads which are greater than those for which types **ATF** and **NBF** are designed. Since types **ATL** and **NBL** bearings are quite long, it is important to mount them on high strength shafts or bolts. The alignment between the bearing axis and the track is even more critical than with types **ATF** and **NBF**. Types **ATL** and **NBL** bearings must be straddle mounted.

Types **ATF** and **ATL** bearings are sealed and have internal thrust washers, both of which increase the life in case the bearings are infrequently relubricated.

Type **NBC** bearings are designed primarily to carry heavy static loads, or moderate loads under oscillation or slow rotation. This type of bearing can tolerate incidental thrust loads only through the outer ring when the retaining washers are properly backed up.

Type **NBC** bearings must be supported by housings and mounted on high strength shafts if their inherent load ratings are to be realized. Initial alignment must be good and operating deflections must be minimized to insure uniform load distribution along the length of the rolling elements.

Types **NBE** and **NBK** bearings are also used primarily for heavy static loads, and will also handle oscillation or slow rotation. They are designed to accommodate only minor locational thrust loads. Types **NBE** and **NBK** bearings, like type **NBC**, must be supported by housings and mounted on high strength shafts if their inherent load ratings are to be realized.

Types **NBE** and **NBK** bearings are of larger cross section than the type **NBC**, and, if properly mounted, will tolerate misalignment up to $\pm 5^\circ$. They are **not** designed to self-align under heavy loads. If alignment must be accommodated while the bearings are highly loaded, the torque required to overcome the friction at the spherical surfaces may overload the rolling elements.

Types **HRSC** and **HRS** bearings are designed for use as track rollers to carry moderate rolling loads. The bearings have an integral stud, which eliminates the need for a separate mounting bolt.

Types **HRSC** and **HRS** are to be cantilever mounted. Under load, the supporting member, the bearing stud, and the track may deflect to produce misalignment between the bearing and the track. These deflections should be carefully balanced to minimize the effective misalignment, and improve the load distribution. Where misalignment is a factor, preference should be given to type **HRSC**, which has a crowned outer ring.

CONSTRUCTION

All of these airframe needle roller bearings incorporate materials, protective finishes and relubrication facilities required for airframe service.

Materials:

The outer rings, inner rings and self-aligning rings are made of high carbon chrome steel, hardened and precision ground.

Studs are made of bearing quality steel, heat treated to 60 HRC minimum in the raceway area and 36-44 HRC in the shank and thread areas.

The rollers are made of high carbon chrome steel, through hardened, precision ground and lapped.

The retaining washers are made of high carbon steel, and hardened.

Protective finishes:

Outer rings of types **ATF**, **ATL**, **NBF**, **NBL**, **HRSC** and **HRS** bearings, which are subjected to heavy rolling loads, are chrome plated on the exposed surfaces for corrosion protection. The other external surfaces of the bearings, except the inner ring bore, (where applicable) are cadmium or zinc-nickel plated.

Types **NBC**, **NBE** and **NBK** bearings are cadmium or zinc-nickel plated on all external surfaces except the bore of the inner ring.

Relubrication facilities:

The inner rings of types **ATF**, **ATL**, **NBF** and **NBL** bearings are provided with relubrication grooves and holes. Relubrication features are omitted from the outer rings since they would be undesirable in track roller bearings.

Types **HRSC** and **HRS** can be provided with lubrication fittings in the flanged end or threaded end of the stud, or with no relubrication provision.

Grooves are provided in the bore and outside diameters of the larger types **NBC**, **NBE** and **NBK** bearings with drilled holes leading to the needle roller complement to allow relubrication through the housing or the shaft. The smaller sizes, as noted in the tabular pages, do not have relubrication grooves and holes in their inner rings since the mounting shafts would be considerably weakened by the required drilled lubrication holes.

The right is reserved to change material specifications or to revise designs without notice.



LOAD RATINGS

The **limit** load ratings listed in this catalog are the maximum radial loads which can be applied without impairing the subsequent function of the bearing in airframe applications.

The **ultimate (static fracture)** load ratings are not less than 1.5 times the limit load rating.

For types **ATF, ATL, NBF** and **NBL** bearings, the ultimate load rating assumes an unsupported outer ring. Therefore the **limit** load ratings listed on the tabular pages correspond to 2/3 of the **limit** load ratings of a fully supported bearing, or 1/3 ASC. The **ultimate (static fracture)** load ratings are not less than 1.5 times the **limit** load rating (2/3 ASC).

In addition to heavy static radial loads, types **ATF, ATL, NBF** and **NBL** bearings must withstand heavy rolling loads under slow rotation. The **capacity as a track roller** is the load the bearing will carry as a track roller for an L₁₀ life of 20,000 revolutions. The **capacity as a track roller** is based on 1/3 Aircraft Static Capacity.

To calculate the L₁₀ life, in revolutions, of a type **ATF, ATL, NBF** and **NBL** bearing, the following formula should be used:

$$TL = \frac{20000}{\sum Ti \left(\frac{Pi}{CTR}\right)^6 + \sum ti \left(\frac{pi}{CTR}\right)^{10/3}}$$

where TL = total life (L₁₀)

CTR = capacity as a track roller

P_i = loads greater than CTR

p_i = loads less than CTR

T_i = fraction of total revolutions at load P_i

t_i = fraction of total revolutions at load p_i

Under no circumstances should the applied load exceed the **limit** load rating.

In the case of types **NBC, NBE** and **NBK** bearings, the ultimate load ratings correspond to the Aircraft Static Capacity (ASC). The **limit** load rating listed is 2/3 of the ultimate load rating.

Types **NBC, NBE** and **NBK** bearings are generally applied where they carry only moderate loads while oscillating or rotating slowly, but they are expected to carry heavy static radial loads or shock loads. For this reason the basic (dynamic) load ratings are not listed. If the basic load ratings are required for specific bearings, please consult the Aircraft Engineering Department.

If types **NBE** and **NBK** bearings are required to carry more than light loads while self-aligning, the torque required to overcome the friction between the spherical surfaces may add substantially to the radial loads on the rolling elements. Under such circumstances, please consult the Fafnir Engineering Aircraft Group.

Type **HRS** and **HRSC** track roller bearings have heat treated studs as such working loads are not limited by stud strength. The limit load ratings listed on the tabular pages correspond to 2/3 of ASC. The **ultimate (static fracture)** load ratings are not less than 1.5 times the limit load rating (ASC). The capacity as a track roller for 20,000 revolutions L₁₀ life is 1/3 • ASC.

TRACK CAPACITY

When applying types **ATF, ATL, NBF, NBL, HRS** and **HRSC** track roller bearings, the compressive strength of the track material is often the critical design factor for the application. Where listed, the **track capacities** are based on a track hardness equivalent to 40 HRC. For other hardness values multiply the **track capacity** listed on the tabular pages by the appropriate factor selected from Table 1.

When using track materials with high hardness, it must be remembered that the load applied to a bearing should not exceed the limit load for that bearing.

Table 1

Track Hardness	Track Capacity Factor
HRC	
20	0.4
25	0.5
30	0.6
35	0.8
40	1.0
45	1.4
50	1.9
55	2.6
58	3.2

TEMPERATURE

The unsealed airframe needle bearings listed herein can be operated at temperatures up to 400° F(200°C) if a suitable lubricant is used. Subjecting these bearings to higher temperatures will result in a loss of capacity which depends upon the length of time that the bearings are exposed to the higher temperature. Temperature differential between bearing parts should be watched to prevent take-up of internal clearance due to differential expansion.

The operating temperature of the sealed bearings is limited by the seal material and should not exceed 250°F (120°C).

The data herein permit tentative bearing selection but before the application is finalized, consult the Fafnir Engineering Aircraft Group.

SPECIAL BEARINGS

The Torrington Company supplies airframe bearings, in addition to types **ATF** and **ATL**, which are sealed to help retain lubricants and exclude foreign matter. We also supply bearings with special configurations, materials, protective finishes, tolerances and lubricants. Please consult the Fafnir Engineering Department for details.



Types ATF, ATL

CONSTRUCTION

A non-separable unit, consisting of inner ring, needle rollers, retaining washers, internal thrust washers, seals, and an extra-thick outer ring to withstand heavy rolling loads. The end washers are fastened to the inner ring. Type ATF has a single row of rollers and type ATL has two rows of rollers. The outer ring of type ATF bearing is crowned.

The seals on the ATF and ATL bearings are located in counterbores of the outer ring and seal against the o.d. of the end washers, providing a good retention of lubricant and exclusion of foreign material. Internal thrust washers, made of a self-lubricating resin material, separate the steel thrust surfaces, extending the life of lubricant and bearing.

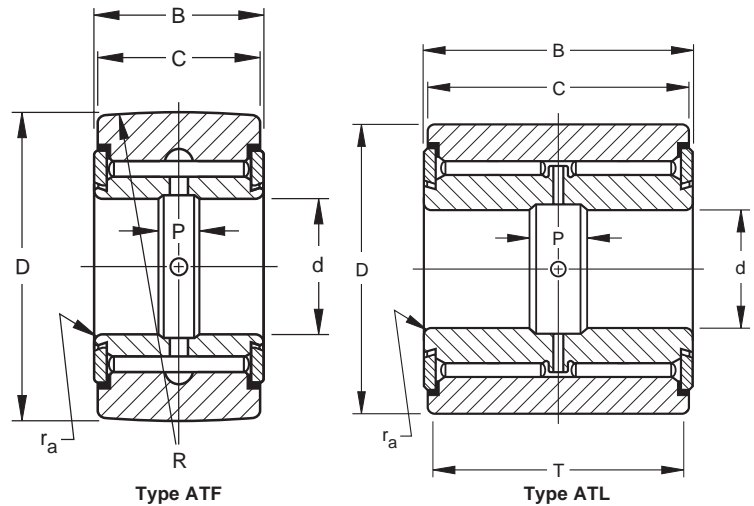
Grooves and holes for relubrication are provided in the inner ring only, since the outer ring must serve as a roller. Type ATF has a groove in the bore of the outer ring for storage of additional lubricant. For protection from corrosion under heavy rolling loads, the O.D. of the bearing is chrome plated. Other exposed surfaces, as mounted are cadmium or zinc-nickel plated. Inner rings may be black oxidized or plated.

DIMENSIONS

Types ATF and ATL are manufactured to inch nominal dimensions. Metric dimensions shown are for the convenience of the user, and the controlling dimensions are in inches.

Dimensions listed are for the finished bearing after plating.

The shaft diameter dimensions necessary to mount these bearings properly are listed on the facing page.



BEARING DIMENSIONS

d* Bore				D* O.D.		B Overall Width		Bearing Designation	C Outer Ring Width		ra§ Shaft Fillet		R Crown Radius		P Inner Ring Groove Width	
inches		millimeters		+0.001 -0.001	+0.025 -0.025	+0.000 -0.010	+0.00 -0.25		+0.000 -0.005	+0.00 -0.13	(max.)		(ref.)			
max.	min.	max.	min.	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	
0.1900	0.1893	4.826	4.808	0.7500	19.050	0.312	7.92	ATF-3	0.270	6.86	0.022	0.6	11	280	0.094	2.4
0.2500	0.2493	6.350	6.332	0.8750	22.225	0.375	9.52	ATF-4	0.335	8.51	0.022	0.6	11	280	0.125	3.2
0.3750	0.3743	9.525	9.507	1.0625	26.988	0.500	12.70	ATF-6	0.445	11.30	0.022	0.6	11	280	0.188	4.8
0.5000	0.4993	12.700	12.682	1.3125	33.338	0.625	15.88	ATF-8	0.570	14.48	0.032	0.8	13	330	0.188	4.8
0.6250	0.6243	15.875	15.857	1.5000	38.100	0.750	19.05	ATF-10	0.695	17.65	0.032	0.8	18	460	0.250	6.4
0.7500	0.7493	19.050	19.032	1.7500	44.450	1.000	25.40	ATF-12	0.940	23.88	0.032	0.8	31	790	0.250	6.4
0.8750	0.8743	22.225	22.207	2.0000	50.800	1.125	28.58	ATF-14	1.065	27.05	0.032	0.8	36	910	0.250	6.4
1.2500	1.2493	31.750	31.732	2.5000	63.500	1.250	31.75	ATF-20	1.190	30.23	0.032	0.8	61	1550	0.375	9.5
1.5000	1.4993	38.100	38.082	3.0000	76.200	1.500	38.10	ATF-24	1.440	36.58	0.032	0.8	61	1550	0.375	9.5
								ATF-28								
0.3750	0.3743	9.525	9.512	1.1250	28.575	1.000	25.40	ATL-6	0.940	23.88	0.022	0.6	-	-	0.188	4.8
0.5000	0.4993	12.700	12.687	1.3750	34.925	1.250	31.75	ATL-8	1.190	30.23	0.032	0.8	-	-	0.250	6.4
0.6250	0.6243	15.875	15.857	1.6250	41.275	1.500	38.10	ATL-10	1.440	36.58	0.032	0.8	-	-	0.375	9.5
0.7500	0.7493	19.050	19.032	1.8750	47.625	1.750	44.45	ATL-12	1.690	42.93	0.032	0.8	-	-	0.375	9.5
0.8750	0.8743	22.225	22.207	2.1250	53.975	2.000	50.80	ATL-14	1.940	49.28	0.032	0.8	-	-	0.375	9.5
1.0000	0.9993	25.400	25.382	2.3750	60.325	2.250	57.15	ATL-16	2.190	55.63	0.032	0.8	-	-	0.375	9.5
1.2500	1.2493	31.750	31.732	2.7500	69.850	2.500	63.50	ATL-20	2.440	61.98	0.032	0.8	-	-	0.375	9.5
1.5000	1.4993	38.100	38.082	3.0000	76.200	2.750	69.85	ATL-24	2.690	68.33	0.032	0.8	-	-	0.375	9.5
1.7500	1.7493	44.450	44.432	3.4375	87.312	3.000	76.20	ATL-28	2.940	74.68	0.032	0.8	-	-	0.375	9.5
2.0000	1.9993	50.800	50.782	3.8750	98.425	3.000	76.20	ATL-32	2.940	74.68	0.032	0.8	-	-	0.375	9.5

* Bore and o.d. tolerance limits correspond to the single mean diameter (the arithmetical mean of the largest and smallest diameters in a single radial plane).

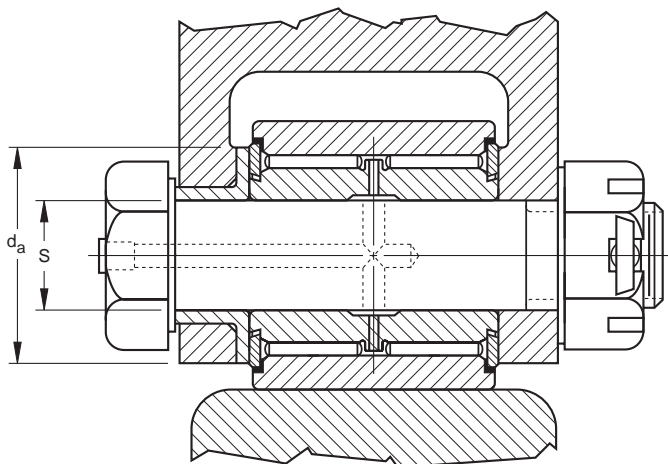
§ Equal to minimum bearing chamfers.



MOUNTING

Types ATF and ATL bearings are designed for heavy rolling loads. The type ATF bearing is usually clevis mounted or cantilever mounted on a high strength shaft or bolt. The type ATL bearing must be straddle mounted on a high strength shaft or bolt.

The end washers are fastened to the inner ring in a manner only to maintain the integrity of the assembly while handling and installing the bearing. Therefore, when mounted they should be firmly backed up by washers or other clamping surfaces which are flat and square with the shaft center line. To provide sufficient washer support, the outside diameter of the clamping surfaces should be at least as large as the minimum clamping diameter (d_a) listed below.



LOAD RATINGS

Bearings are constructed to provide maximum capacity under rolling loads.

The limit load ratings (also called “allowable working load ratings”) of the bearings are listed below. The **ultimate** load ratings are not less than 1.5 times the **limit** load ratings. The **ultimate** load ratings correspond to 2/3 of the Aircraft Static Capacity ratings.

For additional data refer to page 134. Before final bearing selection is made, please consult our Fafnir Engineering Aircraft Group.

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

MOUNTING DIMENSIONS

T		Mass (appr.)	S Shaft Diameter								d_a Clamping Diameter		Clamping Force (max.)	Bearing Designation	Military Standard Number (U.S.)	Bearing Capacity	
Track Contact Width minimum			Transition Fits (loose range)				Transition Fits (tight range)				(minimum)					as a Track Roller (CTR)	Limit Load Rating
inch	mm	lbs	max	min	max	min	max	min	max	min	inch	mm	lbf			lbf	lbf
-	-	0.030	0.1894	0.1889	4.811	4.798	0.1902	0.1897	4.831	4.818	0.438	11.1	480	ATF-3	MS21438-103	900	1200
-	-	0.051	0.2494	0.2489	6.335	6.332	0.2502	0.2497	6.355	6.342	0.516	13.1	870	ATF-4	MS21438-104	1430	1910
-	-	0.103	0.3744	0.3739	9.510	9.497	0.3752	0.3747	9.530	9.517	0.672	17.1	2100	ATF-6	MS21438-106	2700	3600
-	-	0.187	0.4994	0.4989	12.685	12.672	0.5002	0.4997	12.705	12.692	0.844	21.4	3840	ATF-8	MS21438-108	4300	5780
-	-	0.279	0.6244	0.6239	15.860	15.847	0.6252	0.6247	15.880	15.867	0.953	24.2	6150	ATF-10	MS21438-110	6400	8530
-	-	0.520	0.7494	0.7489	19.035	19.022	0.7502	0.7497	19.055	19.042	1.109	28.2	8950	ATF-12	MS21438-112	10700	14200
-	-	0.749	0.8744	0.8739	22.210	22.197	0.8752	0.8747	22.230	22.217	1.219	31.0	12200	ATF-14	MS21438-114	14400	19300
-	-	1.160	1.2494	1.2488	31.735	31.720	1.2503	1.2497	31.758	31.743	1.625	41.3	25800	ATF-20	MS21438-120	18900	25300
-	-	2.360	1.4994	1.4988	38.085	38.070	1.5003	1.4997	38.108	38.093	2.000	50.4	25800	ATF-24	MS21438-124	28400	37900
0.815	20.70	0.239	0.3744	0.3739	9.510	9.497	0.3752	0.3747	9.530	9.517	0.672	17.1	2100	ATL-6	MS21439-106	5370	7130
1.065	27.05	0.437	0.4994	0.4989	12.685	12.672	0.5002	0.4997	12.705	12.692	0.891	22.6	3840	ATL-8	MS21439-108	9370	12500
1.315	33.40	0.728	0.6244	0.6239	15.860	15.847	0.6252	0.6247	15.880	15.867	1.109	28.2	6150	ATL-10	MS21439-110	15000	19900
1.565	39.75	1.130	0.7494	0.7489	19.035	19.022	0.7502	0.7497	19.055	19.042	1.281	32.5	8950	ATL-12	MS21439-112	21400	28500
1.895	48.13	1.630	0.8744	0.8739	22.210	22.197	0.8752	0.8747	22.230	22.217	1.469	37.3	12200	ATL-14	MS21439-114	28900	38500
2.045	51.94	2.310	0.9994	0.9989	25.385	25.372	1.0002	0.9997	25.405	25.392	1.578	40.1	16300	ATL-16	MS21439-116	33600	44900
2.225	56.52	3.260	1.2494	1.2488	31.735	31.720	1.2503	1.2497	31.758	31.743	1.844	46.8	25800	ATL-20	MS21439-120	44600	59500
2.475	62.86	4.330	1.4994	1.4988	38.085	38.070	1.5003	1.4997	38.108	38.093	1.984	50.4	25800	ATL-24	MS21439-124	53600	71300
2.685	68.20	6.090	1.7494	1.7488	44.435	44.420	1.7503	1.7497	44.458	44.443	2.281	57.9	25800	ATL-28	MS21439-128	69000	92000
2.685	68.20	7.350	1.9994	1.9987	50.785	50.767	2.0003	1.9996	50.808	50.790	2.562	65.1	25800	ATL-32	MS21439-132	76600	102000



Types NBF, NBL

CONSTRUCTION

A non-separable unit, consisting of inner ring, needle rollers, retaining washers and outer ring made extra-thick to better withstand rolling loads. The end washers are fastened to the inner ring. Type NBF has a single row of rollers, and type NBL has two rows of rollers.

Lubrication grooves and holes are provided for relubrication, in the inner ring only since the outer ring must serve as a roller.

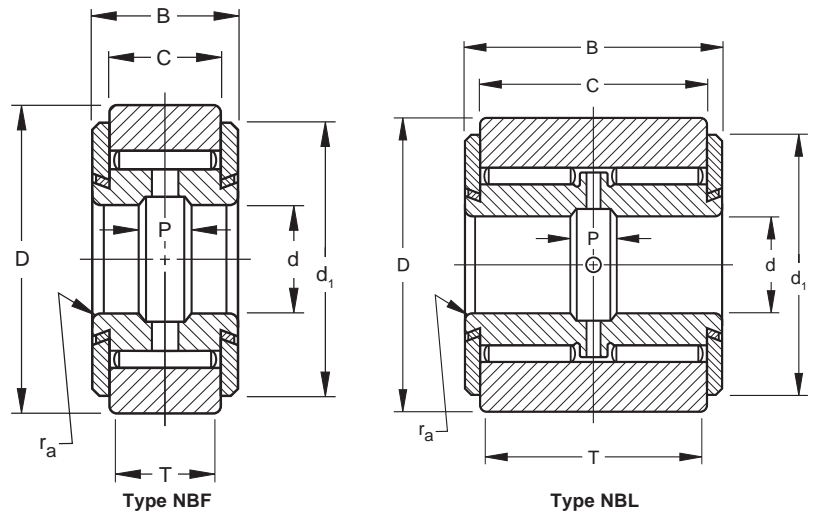
For protection from corrosion under the heavy rolling loads, the O.D. of the bearing is chrome plated. Other exposed surfaces, as mounted, are cadmium plated, or zinc-nickel plated.

DIMENSIONS

Dimensions listed below are for the finished bearing after plating.

Bearings are made to ISO, British, and U.S. Military Standards, and are constructed to have maximum capacity under rolling loads.

The shaft diameter dimensions necessary to mount these bearings properly are listed on the facing page.



BEARING DIMENSIONS

d* Bore		D* O.D.	B Overall Width	Bearing Designation	C Outer Ring Width	ra§ Shaft Fillet	d1 End Washer Diameter	P Inner Ring Groove Width	T Track Contact Width	Mass
inches		+0.000 -0.001	+0.000 -0.005		+0.000 -0.005	(max.)				(approx.)
max.	min.	inch	inch		inch	inch	inch	inch	inch	lb
0.1900	0.1893	0.7500	0.312	3NBF512YJ	0.218	0.022	0.688	0.094	0.125	0.029
0.2500	0.2493	0.8750	0.375	4NBF614YJ	0.281	0.022	0.750	0.125	0.218	0.049
0.3750	0.3743	1.0625	0.500	6NBF817YJ	0.375	0.022	0.938	0.188	0.312	0.098
0.5000	0.4993	1.3125	0.625	8NBF1021YJ	0.500	0.032	1.188	0.188	0.438	0.178
0.6250	0.6243	1.5000	0.750	10NBF1224YJ	0.625	0.032	1.375	0.250	0.562	0.266
0.7500	0.7493	1.7500	1.000	12NBF1628YJ	0.875	0.032	1.625	0.250	0.750	0.495
0.8750	0.8743	2.0000	1.125	14NBF1832YJ	1.000	0.032	1.875	0.250	0.875	0.713
1.2500	1.2493	2.5000	1.250	20NBF2040YJ	1.049	0.032	1.906	0.375	0.938	1.100
1.5000	1.4993	3.0000	1.500	24NBF2448YJ	1.299	0.032	2.875	0.375	1.172	2.250
0.3750	0.3743	1.1250	1.000	6NBL1618YJ	0.875	0.022	1.000	0.188	0.750	0.228
0.5000	0.4993	1.3750	1.250	8NBL2022YJ	1.125	0.032	1.250	0.250	1.000	0.416
0.6250	0.6243	1.6250	1.500	10NBL2426YJ	1.375	0.032	1.500	0.375	1.125	0.693
0.7500	0.7493	1.8750	1.750	12NBL2830YJ	1.625	0.032	1.750	0.375	1.375	1.080
0.8750	0.8743	2.1250	2.000	14NBL3234YJ	1.875	0.032	2.000	0.375	1.625	1.550
1.0000	0.9993	2.3750	2.250	16NBL3638YJ	2.049	0.032	2.125	0.375	1.797	2.200
1.2500	1.2493	2.7500	2.500	20NBL4044YJ	2.299	0.032	2.500	0.375	2.047	3.100
1.5000	1.4993	3.0000	2.750	24NBL4448YJ	2.549	0.032	2.750	0.375	2.297	4.120
1.7500	1.7493	3.4375	3.000	28NBL4855YJ	2.799	0.032	3.188	0.375	2.547	5.800
2.0000	1.9993	3.8750	3.000	32NBL4862YJ	2.799	0.032	3.625	0.375	2.547	7.000

* Bore and o.d. tolerance limits correspond to the single mean diameter (the arithmetical mean of the largest and smallest diameters in a single radial plane).

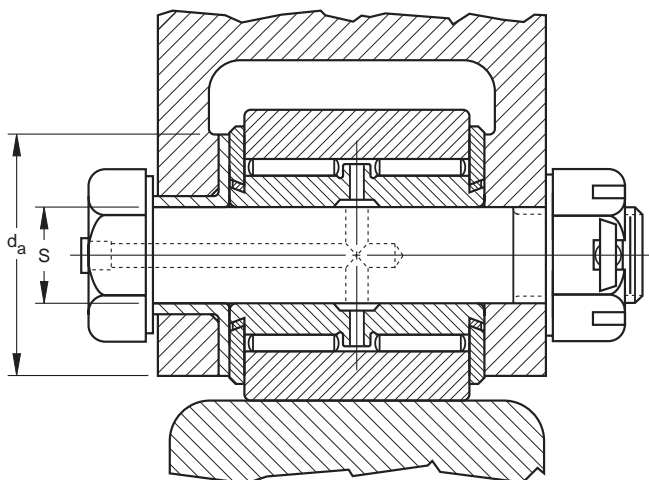
§ Equal to minimum inner bearing chamfers.



MOUNTING

Types NBF and NBL bearings are designed for heavy rolling loads. The type NBF bearing is usually clevis mounted or cantilever mounted on a high strength shaft or bolt. The type NBL bearing must be straddle mounted on a high strength shaft or bolt.

The end washers are fastened to the inner ring in a manner only to maintain the integrity of the assembly while handling and installing the bearing. Therefore, when mounted they should be firmly backed up by washers or other clamping surfaces which are flat and square with the shaft center line. To provide sufficient washer support, the outside diameter of the clamping surfaces should be at least as large as the minimum clamping diameter (d_a) listed below.



LOAD RATINGS

The limit load ratings (also called “allowable working load ratings”) of the bearings are listed below. The **ultimate** load ratings are not less than 1.5 times the **limit** load ratings. The ultimate load ratings correspond to $\frac{2}{3}$ of the Aircraft Static Capacity ratings.

The track capacity ratings listed below are based on a track hardness equivalent to 40 HRC. For track capacity ratings for other hardness values see page 134. It is important that the limit load rating of the bearings not be exceeded.

For additional data refer to page 134. Before final bearing selection is made, please consult our Fafnir Engineering Aircraft Group.

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

MOUNTING DIMENSIONS

S Shaft Diameter				d_a Clamping Diameter	Clamping Force	Bearing Designation	Military Standard Number (U.S.)	Track Capacity R _c 40 Steel	Bearing Capacity	
Transition Fits (loose range)		Transition (tight range)							as a Track Roller (CTR)	Limit Load Rating
max.	min.	max.	min.	min.	max.		(reference)	lbf	lbf	lbf
inch	inch	inch	inch	inch	lbf					
0.1894	0.1889	0.1902	0.1897	0.438	480	3NBF512YJ	MS24465-3	290	900	1200
0.2494	0.2489	0.2502	0.2497	0.516	870	4NBF614YJ	MS24465-4	575	1430	1910
0.3744	0.3739	0.3752	0.3747	0.672	2100	6NBF817YJ	MS24465-6	1000	2700	3600
0.4994	0.4989	0.5002	0.4997	0.844	3840	8NBF1021YJ	MS24465-8	1785	4300	5780
0.6244	0.6239	0.6252	0.6247	0.953	6150	10NBF1224YJ	MS24465-10	2600	6400	8530
0.7494	0.7489	0.7502	0.7497	1.109	8950	12NBF1628YJ	MS24465-12	4050	10700	14200
0.8744	0.8739	0.8752	0.8747	1.219	12200	14NBF1832YJ	MS24465-14	5350	14400	19300
1.2494	1.2488	1.2503	1.2497	1.625	25800	20NBF2040YJ	MS24465-20	7370	18900	25300
1.4994	1.4988	1.5003	1.4997	2.984	25800	24NBF2448YJ	—	10800	28400	37900
0.3744	0.3739	0.3752	0.3747	0.672	2100	6NBL1618YJ	MS24466-6	2600	5370	7130
0.4994	0.4989	0.5002	0.4997	0.891	3840	8NBL2022YJ	MS24466-8	4250	9370	12500
0.6244	0.6239	0.6252	0.6247	1.109	6150	10NBL2426YJ	MS24466-10	5650	15000	19900
0.7494	0.7489	0.7502	0.7497	1.281	8950	12NBL2830YJ	MS24466-12	7950	21400	28500
0.8744	0.8739	0.8752	0.8747	1.469	12200	14NBL3234YJ	MS24466-14	10650	28900	38500
0.9994	0.9989	1.0002	0.9997	1.578	16300	16NBL3638YJ	MS24466-16	13200	33600	44900
1.2494	1.2488	1.2503	1.2497	1.844	25800	20NBL4044YJ	MS24466-20	17300	44600	59500
1.4994	1.4988	1.5003	1.4997	1.984	25800	24NBL4448YJ	MS24466-24	21200	53600	71300
1.7494	1.7488	1.7503	1.7497	2.281	25800	28NBL4855YJ	MS24466-28	27000	69000	92000
1.9994	1.9987	2.0003	1.9996	2.562	25800	32NBL4862YJ	MS24466-32	30400	76600	102000



Type NBC

CONSTRUCTION

A non-separable unit, consisting of inner ring, outer ring, needle rollers, and retaining washers which are fastened to the inner ring.

Grooves and hole for relubrication are provided in the inner ring and outer ring.

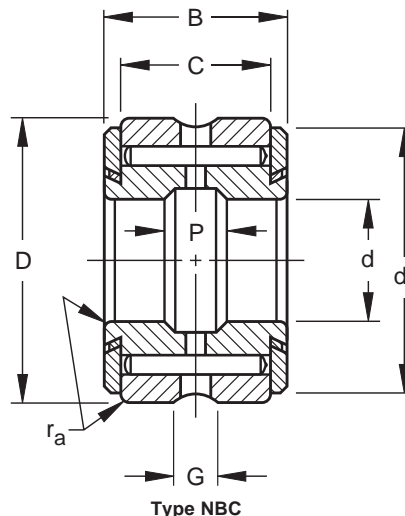
External surfaces, except the inner ring bore, are cadmium plated.

DIMENSIONS

Dimensions listed are for the finished bearing after plating.

Bearings are made to ISO and U.S. Military Specifications, and are constructed to have low radial clearance when mounted to minimize vibration and backlash.

The shaft diameter and housing bore dimensions necessary to mount these bearings properly are listed on the facing page.



BEARING DIMENSIONS

d* Bore		D* O.D.		B Overall Width	Bearing Designation	C Outer Ring Width	ra§ Shaft and housing Fillet (max.)	d1 End Washer Diameter	G Outer Ring Groove Width	P Inner Ring Groove Width	Mass
max.	min.	max.	min.	+0.000 -0.005		+0.000 -0.005	inch	inch	inch	inch	inch
inch	inch	inch	inch	inch		inch	inch	inch	inch	inch	
0.1900	0.1893	0.6875	0.6870	0.312	3NBC511ZP†	0.218	0.022	0.625	0.062	—	0.028
0.2500	0.2493	0.7500	0.7495	0.375	4NBC612ZP†	0.281	0.022	0.688	0.094	—	0.040
0.3125	0.3118	0.8125	0.8120	0.437	5NBC713ZP†	0.344	0.022	0.750	0.094	—	0.057
0.3750	0.3743	0.8750	0.8745	0.562	6NBC914YZP	0.469	0.022	0.812	0.125	0.188	0.075
0.4375	0.4368	0.9375	0.9370	0.625	7NBC1015YZP	0.531	0.032	0.875	0.125	0.188	0.097
0.5000	0.4993	1.1250	1.1245	0.750	8NBC1218YZP	0.656	0.032	1.031	0.125	0.188	0.165
0.5625	0.5618	1.1875	1.1870	0.875	9NBC1419YZP	0.781	0.032	1.094	0.156	0.188	0.207
0.6250	0.6243	1.2500	1.2495	1.000	10NBC1620YZP	0.906	0.032	1.156	0.156	0.250	0.252
0.7500	0.7493	1.3750	1.3745	1.125	12NBC1822YZP	1.000	0.032	1.281	0.156	0.250	0.336
0.8750	0.8743	1.6250	1.6245	1.250	14NBC2026YZP	1.125	0.032	1.500	0.156	0.375	0.423
1.0000	0.9993	1.7500	1.7495	1.250	16NBC2028YZP	1.125	0.032	1.625	0.156	0.375	0.510
1.2500	1.2493	2.0000	1.9994	1.250	20NBC2032YZP	1.049	0.032	1.906	0.156	0.375	0.600
1.5000	1.4993	2.2500	2.2494	1.250	24NBC2036YZP	1.049	0.032	2.156	0.156	0.375	0.710
1.7500	1.7493	2.5000	2.4994	1.250	28NBC2040YZP	1.049	0.032	2.406	0.156	0.375	0.780
2.0000	1.9993	2.7500	2.7494	1.250	32NBC2044YZP	1.049	0.032	2.656	0.156	0.375	0.880
2.2500	2.2493	3.0000	2.9994	1.250	36NBC2048YZP	1.049	0.022	2.906	0.156	0.375	0.980
2.5000	2.4993	3.2500	3.2492	1.250	40NBC2052YZP	1.049	0.032	3.156	0.156	0.375	1.060
2.7500	2.7493	3.5000	3.4992	1.250	44NBC2056YZP	1.049	0.032	3.406	0.156	0.375	1.150
3.0000	2.9993	3.7500	3.7492	1.250	48NBC2060YZP	1.049	0.032	3.656	0.156	0.375	1.240
3.2500	3.2492	4.0000	3.9992	1.250	52NBC2064YZP	1.049	0.032	3.906	0.156	0.375	1.340
3.5000	3.4992	4.3750	4.3742	1.250	56NBC2070YZP	1.049	0.044	4.219	0.156	0.375	1.730
3.7500	3.7492	4.6250	4.6242	1.250	60NBC2074YZP	1.049	0.044	4.469	0.156	0.375	1.840
4.0000	3.9992	4.8750	4.8740	1.250	64NBC2078YZP	1.049	0.044	4.719	0.156	0.375	1.990

*Bore and o.d. tolerance limits correspond to the single mean diameter (the arithmetical mean of the largest and smallest diameters in a single radial plane).

†These bearings have no oil holes or groove in inner ring.

§Equal to minimum bearing chamfers.

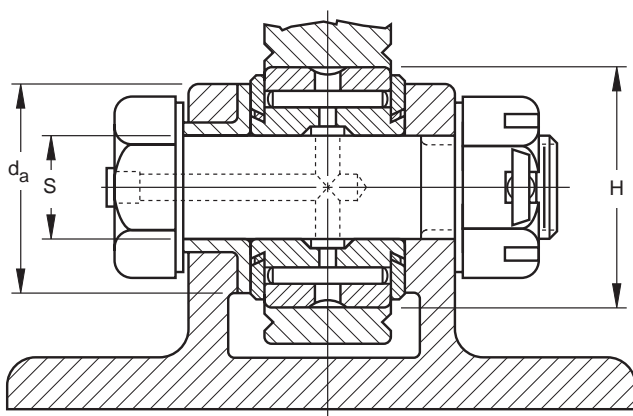


MOUNTING

The housing bore dimensions shown below are applicable to bearings mounted in steel. These dimensions should be decreased .0002" (.005mm) when aluminum alloy housings are used.

The end washers are fastened to the inner ring in a manner only to maintain the integrity of the assembly while handling and installing the bearing. Therefore, when mounted they should be firmly backed up by washers or other clamping surfaces which are flat and square with the shaft center line. To provide sufficient washer support, the outside diameter of the clamping surfaces should be at least as large as the minimum clamping diameter (d_a) listed below.

Tight range transitional fitting practice should not be used for both the outer and the inner rings, since this may cause excessive preloading of the bearing. If this type of mounting becomes necessary, consult our engineering department for specific recommendations.



LOAD RATINGS

The limit load ratings (also called "allowable working load ratings") of the bearings are listed below. The **ultimate** load ratings are not less than 1.5 times the **limit** load ratings. The ultimate load ratings correspond to the Aircraft Static Capacity ratings.

For additional data refer to page 134. Before final bearing selection is made, please consult our Fafnir Engineering Aircraft Group.

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

MOUNTING DIMENSIONS

S Shaft Diameter				H Housing Bore				d_a Clamping Diameter	Clamping Force	Bearing Designation	Military Standard Number (U.S.) (reference)	Limit Load Rating
Transition Fits (loose range)		Transition Fits (tight range)		Transition Fits (tight range)		Transition Fits (loose range)						
max	min	max	min	min	max	min	max	inch	lbf			lbf
0.1894	0.1889	0.1902	0.1897	0.6867	0.6872	0.6874	0.6879	0.438	480	3NBC511ZP†	MS24461-3	1800
0.2494	0.2489	0.2502	0.2497	0.7492	0.7497	0.7499	0.7504	0.516	870	4NBC612ZP†	MS24461-4	2870
0.3119	0.3114	0.3127	0.3122	0.8117	0.8122	0.8124	0.8129	0.578	1400	5NBC713ZP†	MS24461-5	4070
0.3744	0.3739	0.3752	0.3747	0.8742	0.8747	0.8749	0.8754	0.641	2100	6NBC914YZP	MS24461-6	6330
0.4369	0.4364	0.4377	0.4372	0.9367	0.9372	0.9374	0.9379	0.703	2850	7NBC1015YZP	MS24461-7	8000
0.4994	0.4989	0.5002	0.4997	1.1242	1.1247	1.1249	1.1254	0.844	3840	8NBC1218YZP	MS24461-8	11600
0.5619	0.5614	0.5627	0.5622	1.1867	1.1872	1.1874	1.1879	0.891	4870	9NBC1419YZP	MS24461-9	15000
0.6244	0.6239	0.6252	0.6247	1.2492	1.2497	1.2499	1.2504	0.953	6150	10NBC1620YZP	MS24461-10	18900
0.7494	0.7489	0.7502	0.7497	1.3741	1.3747	1.3749	1.3755	1.078	8950	12NBC1822YZP	MS24461-12	23900
0.8744	0.8739	0.8752	0.8747	1.6241	1.6247	1.6249	1.6255	1.250	12200	14NBC2026YZP	MS24461-14	30500
0.9994	0.9989	1.0002	0.9997	1.7491	1.7497	1.7499	1.7505	1.375	16300	16NBC2028YZP	MS24461-16	33900
1.2494	1.2488	1.2503	1.2497	1.9991	1.9997	1.9999	2.0005	1.625	25800	20NBC2032YZP	MS24461-20	37900
1.4994	1.4988	1.5003	1.4997	2.2488	2.2496	2.2499	2.2507	1.875	25800	24NBC2036YZP	MS24461-24	44200
1.7494	1.7488	1.7503	1.7497	2.4988	2.4996	2.4999	2.5007	2.125	25800	28NBC2040YZP	MS24461-28	50500
1.9994	1.9987	2.0003	1.9996	2.7488	2.7496	2.7499	2.7507	2.375	25800	32NBC2044YZP	MS24461-32	56800
2.2494	2.2487	2.2503	2.2496	2.9988	2.9996	2.9999	3.0007	2.625	25800	36NBC2048YZP	MS24461-36	63100
2.4994	2.4987	2.5003	2.4996	3.2485	3.2495	3.2498	3.2508	2.875	25800	40NBC2052YZP	MS24461-40	69400
2.7494	2.7487	2.7503	2.7496	3.4985	3.4995	3.4998	3.5008	3.125	25800	44NBC2056YZP	MS24461-44	75700
2.9994	2.9987	3.0003	2.9996	3.7485	3.7495	3.7498	3.7508	3.375	25800	48NBC2060YZP	MS24461-48	82000
3.2494	3.2486	3.2504	3.2496	3.9985	3.9995	3.9998	4.0008	3.641	25800	52NBC2064YZP	MS24461-52	88300
3.4994	3.4986	3.5004	3.4996	4.3735	4.3745	4.3748	4.3758	3.969	25800	56NBC2070YZP	MS24461-56	96700
3.7494	3.7486	3.7504	3.7496	4.6235	4.6245	4.6248	4.6258	4.219	25800	60NBC2074YZP	MS24461-60	103000
3.9994	3.9986	4.0004	3.9996	4.8735	4.8745	4.8748	4.8758	4.469	25800	64NBC2078YZP	MS24461-64	109000



Types NBE, NBK

CONSTRUCTION

A non-separable, self-aligning unit consisting of inner ring, needle rollers, outer ring with spherical O.D., retaining washers and housing ring with spherical I.D. The end washers are fastened to the inner ring. Type NBE has a single row of rollers, and type NBK has two rows of rollers.

Lubrication grooves and holes in the inner ring, outer ring and housing ring are provided in the type NBK bearing. The type NBE bearing is similarly designed except groove and holes in the inner ring are omitted.

The self-aligning bearing outer ring and its housing ring are a matched assembly that must be kept together.

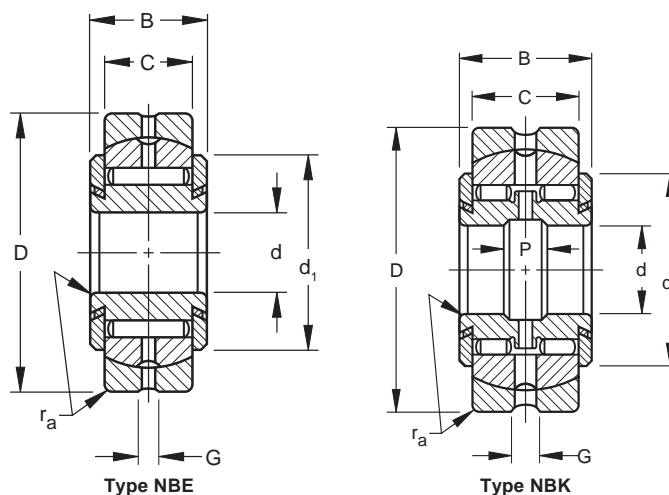
External surfaces, except the inner ring bore, are cadmium or zinc-nickel plated.

DIMENSIONS

Dimensions listed are for the finished bearing after plating.

Bearings are made to ISO and U.S. Military Specifications, and are constructed to have low radial clearance when mounted to minimize vibration and backlash.

The shaft diameter and housing bore dimensions necessary to mount these bearings properly are listed on the facing page.



BEARING DIMENSIONS

d* Bore		D* O.D.		B Overall Width	Bearing Designation	C Outer Ring Width	ra§ Shaft Fillet	d1 End Washer Diameter	G Outer Ring Groove Width	P Inner Ring Groove Width	Mass (approx.)
max.	min.	max.	min.								
0.1900	0.1893	0.8750	0.8745	0.312	3NBE514ZP	0.218	0.022	0.625	0.062	—	0.041
0.2500	0.2493	0.9375	0.9370	0.375	4NBE615ZP	0.281	0.022	0.688	0.094	—	0.053
0.3125	0.3118	1.0625	1.0620	0.437	5NBE717ZP	0.344	0.022	0.750	0.094	—	0.079
0.3750	0.3743	1.1875	1.1870	0.562	6NBK919YZP	0.469	0.022	0.812	0.125	0.188	0.130
0.4375	0.4368	1.3125	1.3120	0.625	7NBK1021YZP	0.531	0.032	0.875	0.125	0.188	0.174
0.5000	0.4993	1.5000	1.4995	0.750	8NBK1224YZP	0.656	0.032	1.031	0.125	0.188	0.293
0.5625	0.5618	1.6875	1.6870	0.875	9NBK1427YZP	0.781	0.032	1.094	0.156	0.188	0.420
0.6250	0.6243	1.7500	1.7495	1.000	10NBK1628YZP	0.906	0.032	1.156	0.156	0.250	0.520
0.7500	0.7493	1.8750	1.8745	1.125	12NBK1830YZP	1.000	0.032	1.281	0.156	0.250	0.630
0.8750	0.8743	2.1250	2.1244	1.250	14NBK2034YZP	1.125	0.032	1.500	0.156	0.375	0.870
1.0000	0.9993	2.2500	2.2494	1.250	16NBK2036YZP	1.125	0.032	1.625	0.156	0.375	0.960
1.2500	1.2493	2.5000	2.4994	1.250	20NBK2040YZP	1.049	0.032	1.906	0.156	0.375	1.070
1.5000	1.4993	2.7500	2.7494	1.250	24NBK2044YZP	1.049	0.032	2.156	0.156	0.375	1.230
2.0000	1.9993	3.2500	3.2492	1.250	32NBK2052YZP	1.049	0.032	2.656	0.156	0.375	1.490
2.5000	2.4993	3.7500	3.7492	1.250	40NBK2060YZP	1.049	0.032	3.156	0.156	0.375	1.780
3.0000	2.9993	4.2500	4.2492	1.250	48NBK2068YZP	1.049	0.032	3.656	0.156	0.375	2.060
3.5000	3.4992	4.8750	4.8740	1.250	56NBK2078YZP	1.049	0.044	4.219	0.156	0.375	2.650

*Bore and o.d. tolerance limits correspond to the single mean diameter (the arithmetical mean of the largest and smallest diameters in a single radial plane).

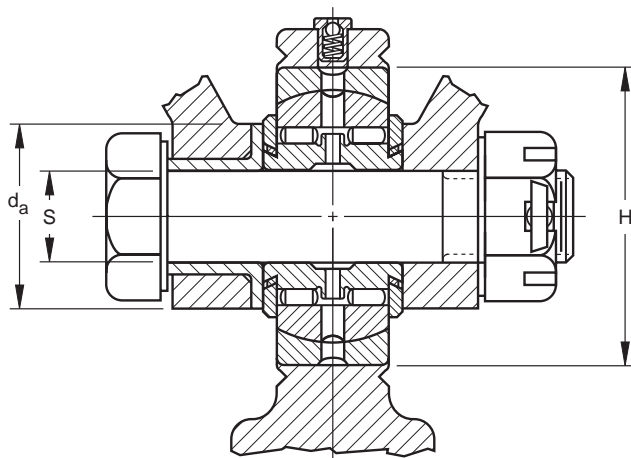
§Equal to minimum inner bore chamfers.



MOUNTING

The housing bore dimensions shown below are applicable to bearings mounted in steel. These dimensions should be decreased .0002" (.005mm) when aluminum alloy housings are used.

The end washers are fastened to the inner ring in a manner only to maintain the integrity of the assembly while handling and installing the bearing. Therefore, when mounted they should be firmly backed up by washers or other clamping surfaces which are flat and square with the shaft center line. To provide sufficient washer support, the outside diameter of the clamping surfaces should be at least as large as the minimum clamping diameter (d_a) listed below. The maximum clamping diameter is also given to assure that a misalignment of $\pm 5^\circ$ can be accommodated.



LOAD RATINGS

The limit load ratings (also called "allowable working load ratings") of the bearings are listed below. The **ultimate** load ratings are not less than 1.5 times the **limit** load ratings. The **ultimate** load ratings correspond to the Aircraft Static Capacity ratings.

When the application requires dynamic self-alignment, additional bearing loads (due to the friction of dynamic self-alignment) must be taken into account.

For additional data refer to page 134. Before final bearing selection is made, please consult our Fafnir Engineering Aircraft Group.

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

MOUNTING DIMENSIONS

S Shaft Diameter				H Housing Bore				d_a Clamping Diameter		Clamping Force	Bearing Designation	Military Standard Number (U.S.)	Limit Load Rating
Transition Fits (loose range)		Transition Fits (tight range)		Transition Fits (tight range)		Transition Fits (loose range)							
inches				inches				inches		lbf		(reference)	
max	min	max	min	min	max	min	max	max	min	max			lbf
0.1894	0.1889	0.1902	0.1897	0.8742	0.8747	0.8749	0.8754	0.625	0.438	480	3NBE514ZP	MS24463-3	1800
0.2494	0.2489	0.2502	0.2497	0.9367	0.9372	0.9374	0.9379	0.688	0.516	870	4NBE615ZP	MS24463-4	2870
0.3119	0.3114	0.3127	0.3122	1.0617	1.0622	1.0624	1.0629	0.734	0.578	1400	5NBE717ZP	MS24463-5	4070
0.3744	0.3739	0.3752	0.3747	1.1867	1.1872	1.1874	1.1879	0.781	0.641	2100	6NBK919YZP	MS24464-6	4530
0.4369	0.4364	0.4377	0.4372	1.3116	1.3122	1.3124	1.313	0.844	0.703	2850	7NBK1021YZP	MS24464-7	5870
0.4994	0.4989	0.5002	0.4997	1.4991	1.4997	1.4999	1.5005	1.000	0.844	3840	8NBK1224YZP	MS24464-8	8670
0.5619	0.5614	0.5627	0.5622	1.6866	1.6872	1.6874	1.688	1.062	0.891	4870	9NBK1427YZP	MS24464-9	11800
0.6244	0.6239	0.6252	0.6247	1.7491	1.7497	1.7499	1.7505	1.094	0.953	6150	10NBK1628YZP	MS24464-10	15500
0.7494	0.7489	0.7502	0.7497	1.8741	1.8747	1.8749	1.8755	1.156	1.078	8950	12NBK1830YZP	MS24464-12	20000
0.8744	0.8739	0.8752	0.8747	2.1238	2.1246	2.1249	2.1257	1.375	1.250	12200	14NBK2034YZP	MS24464-14	25800
0.9994	0.9989	1.0002	0.9997	2.2488	2.2496	2.2499	2.2507	1.500	1.375	16300	16NBK2036YZP	MS24464-16	28700
1.2494	1.2488	1.2503	1.2497	2.4988	2.4996	2.4999	2.5007	1.781	1.625	25800	20NBK2040YZP	MS24464-20	31400
1.4994	1.4988	1.5003	1.4997	2.7488	2.7496	2.7499	2.7507	2.062	1.875	25800	24NBK2044YZP	MS24464-24	36600
1.9994	1.9987	2.0003	1.9996	3.2485	3.2495	3.2498	3.2508	2.594	2.375	25800	32NBK2052YZP	MS24464-32	47100
2.4994	2.4987	2.5003	2.4996	3.7485	3.7495	3.7498	3.7508	3.062	2.875	25800	40NBK2060YZP	MS24464-40	57500
2.9994	2.9987	3.0003	2.9996	4.2485	4.2495	4.2498	4.2508	3.562	3.375	25800	48NBK2068YZP	MS24464-48	67900
3.4994	3.4986	3.5004	3.4996	4.8735	4.8745	4.8748	4.8758	4.141	3.969	25800	56NBK2078YZP	MS24464-56	80100



Types HRS, HRSC

CONSTRUCTION

Torrington stud type airframe track rollers have been designed for specific use on track type or cam-controlled equipment when cantilever mounting is desired.

Each non-separable unit consists of an outer ring, a full complement of needle rollers, stud and washer. The o.d. of the outer ring is chromium plated in accordance with the QQ-C-320, Class 2 specifications to a minimum thickness of .0004". All other exposed surfaces are cadmium or zinc-nickel plated. The sealed track rollers have seals made from a special plastic or acetyl resin.

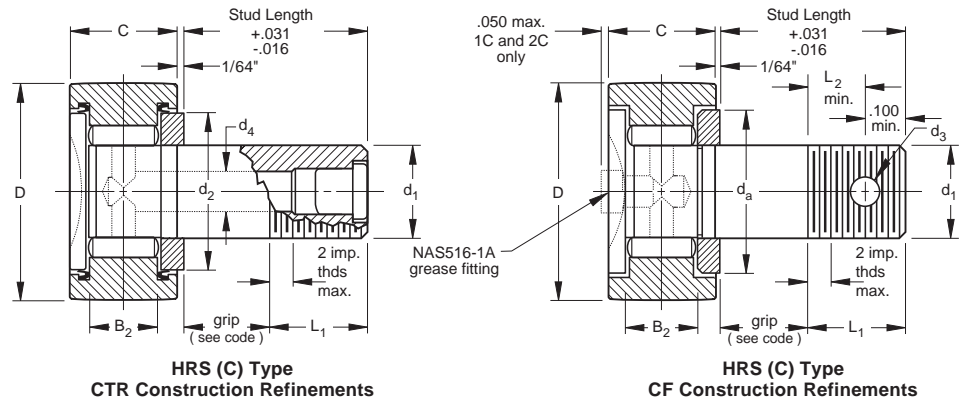
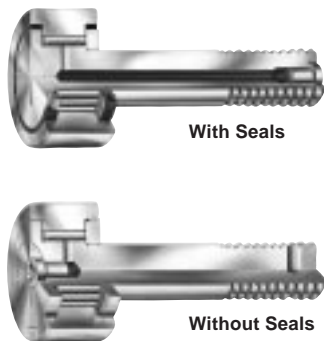
Track rollers are available with cylindrical or crowned outer rings. Crowned track rollers reduce the effect of uneven bearing loading resulting from deflection, bending or misalignment in mounting. A track

roller with a cylindrical outer ring is identified by the prefix letters HRS. A track roller with a crowned outer ring has a letter "C" added to the end of the prefix code (i.e., HRSC).

Normally, the track rollers are prepackaged with a low temperature aircraft grease meeting MIL-G-81322 specification, when specified.

DIMENSIONS

Dimensions are for the finished bearing after chrome and cadmium plating. No standard stud length is shown in the tables because the grip length is variable in 1/16" increments, coded in the bearing number. Since many combinations of length and type are possible for each track roller size, almost every track roller ordered is a special bearing. See note 3 below for thread specifications.



DIMENSION IN INCHES

Catalog Number		d ₁ Stud Diam. +0.0000 -.0015	D O.D. ⁽¹⁾ +0.0010 -.0005	C O.R. Width +0.0000 -.0005	L ₂ min.	d ₂ min.	B ₂ Track Contact Width ⁽²⁾ min.	Preferred Max. Grip Length	L ₁ Thread Length (ref.)	Thread Size ⁽³⁾	d ₃ Cotter Pin Hole Diam. (ref.)	d ₄ dia. (ref.)		
Basic Bearing Number	MS Number Reference ⁽⁴⁾												Former NAS 562 Number	
HRS1C	HRSC1C	MS 21432-3	NAS 562-3	0.1900	0.5000	0.281	0.211	0.323	0.230	5/8	0.344	10-32	0.070	none
HRS2C	HRSC2C	MS 21432-4	NAS 562-4	0.2500	0.6875	0.281	0.224	0.418	0.230	15/16	0.344	7/8-28	0.076	0.076
HRS3C	HRSC3C	MS 21432-5	NAS 562-5	0.3120	0.7500	0.344	0.234	0.494	0.290	1 1/4	0.359	3/8-24	0.076	0.076
HRS4C	HRSC4C	MS 21432-6	NAS 562-6	0.3750	0.8750	0.469	0.265	0.575	0.380	1 5/8	0.359	7/8-24	0.106	0.106
HRS5C	HRSC5C	MS 21432-7	NAS 562-7	0.4370	1.0000	0.531	0.283	0.680	0.430	1 3/4	0.422	7/8-20	0.106	0.106
HRS6C	HRSC6C	MS 21432-8	NAS 562-8	0.5000	1.1250	0.656	0.314	0.744	0.530	1 3/4	0.422	7/8-20	0.106	0.106

⁽¹⁾ Tolerance for crowned outer ring o.d. is +.0010, -.0015.
⁽²⁾ Applies to cylindrical outer ring design only.

⁽³⁾ All threads conform to MIL-S-8879 specification, UNJF series and Class 3A. The last two threads on the stud are imperfect threads.

⁽⁴⁾ HRSC bearings meet the requirements of MS 21447.

BEARING NUMBER

Bearing numbers for Torrington Airframe HRSC and HRS Track Rollers are based on ABMA identification system. Each complete bearing number is composed of three sections of letter and numeral codes which indicate, in this order, basic type and size, construction refinements, and grip length. The sections of the number are contiguous and not separated by spaces or dashes. Designers should familiarize themselves with the numbering system and use the proper sequence of letters and numerals in print specifications and correspondence.

Section 1 : Basic Bearing Number

The letters HRS and HRSC followed by size designations (1C, 2C, etc.) relate to the dimensions given in the tabulation above.

Section 2: Construction Refinements

Additional letters, which must appear in the sequence as given below, indicate special optional features:

- F— lubricator in flanged end of stud.
- T— lubricator in threaded end of stud; cotter pin hole omitted. (Note: the HRS1C stud is too small to permit lubrication through the threaded end.)
- K— stud slotted to receive an MS 27111 washer.
- A— no cotter pin hole.
- R— sealed.

Section 3: Grip Length Number

A number indicating the grip length in increments of 1/16". Tolerance on grip length is ±.016". The nominal stud length is the sum of the nominal grip length and thread length (column L₁).



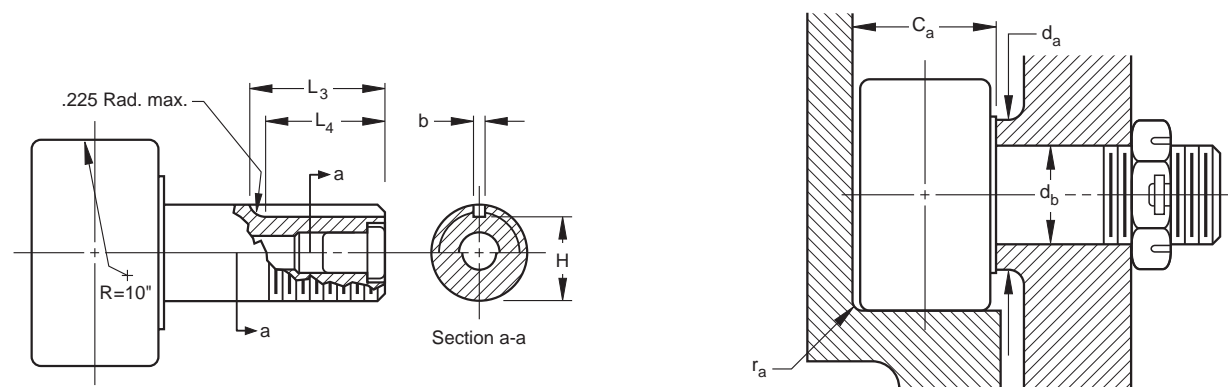
MOUNTING

The bore diameter for the stud is listed in column d_b . Other mounting requirements are track fillet radius (r_a), minimum overhang space (C_a) and minimum clamping diameter (d_a). See footnotes 1 and 2 below for additional requirements.

LOAD RATINGS

To utilize a track roller properly, three different capacities have to be considered. First, the capacity of the material on which the track roller will roll (see Note 3). Second, the capacity of the bearing elements to carry the load (see Note 4). Third, the capacity of the bearing elements to withstand the maximum radial loads (see Note 5).

Before final bearing selection is made please consult our Fafnir Engineering Aircraft Group.



DIMENSIONS AND MOUNTING SPECIFICATIONS

L ₄	L ₃	b	H	Weight, Pounds Approx. gln=Grip Length Number	d _b Bore Diameter for stud		Mounting Dimensions, Inches					Load Ratings, Pounds			
							r _a Track Fillet Radius (max.)	Rec. Clamping Torque (max.) lb.-in. ⁽¹⁾	C _a * Min. Overhang Space	d _a Clamping Diameter (min.)	Bearing Size No.	Bearing Capacity			
												Track Capacity 40HRc Steel ⁽³⁾	as a Track Roller ⁽⁴⁾	Limit Load Rating ⁽⁵⁾	
+0.030 -0.000	(ref.)	±0.0020	±0.0030		max.	min.									
n.a.	n.a.	n.a.	n.a.	.014 + (gln x .0005)	0.1905	0.1900	0.010	8	0.313	0.297	1	385	395	790	
0.375	0.534	0.0635	0.2143	.031 + (gln x .0009)	0.2505	0.2500	0.010	20	0.313	0.359	2	525	470	940	
0.390	0.546	0.0635	0.2768	.043 + (gln x .0014)	0.3120	0.2500	0.010	40	0.376	0.422	3	725	830	1660	
0.390	0.572	0.0947	0.3236	.081 + (gln x .0020)	0.3755	0.3750	0.025	55	0.501	0.500	4	1100	1360	2720	
0.453	0.635	0.0947	0.3861	.125 + (gln x .0026)	0.4375	0.4370	0.025	150	0.563	0.562	5	1425	1930	3860	
0.453	0.662	0.1260	0.4330	.190 + (gln x .0035)	0.5005	0.5000	0.040	205	0.688	0.625	6	1975	3040	6080	

⁽¹⁾ The maximum recommended clamping torque is based on lubricated threads. If threads are dry, the torque values listed may be doubled.

⁽²⁾ The edge of the housing which supports the stud shank should be as sharp as possible, without burrs, and square with the stud centerline.

⁽³⁾ Track capacity is critical with respect to bearing rolling capacity. Increase in track hardness will increase track capacity. Never exceed bearing capacity as a track roller under dynamic conditions.

⁽⁴⁾ The highest load that can be applied to a bearing for a life of 20,000 revolutions, L₁₀.

⁽⁵⁾ The limit load is the maximum radial load which can be applied to a bearing without impairing the subsequent functioning of the bearing in airframe applications. To realize this rating fully, compensation must be provided for stud deflection in order to assure full track contact under load. The static fracture load (Aircraft Static Capacity) is not less than 1.5 times the limit load rating.

BEARING NUMBER EXAMPLES (Torrington WITH MS EQUIVALENTS)

Torrington-ABMA HRS3CT7 — equivalent to MS 21432-5T7

Track roller with .7500" outer ring o.d.; .344" outer ring width; .3120" stud diameter; lubricator in threaded end of stud; cotter pin hole omitted; and a 7/16" grip length.

Torrington-ABMA HRSC4CFR6 — equivalent to MS 21477-6F6

Track roller with .8750" outer ring o.d.; .469" outer ring width; .3750" stud diameter; lubricator in threaded end of stud; .106" diameter cotter pin hole located in threaded end of stud; sealed; and a 9/16" grip length.

Torrington-ABMA HRS2CTK3 — no equivalent to MS 21432

Track roller with .6875" outer ring o.d.; .281" outer ring width; .2500" stud diameter; lubricator in threaded end of stud. Stud slotted to receive an MS 27111 key washer; and a 3/16" grip length.

*The NAS 516-1A grease fitting is flush or indented on all sizes except HRS1CF and HRS2CF, where it protrudes .050" Accordingly, when these two sizes are mounted, dimension C_a must be adjusted to accommodate the slight protrusion.



Special Designs

Standard HRS or HRSC track rollers are not always suitable in aircraft design. When unusual or tough requirements present bearing application problems, it's time to draw on the Torrington Company's wide experience in producing special bearing solutions.

Prototype bearings can be made to meet the critical time schedules of development projects.

Stud type track rollers can be manufactured with the customary concentric studs, or eccentric studs that will permit adjustment at the time of assembly. Both types are illustrated on this page along with typical installation arrangements.

To tap our reservoir of design and application experience, simply call your nearest Torrington Service Engineer. He will be glad to help you analyze the problem, and often he can provide cost and time saving recommendations.

