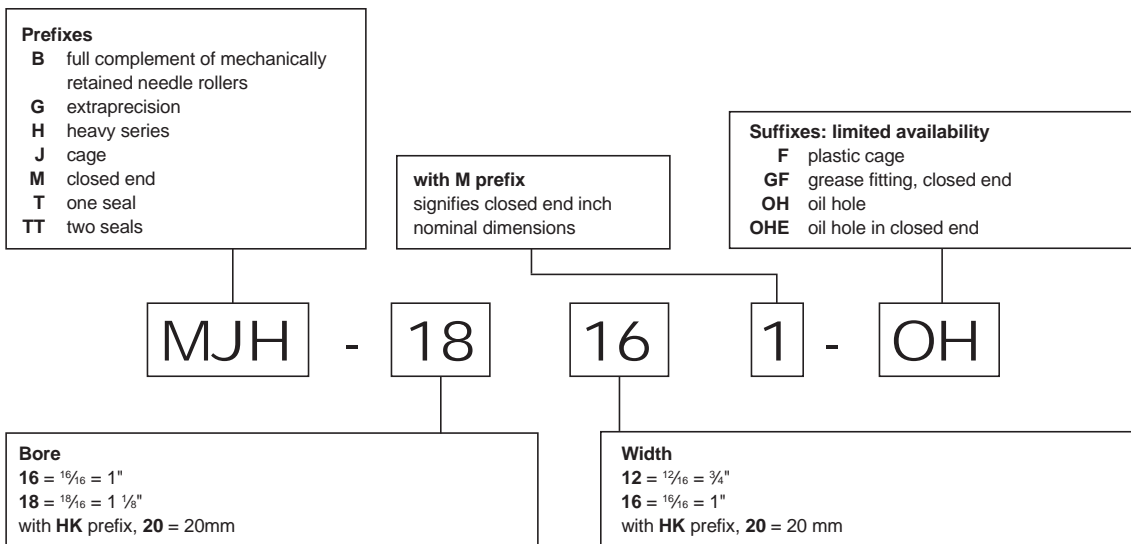


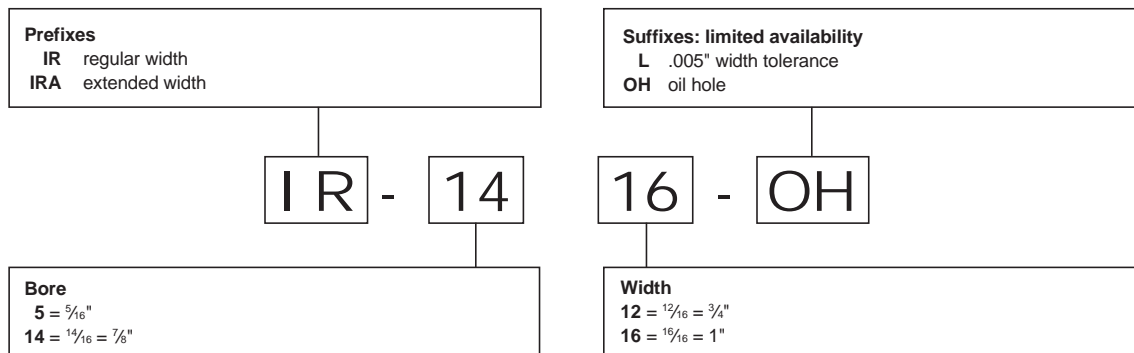
Drawn Cup Needle Roller Bearings & Clutches

	Page		Page
DRAWN CUP BEARINGS		ROLLER CLUTCHES	
Nomenclature	356	Nomenclature	492
Introduction	358	Introduction, Design, Operation	494
Identification	358	Identification, Construction, Special Clutches	495
Bore/O.D. Comparison, Standard and Large Rollers	358	Application	496-497
Full Complement Bearing Construction	359	Housing Design, Shaft Design	497
Caged Bearing Construction, Sealed Bearings	359	Installation	498
Description of Tabular Data	360	Applied Loads, Lubrication, Temperatures, Backlash,	499
Internal Clearances and Fits	360	Rate of Engagement, Overrun Limit Speed, Inspection . .	499
Outer Ring Rotation, Oscillating Motion	360	DC ROLLER CLUTCHES	
Installation Procedures	361	Types FC, FCS, FCL-K, RC-FS and RC	
Inner Rings, Lubrication	362	Dimensions, Ratings, Gauging and Mounting	500-501
Inspection Procedures	362-363	DC ROLLER CLUTCH AND BEARING ASSEMBLIES	
FULL COMPLEMENT AND CAGED BEARINGS		Types FCB, FCBL-K, RCB-FS and RCB	
Dimensions, Load Ratings and Mounting	364-375	Dimensions, Ratings, Gauging and Mounting	502-503
EXTRAPRECISION BEARINGS			
Gauging and Mounting	376-377		
SEALED DRAWN CUP BEARINGS			
Dimensions, Load Ratings and Mounting	378-379		
INNER RINGS FOR DRAWN CUP BEARINGS			
Dimensions and Mounting	380-383		
INNER RINGS, INCH SERIES . . .	412-415		
Metric Inner Rings			
Dimensions	452-457		

Drawn Cup Bearings – Inch Nominal Dimensions



Inner Rings (with 4-digit number for drawn cup bearings only)





Full Complement Bearings



Full Complement Mechanically Retained Rollers



Full Complement Closed End

INTRODUCTION

Before selecting individual bearings the Engineering section of this catalog should be reviewed for detailed information concerning:

- bearing type selection
- bearing life and reliability
- definition of load ratings
- life and load relationships
- effect of raceway hardness
- example of life calculation
- lubrication
- limiting speeds
- shaft design
- housing design

In addition to these general considerations, review the material which follows when selecting drawn cup bearings.

IDENTIFICATION

The prefix letter or letters in the bearing designation for Drawn Cup (DC) bearings denote whether the bearings are made to inch or metric nominal dimensions as well as their major construction features.

For example, a bearing with metric nominal dimensions is indicated by the code letter **F** or **HK** having open ends and letters **BK** for closed ends, in the prefix. Letters in the prefix other than **HK**, **BK** or **F** indicate a bearing of inch nominal dimensions.

Most sizes of inch bearings are available with either a full complement of rollers or caged rollers. Metric bearings are available with caged rollers as a standard. The use of caged rollers in inch bearings is indicated by the prefix code letter **J**.

Inch bearings are available in either of two radial cross sections. The larger cross section is indicated by the prefix code letter **H**. Absence of the letter **H** indicates the smaller radial cross section.

These major features of dimension and construction are summarized in Table 1.

In addition, there can be other identifying letters which cover special modifications. Please consult Torrington Engineering Sales Office when special modifications are required.

Table 1

Identifying Letters	Prefix Letters in Bearing Designation		
	Inch Series		Metric Series
	Smaller Roller	Larger Roller	Regular Roller
Full Complement Mechanically Retained	B	BH	—
Caged	J	JH	HK,FJ

Other prefix letters in inch bearings denoting major construction features are:

- M** – closed end style
- P** – open end (finger) cage
- T** – single seal
- TT** – double seal
- G** – extra-precision

Since the entire identification code in the bearing designation may not appear on the bearing itself, the manufacturers' 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.

BORE/O.D. COMPARISON, STANDARD AND LARGER ROLLERS

As noted above, many sizes of Torrington inch drawn cup needle roller bearings are made in two bore/o.d. series, differing primarily in the roller diameter for a given bearing bore. Both series are very compact and offer very low cross section profiles compared with other rolling bearing types. The more compact series with the smaller rollers offers optimum performance with minimum feasible outside diameter for a given shaft size. The series with larger rollers, designated by the letter prefix **H**, offers more capacity and better performance at higher speeds for the same given shaft size.



FULL COMPLEMENT BEARING CONSTRUCTION

The original drawn cup needle roller bearing, as invented and introduced by Torrington, employs a full complement of rollers. The full complement drawn cup bearing combines maximum capacity and low cost with the advantages of the drawn outer ring.

The inward turned lips of the cup are used to mechanically retain the full complement of needle rollers to provide positive radial retention of the rollers even though it may be necessary to remove the shaft repeatedly during the servicing of the mechanism employing the bearing.

Full Complement Mechanically Retained Rollers



Full Complement Closed End



CAGED BEARING CONSTRUCTION

Torrington caged drawn cup bearings have a steel cage which provides inward retention of the needle rollers. The design provides maximum cage strength consistent with the long life requirements.

Torrington also has available bearings with other cage designs. Bearings with reinforced plastic cages are for use where operating conditions permit. Before applying bearings with plastic cages please consult Torrington sales or engineering personnel.

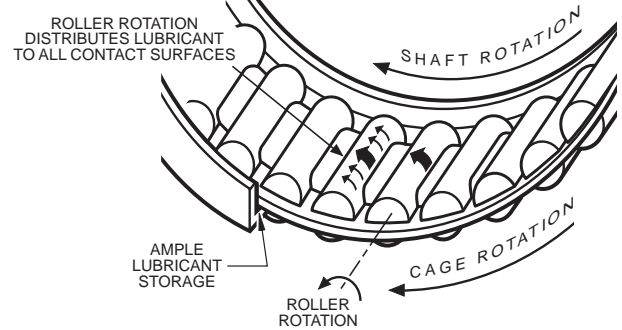
Caged, Cage Retained Rollers



Caged, Closed End



Caged Bearing Construction



SEALED BEARINGS

Torrington drawn cup caged needle roller bearings are offered with integral seals. The tables of dimensions on pages 378-379 indicate those sizes available with lip contact seals which limit the bearing operating temperature between -25°F and +225°F (-30°C and +110°C). The seal lip design achieves a light and constant contact with the shaft throughout the range of mounting bearing clearances thereby ensuring positive sealing and low frictional drag.

Sealed drawn cup bearings are intended to retain grease or non-pressurized oil within a bearing while also preventing contaminants entering the raceway area. These seals are not intended to withstand a pressure differential exceeding 2 psi (14kPa).

Details of shaft design for sealed bearings are given in the Engineering section of this catalog.

The standard lip contact seals are compatible with common lubricating oils and petroleum based fuels, but they are adversely affected by certain fire-resistant hydraulic fluids and most common solvents.

If the operating temperature must be outside of the above range or if seals are exposed to unusual fluids please consult the Torrington Engineering Sales Office.

Caged, Double Sealed





DESCRIPTION OF TABULAR DATA

The opportunities for interchange of different types and series are seen in the tables of dimensions starting on page 364, where bearings with the same bore, o.d. and width are listed on the same line in the table. (Sealed DC bearings are shown on pages 378-379 and extraprecision DC bearings are shown on pages 376-377.)

INTERNAL CLEARANCES AND FITS

Drawn cup bearings are manufactured to a degree of precision that will satisfy the radial clearance requirements of most applications. The total radial clearance of an installed DC bearing results from the build-up of manufacturing tolerances of the housing bore, inner raceway o.d. and the bearing, as well as the minimum radial clearance required for the application.

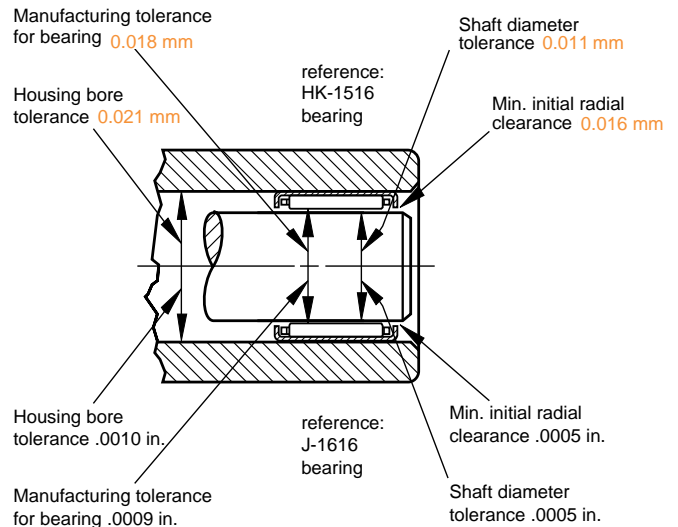
For bearings of nominal inch dimensions, the recommended mounting dimensions will provide correct running clearance for most applications. Closer control of radial clearance would be governed by the user's capability of holding housing and shaft raceway dimensional tolerances tighter than the limits shown on the tabular pages.

For bearings of nominal metric dimensions, the recommended mounting dimensions shown on the tabular pages are consistent with ISO N7 housing bore and h6 inner raceway o.d. tolerances. When closer control of clearance is required, the user may select N6 housing bore and h5 inner raceway o.d. tolerances.

The drawing illustrates the manufacturing tolerances and the built-in clearances applying to medium size drawn cup bearings in rotating applications when using the recommended tabulated mounting dimensions.

Radial clearance in a mounted bearing may be more closely controlled by reducing the manufacturing tolerances of the housing bore and inner raceway diameter. Where extremely close control of radial clearance is required for bearings of nominal inch dimensions, extraprecision full complement bearings are available.

Manufacturing Tolerances and Built-in Clearances



OUTER RING ROTATION

For applications where the outer ring rotates with respect to the load, it is recommended that both the housing bore and the inner raceway diameter be reduced.

Bearings of nominal inch dimensions should have the housing bore and inner raceway diameter reduced by .0005" or .013 mm.

Bearings of nominal metric dimensions should follow ISO R7 and f6 tolerance practices.

OSCILLATING MOTION

Applications involving oscillating motion often require reduced radial clearances. This reduction is accomplished by increasing the shaft raceway diameters as shown in Tables 2 and 3. The metric bearing user should note that addition of these values to the h6 tolerances given in tables of dimensions results in a standard j6 tolerance.

Table 2
Nominal inch bearing oscillating shaft size

shaft size		add	
inch	mm	inch	mm
½ to ⅞ incl	2.38 to 4.76 incl	0.0003	0.008
¼ to 1 ⅞ incl	6.35 to 47.62 incl	0.0005	0.013
2 to 5 ½ incl	50.8 to 139.7 incl	0.0006	0.015

Table 3
Nominal metric bearing oscillating shaft size

shaft size		add	
mm	inch	mm	inch
over 3 to 6	over .1181 to .2362	0.006	0.0002
over 6 to 10	over .2362 to .3937	0.007	0.0003
over 10 to 18	over .3937 to .7087	0.008	0.0003
over 18 to 30	over .7087 to 1.1811	0.009	0.0004
over 30 to 50	over 1.1811 to 1.9685	0.011	0.0004
over 50 to 80	over 1.9685 to 3.1496	0.012	0.0005



INSTALLATION PROCEDURES

A drawn cup bearing must be pressed into its housing. An installation tool similar to the one illustrated must be used in conjunction with a standard press.

It is advisable to utilize a positive stop on the press tool to locate the bearing properly in the housing. The assembly tool should have a leader or pilot, as shown, to aid in starting the bearing true in the housing.

The installation tool must be coaxial with the housing bore. The ball detent shown on the drawing is used to assist in aligning the rollers of a full complement bearing during installation and to hold the bearing on the installation tool.

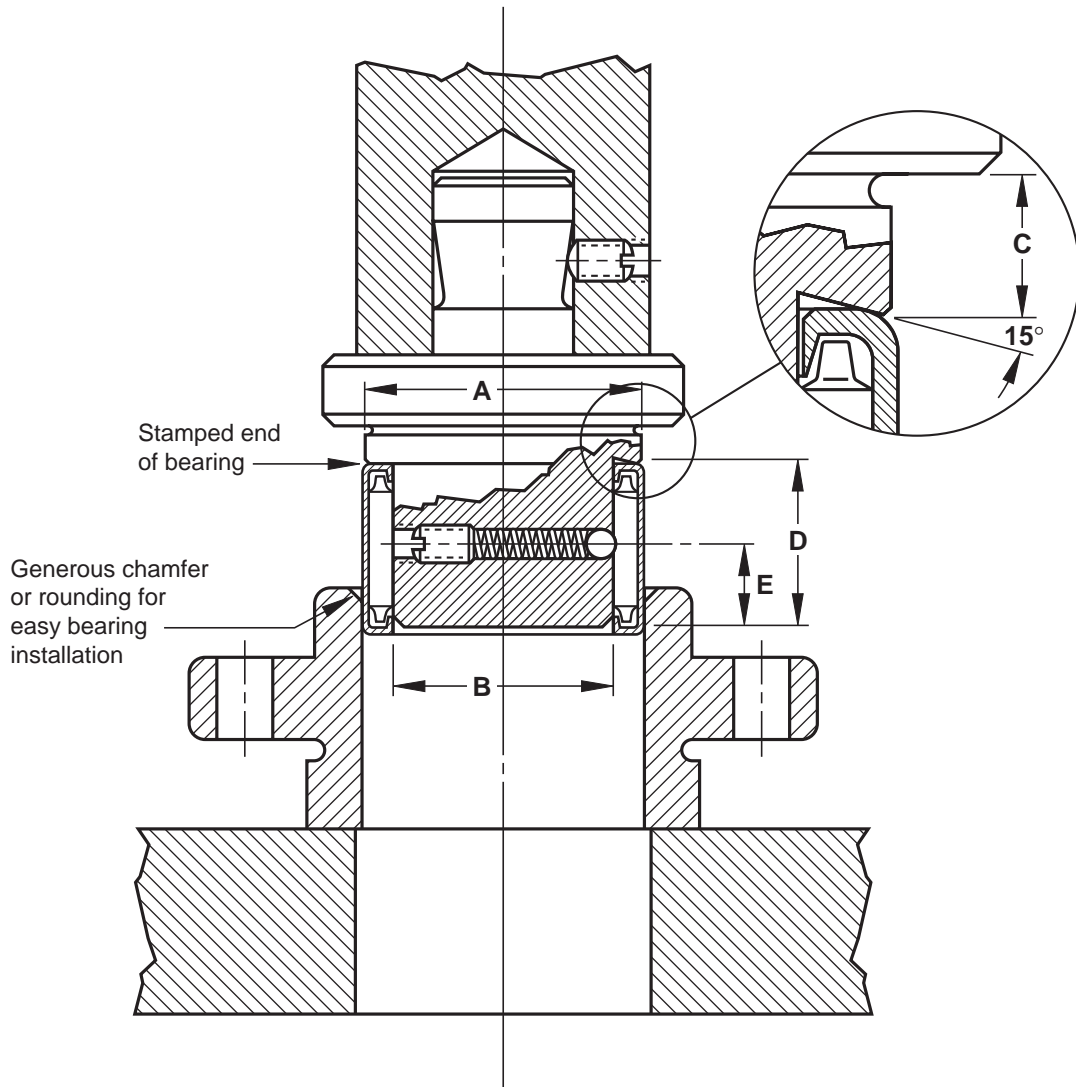
Assemble the bearing with the stamped end (the end with identification markings) against the angled shoulder of the pressing tool.

Never hammer the bearing into its housing even in conjunction with the proper assembly mandrel.

Never press the bearing tightly against a shoulder in the housing. If it is necessary to use a shouldered housing, the depth of the housing bore must be sufficient to ensure the housing shoulder fillet, as well as the shoulder face, clears the bearing.

To remove a drawn cup bearing from a through-bored housing, use a tool similar to the installation tool illustrated, but without the stop. For suggested methods of removing bearings from blind and shouldered bores, consult the Torrington Engineering Sales Office personnel.

- A- $\frac{1}{64}$ " (0.4 mm) less than housing bore
- B- .003" (0.08 mm) less than shaft diameter
- C- distance bearing will be inset into housing, minimum of .008" (0.2 mm)
- D- pilot length should be length of bearing less $\frac{1}{32}$ " (0.8 mm)
- E- approximately $\frac{1}{2}$ D





INNER RINGS

Where it becomes impractical to meet the shaft raceway design requirements (hardness, case depth, surface finish, etc.) outlined in the General Engineering section, standard inner rings for drawn cup bearings are available. These are tabulated on pages 380 to 383 of the drawn cup section.

Inner rings for drawn cup bearings are designed to be a loose transition fit on the shaft and should be clamped against a shoulder.

If a tight transition fit must be used to keep the inner ring from rotating relative to the shaft, the inner ring o.d., as mounted, must not exceed the raceway diameters required by the drawn cup bearing for the particular application. See the previous discussion on internal clearances and fits for further details on inner raceway diameter choice.

LUBRICATION

Drawn cup bearings can be furnished with an oil hole (centered in the drawn cup) to facilitate relubrication. If desired, specify on order.

For general information regarding lubrication of drawn cup bearings refer to page E72.

INSPECTION PROCEDURES

Although the bearing cup (outer ring) is accurately drawn from strip steel it may go out of round during heat treatment. When the bearing is pressed into a true round housing or ring gauge of correct size and wall thickness, it becomes round and is sized properly. **For this reason, it is incorrect to inspect an unmounted drawn cup bearing by measuring the o.d.** The correct method for inspecting the bearing size is to:

- (1) press the bearing into a ring gauge of proper size.
- (2) plug the bearing bore with the appropriate "go" and "no go" gauges.

Tables 4 and 5 provide the correct ring and plug gauge diameters for inspecting Torrington drawn cup needle roller bearings. When the letter **H** appears in the inch series bearings column headed "nominal bore diameter," the gauge sizes listed are for the larger cross section inch series bearings which include **H** in their bearing designation prefix.

Example 1

Find the ring gauge and plug gauge dimensions for a BH-68 bearing.

Since the bearing designation prefix does not include the letter **SF** or **HK**, this bearing is of nominal inch dimensions. The nominal bore diameter for the bearing, as shown in the table of dimensions on page 364, is $\frac{3}{8}$ inch. Since the letter **H** appears in the bearing designation, the following information will be found opposite **H** $\frac{3}{8}$ in the **nominal bore diameter** column for the **inch series bearings** in Table 4:

	<u>inch</u>	<u>mm</u>
ring gauge	.6255	15.8877
diameter under needle rollers, min.	.3765	9.5631
diameter under needle rollers, max.	.3774	9.5860

The "go" plug gauge is the same size as the **minimum** diameter under the needle rollers and the "no go" plug gauge size is .0001 inch (.0025 mm) larger than the **maximum** diameter under the needle rollers. Therefore the correct ring and plug gauge dimensions are:

	<u>inch</u>	<u>mm</u>
ring gauge	.6255	15.8877
plug gauge, "go"	.3765	9.5631
plug gauge, "no go"	.3775	9.5885

These same gauge dimensions also apply to JH-68.

Example 2

Find the ring gauge and plug gauge dimensions for a HK-1516 bearing.

The bearing designation prefix letters **HK** indicate that, the bearing is of nominal metric dimensions. The nominal bore diameter for this bearing, as shown in the table of dimensions on page 367, is **15 mm**. Opposite "15", in the **nominal bore diameter** column for **metric series bearings** in Table 5, will be found the following information:

	<u>mm</u>	<u>inch</u>
ring gauge	20.976	.82583
diameter under needle rollers, min.	15.016	.59118
diameter under needle rollers, max.	15.034	.59189

The "go" plug gauge is the same size as the **minimum** diameter under the needle rollers and the "no go" plug gauge size is 0.0020 mm (.00008 inch) larger than the **maximum** diameter under the needle rollers. Therefore the correct ring and plug gauge dimensions are:

	<u>mm</u>	<u>inch</u>
ring gauge	20.976	.82583
plug gauge, "go"	15.016	.59118
plug gauge, "no go"	15.036	.59197



Table 4
Inch series bearings

nominal bore diameter inch	dimensions-inch			dimensions-mm		
	ring gauge	diameter inside needle rollers		ring gauge	diameter inside needle rollers	
		min.	max.		min.	max.
1/8	0.2505	0.1258	0.1267	6.3627	3.1953	3.2182
5/32	0.2817	0.1571	0.1580	7.1552	3.9903	4.0132
3/16	0.3437	0.1883	0.1892	8.7300	4.7828	4.8057
1/4	0.4380	0.2515	0.2524	11.1252	6.3881	6.4110
5/16	0.5005	0.3140	0.3149	12.7127	7.9756	7.9985
H 5/16	0.5630	0.3140	0.3149	14.3002	7.9756	7.9985
3/8	0.5630	0.3765	0.3774	14.3002	9.5631	9.5860
H 3/8	0.6255	0.3765	0.3774	15.8877	9.5631	9.5860
7/16	0.6255	0.4390	0.4399	15.8877	11.1506	11.1735
H 7/16	0.6880	0.4390	0.4399	17.4752	11.1506	11.1735
1/2	0.6880	0.5015	0.5024	17.4752	12.7381	12.7610
H 1/2	0.7505	0.5015	0.5024	19.0627	12.7381	12.7610
9/16	0.7505	0.5640	0.5649	19.0627	14.3256	14.3485
H 9/16	0.8130	0.5640	0.5649	20.6502	14.3256	14.3485
5/8	0.8130	0.6265	0.6274	20.6502	15.9131	15.9360
H 5/8	0.8755	0.6265	0.6274	22.2377	15.9131	15.9360
11/16	0.8755	0.6890	0.6899	22.2377	17.5006	17.5235
H 11/16	0.9380	0.6890	0.6899	23.8252	17.5006	17.5235
3/4	0.9995	0.7505	0.7514	25.3873	19.0627	19.0856
H 3/4	1.0620	0.7505	0.7514	26.9748	19.0627	19.0856
13/16	1.0620	0.8130	0.8139	26.9748	20.6502	20.6731
H 13/16	1.1245	0.8130	0.8139	28.5623	20.6502	20.6731
7/8	1.1245	0.8755	0.8764	28.5623	22.2377	22.2606
H 7/8	1.1870	0.8755	0.8764	30.1498	22.2377	22.2606
15/16	1.1870	0.9380	0.9389	30.1498	23.8252	23.8481
1	1.2495	1.0005	1.0014	31.7373	25.4127	25.4356
H 1	1.3120	1.0005	1.0014	33.3248	25.4127	25.4356
1 1/16	1.3120	1.0630	1.0639	33.3248	27.0002	27.0231
1 1/8	1.3745	1.1255	1.1264	34.9123	28.5877	28.6106
H 1 1/8	1.4995	1.1255	1.1264	38.0873	28.5877	28.6106
1 3/16	1.4995	1.1880	1.1889	38.0873	30.1752	30.1981
H 1 1/4	1.4995	1.2505	1.2514	38.0873	31.7627	31.7856
1 1/2	1.6245	1.2505	1.2514	41.2623	31.7627	31.7856
H 1 1/2	1.6245	1.3130	1.3140	41.2623	33.3502	33.3756
1 5/8	1.6245	1.3755	1.3765	41.2623	34.9377	34.9631
H 1 5/8	1.7495	1.3755	1.3765	44.4373	34.9377	34.9631
1 3/4	1.8745	1.5005	1.5016	47.6123	38.1127	38.1406
H 1 3/4	1.9995	1.6255	1.6266	50.7873	41.2877	41.3156
2	2.1245	1.7505	1.7517	53.9623	44.4627	44.4932
H 2	2.2495	1.8755	1.8767	57.1373	47.6377	47.6682
2 1/8	2.3745	2.0006	2.0018	60.3123	50.8152	50.8457
H 2 1/8	2.5307	2.0635	2.0649	64.2798	52.4129	52.4485
2 1/4	2.4995	2.1256	2.1270	63.4873	53.9902	54.0258
2 1/2	2.6245	2.2506	2.2520	66.6623	57.1652	57.2008
NB 2 1/2	2.8795	2.5006	2.5020	73.1393	63.5152	63.5508
2 3/4	2.9995	2.6260	2.6274	76.1873	66.7004	66.7360
H 2 3/4	3.1245	2.7510	2.7524	79.3623	69.8754	69.9110
NBH 3	3.5045	3.0006	3.0020	89.0143	76.2152	76.2508
3 1/2	3.9995	3.5010	3.5024	101.5873	88.9254	88.9610
H 3 1/2	5.9990	5.5010	5.5029	152.3746	139.7254	139.7737

Table 5
Metric series bearings

nominal bore diameter mm	dimensions-mm			dimensions-inch		
	ring gauge *	diameter inside needle rollers		ring gauge *	diameter inside needle rollers	
		min.	max.		min.	max.
4	7.984	4.010	4.028	0.31433	0.15787	0.15858
5	8.984	5.010	5.028	0.35370	0.19724	0.19795
6	9.984	6.010	6.028	0.39307	0.23661	0.23732
7	10.980	7.013	7.031	0.43228	0.27610	0.27681
8	11.980	8.013	8.031	0.47165	0.31547	0.31618
9	12.980	9.013	9.031	0.51102	0.35484	0.35555
10	13.980	10.013	10.031	0.55039	0.39421	0.39492
12	15.980	12.016	12.034	0.62913	0.47307	0.47378
12	17.980	12.016	12.034	0.70787	0.47307	0.47378
13	18.976	13.016	13.034	0.74709	0.51244	0.51315
14	19.976	14.016	14.034	0.78646	0.55181	0.55252
15	20.976	15.016	15.034	0.82583	0.59118	0.59189
16	21.976	16.016	16.034	0.86520	0.63055	0.63126
17	22.976	17.016	17.034	0.90457	0.66992	0.67063
18	23.976	18.016	18.034	0.94394	0.70929	0.71000
20	25.976	20.020	20.041	1.02268	0.78819	0.78901
22	27.976	22.020	22.041	1.10142	0.86693	0.86776
25	31.972	25.020	25.041	1.25874	0.98504	0.98586
28	34.972	28.020	28.041	1.37685	1.10315	1.10398
30	36.972	30.020	30.041	1.45559	1.18189	1.18272
35	41.972	35.025	35.050	1.65244	1.37894	1.37992
40	46.972	40.025	40.050	1.84929	1.57579	1.57677
45	51.967	45.025	45.050	2.04594	1.77264	1.77362
50	57.967	50.025	50.050	2.28217	1.96949	1.97047
55	62.967	55.030	55.060	2.47902	2.16654	2.16772
64	71.967	64.030	64.060	2.83335	2.52087	2.52205

Bearing bore should be checked with “go” and “no go” plug gauges. The “go” gauge size is the minimum diameter inside the needle rollers. The “no go” gauge size is larger than the maximum diameter inside the needle rollers by the following amounts:

- Inch Series – 0.0001 inch
- 0.0025 millimeters
- Metric Series – 0.0020 millimeters
- 0.00008 inch

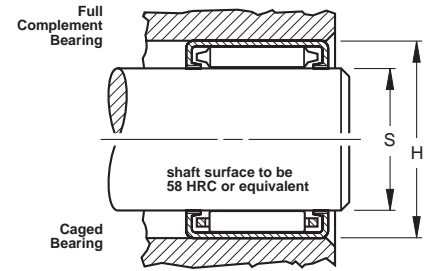
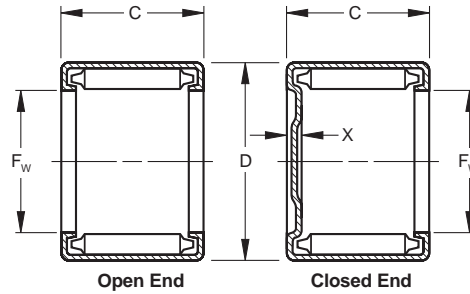
* The ring gauge sizes for metric series bearings are in accordance with ISO N6 lower limit.
Inch - metric conversions given are for the convenience of the user. The controlling dimensions are in inches for nominal inch bearings and in millimeters for nominal metric bearings.



Full Complement Bearings

Check for availability.

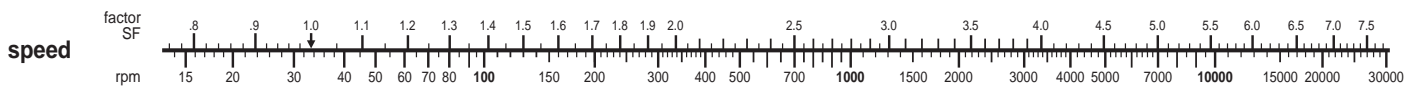
Inch-metric conversions given are for the convenience of the user. The controlling dimensions are in inches for nominal inch bearings and in millimeters for nominal metric bearings.



BEARING DIMENSIONS						MECHANICALLY RETAINED ROLLERS						BEARING MOUNTING						
F _w Bore		D Outside Diameter		C Width		Bearing Designation		Load Ratings			Limiting Speed Full Complement Bearings	X End Thickness		Inch Mounting				
(nom.)		(nom.)		+0.000 -0.010		open end	closed end	Basic Dynamic C _r	Basic Static C ₀	Working Load		(max.)	(max.)	S Shaft Raceway Diameter		H Housing Bore		
inch	mm	inch	mm	inch	mm			Ⓓ	ISO 281	ISO 76	(max.)			rpm	inch	mm	max.	min.
0.118	3	0.256	6.50	0.236	6	—	—	—	—	—	—	—	—	—	0.1181	0.1178	0.2552	0.2557
1/8	3.18	1/4	6.35	0.188	4.78	—	—	—	—	—	—	—	—	—	0.1250	0.1247	0.2500	0.2505
1/8	3.18	1/4	6.35	0.250	6.35	B-24	—	243	374	349	229	13 000	—	—	0.1250	0.1247	0.2500	0.2505
3/32	3.97	5/32	7.14	0.188	4.78	—	—	—	—	—	—	—	—	—	0.1563	0.1560	0.2812	0.2817
3/32	3.97	5/32	7.14	0.250	6.35	B-2 1/4 4	—	286	439	437	274	11 000	—	—	0.1563	0.1560	0.2812	0.2817
3/32	3.97	5/32	7.14	0.312	7.92	B-2 1/2 5	—	375	578	622	389	11 000	—	—	0.1563	0.1560	0.2812	0.2817
.16	4	.31	8	0.315	8	—	—	—	—	—	—	—	—	—	0.1575	0.1572	0.3142	0.3148
3/16	4.76	11/32	8.73	0.250	6.35	B-34	M-341	310	477	453	284	11 000	0.07	1.80	0.1875	0.1872	0.3432	0.3437
3/16	4.76	11/32	8.73	0.375	9.52	B-36	—	538	828	922	577	11 000	—	—	0.1875	0.1872	0.3432	0.3437
0.20	5	0.35	9	0.354	9	—	—	—	—	—	—	—	—	—	0.1969	0.1966	0.3536	0.3542
—	—	—	—	0.315	8	—	—	—	—	—	—	—	—	—	0.2362	0.2359	0.3930	0.3936
0.24	6	0.39	10	0.354	9	—	—	—	—	—	—	—	—	—	0.2362	0.2359	0.3930	0.3936
1/4	6.35	7/16	11.11	0.250	6.35	B-44	M-441	368	566	531	326	10 000	0.08	2.0	0.2500	0.2495	0.4370	0.4380
1/4	6.35	7/16	11.11	0.312	7.92	B-45	M-451	499	768	786	483	10 000	0.08	2.0	0.2500	0.2495	0.4370	0.4380
1/4	6.35	7/16	11.11	0.438	11.13	B-47	M-471	788	1 210	1 410	868	10 000	0.08	2.0	0.2500	0.2495	0.4370	0.4380
0.28	7	0.43	11	0.354	9	—	—	—	—	—	—	—	—	—	0.2756	0.2752	0.4322	0.4329
3/16	7.94	1/2	12.70	0.312	7.92	B-55	M-551	574	883	985	580	8 300	0.08	2.0	0.3125	0.3120	0.4995	0.5005
3/16	7.94	1/2	12.70	0.375	9.52	B-56	—	744	1 140	1 370	806	8 300	—	—	0.3125	0.3120	0.4995	0.5005
3/16	7.94	1/2	12.70	0.438	11.13	B-57	M-571	905	1 390	1 770	1 040	8 300	0.08	2.0	0.3125	0.3120	0.4995	0.5005
3/16	7.94	1/2	12.70	0.562	14.27	B-59	—	1 200	1 850	2 550	1 500	8 300	—	—	0.3125	0.3120	0.4995	0.5005
3/16	7.94	5/16	14.29	0.438	11.13	BH-57	—	995	1 530	1 590	1 010	11 000	—	—	0.3125	0.3120	0.5620	0.5630
3/16	7.94	5/16	14.29	0.562	14.27	BH-59	—	1 350	2 080	2 340	1 510	11 000	—	—	0.3125	0.3120	0.5620	0.5630
0.31	8	0.47	12	0.315	8	—	—	—	—	—	—	—	—	—	0.3150	0.3146	0.4715	0.4722
0.31	8	0.47	12	0.394	10	—	—	—	—	—	—	—	—	—	0.3150	0.3146	0.4715	0.4722
0.35	9	0.51	13	0.394	10	—	—	—	—	—	—	—	—	—	0.3543	0.3539	0.5109	0.5116
0.35	9	0.51	13	0.472	12	—	—	—	—	—	—	—	—	—	0.3543	0.3539	0.5109	0.5116
3/8	9.52	5/16	14.29	0.312	7.92	B-65	M-651	640	984	1 180	676	7 100	0.08	2.0	0.3750	0.3745	0.5620	0.5630
3/8	9.52	5/16	14.29	0.375	9.52	B-66	M-661	829	1 280	1 650	944	7 100	0.08	2.0	0.3750	0.3745	0.5620	0.5630
3/8	9.52	5/16	14.29	0.438	11.13	B-67	—	1 010	1 550	2 120	1 220	7 100	—	—	0.3750	0.3745	0.5620	0.5630
3/8	9.52	5/16	14.29	0.500	12.70	B-68	M-681	1 180	1 810	2 590	1 480	7 100	0.08	2.0	0.3750	0.3745	0.5620	0.5630
3/8	9.52	5/16	14.29	0.562	14.27	B-69	—	1 340	2 070	3 070	1 750	7 100	—	—	0.3750	0.3745	0.5620	0.5630
3/8	9.52	5/16	14.29	0.625	15.88	B-610	M-6101	1 500	2 310	3 530	2 020	7 100	0.08	2.0	0.3750	0.3745	0.5620	0.5630
3/8	9.52	5/8	15.88	0.500	12.70	BH-68	—	1 330	2 050	2 380	1 460	9 400	—	—	0.3750	0.3745	0.6245	0.6255
0.39	10	0.55	14	0.394	10	—	—	—	—	—	—	—	—	—	0.3937	0.3933	0.5503	0.5510
0.39	10	0.55	14	0.472	12	—	—	—	—	—	—	—	—	—	0.3937	0.3933	0.5503	0.5510
0.39	10	0.55	14	0.591	15	—	—	—	—	—	—	—	—	—	0.3937	0.3933	0.5503	0.5510

Ⓓ Symbol denotes Torrington Basic Dynamic Load Rating to be used in load-life calculations taking into consideration the application guidelines and limitations given in this catalog. Applications involving loads approaching this rating or the tabulated working load, whichever is the smaller, should be referred to the Torrington Engineering Sales Office before a final selection is made.

Load Ratings are based on a minimum raceway hardness of 58 HRC or equivalent. Load ratings are given in pounds-force: 1 lbf = 0.454kgf = 4.448N. Required Basic Dynamic Load Rating (C_r) = Applied Load • SF • LF • HF (see page E75).

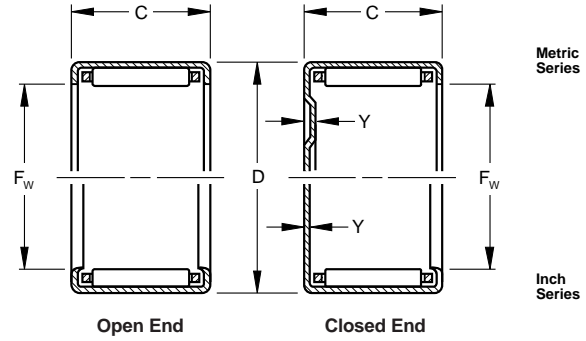




Caged Bearings

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 bearings.

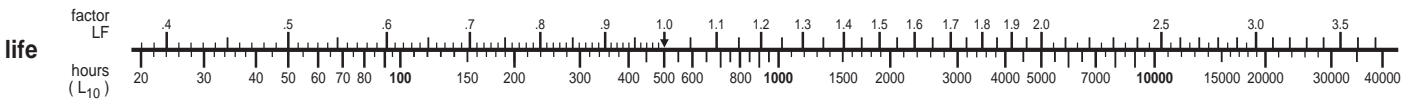


BEARING MOUNTING				CAGE RETAINED ROLLERS								
Metric Mounting				Bearing Designation	Load Ratings				Limiting Speed Caged Bearings	Y End Thickness		
S Shaft Raceway Diameter		H Housing Bore			open end	closed end	Basic Dynamic Cr	Basic Static Co		Working Load		
max.	min.	min.	max.				Ⓓ	ISO 281			ISO 76	(max.)
3,000	2,992	6,481	6,496	HK-0306	—	239	327	257	86	13 000	—	—
3,175	3,167	6,350	6,363	JP-23-F	—	109	149	105	69	75 000	—	—
3,175	3,167	6,350	6,363	—	—	—	—	—	—	—	—	—
3,970	3,962	7,142	7,155	JP-2 1/2 3-F	—	111	152	110	69	75 000	—	—
3,970	3,962	7,142	7,155	—	—	—	—	—	—	—	—	—
3,970	3,962	7,142	7,155	—	—	—	—	—	—	—	—	—
4,000	3,992	7,981	7,996	HK-0408	—	280	384	310	103	75 000	—	—
4,762	4,754	8,717	8,730	—	—	—	—	—	—	—	—	—
4,762	4,754	8,717	8,730	J-36	MJ-361	257	352	336	202	75 000	0.04	1.0
5,000	4,992	8,981	8,996	HK-0509	—	376	515	466	155	74 000	—	—
6,000	5,992	9,981	9,996	HK-0608	—	350	479	438	146	60 000	—	—
6,000	5,992	9,981	9,996	HK-0609	BK-0609	496	679	641	214	60 000	0.06	1.6
—	—	—	—	—	—	—	—	—	—	—	—	—
6,350	6,337	11,100	11,125	J-45	MJ-451	290	397	331	203	57 000	0.04	1.0
6,350	6,337	11,100	11,125	J-47	MJ-471	473	648	617	379	57 000	0.04	1.0
7,000	6,991	10,977	10,995	HK-0709	—	482	660	686	229	50 000	—	—
7,938	7,925	12,687	12,712	J-55	—	315	431	383	226	44 000	—	—
7,938	7,925	12,687	12,712	—	—	—	—	—	—	—	—	—
7,938	7,925	12,687	12,712	J-57	MJ-571	560	767	805	474	44 000	0.04	1.0
7,938	7,925	12,687	12,712	—	—	—	—	—	—	—	—	—
7,938	7,925	14,275	14,300	JH-57	MJH-571	696	954	849	543	47 000	0.04	1.0
7,938	7,925	14,275	14,300	—	—	—	—	—	—	—	—	—
8,000	7,991	11,977	11,995	HK-0808	BK-0808	433	593	615	205	43 000	0.06	1.6
8,000	7,991	11,977	11,995	HK-0810	BK-0810	590	808	915	305	43 000	0.06	1.6
9,000	8,991	12,977	12,995	HK-0910	—	683	936	1 140	380	38 000	—	—
9,000	8,991	12,977	12,995	HK-0912	BK-0912	843	1 164	1 500	500	38 000	0.06	1.6
9,525	9,512	14,275	14,300	J-65	MJ-651	358	491	474	271	36 000	0.04	1.0
—	—	—	—	—	—	—	—	—	—	—	—	—
9,525	9,512	14,275	14,300	—	—	—	—	—	—	—	—	—
9,525	9,512	14,275	14,300	J-68	—	755	1 030	1 240	707	36 000	—	—
9,525	9,512	14,275	14,300	—	—	—	—	—	—	—	—	—
9,525	9,512	14,275	14,300	—	—	—	—	—	—	—	—	—
9,525	9,512	15,862	15,887	JH-68	—	987	1 350	1 370	843	38 000	—	—
10,000	9,991	13,977	13,995	HK-1010	—	713	982	1 240	413	34 000	—	—
10,000	9,991	13,977	13,995	HK-1012	—	881	1 210	1 630	543	34 000	—	—
10,000	9,991	13,977	13,995	HK-1015	—	1 120	1 530	2 210	737	34 000	—	—

Mounting dimensions are based on the inner ring rotating and the outer ring being stationary relative to the load. The housing should be of high strength material. See pages E77-78 for discussion of shaft and housing design.

Drawn cup bearings of nominal inch and metric dimensions with one closed end, which are not tabulated, may be made available upon request.

Caged drawn cup bearings of nominal inch and metric dimensions, with an engineered polymer cage, may be made available upon request.

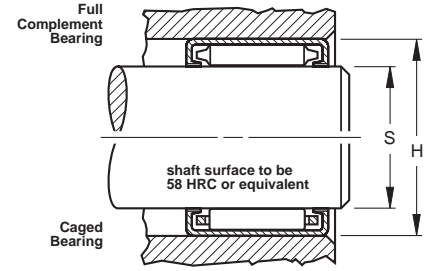
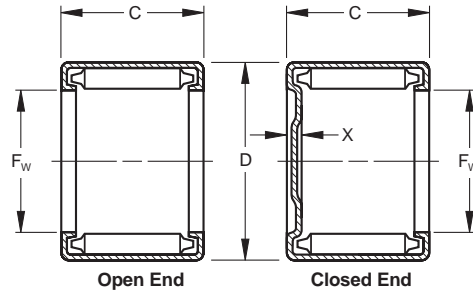




Full Complement Bearings

Check for availability.

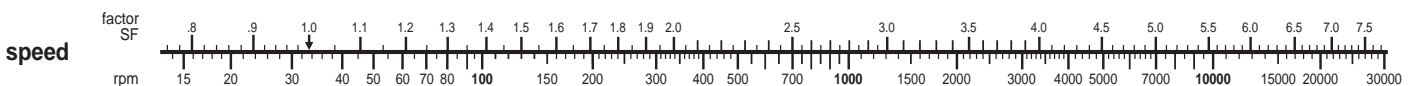
Inch-metric conversions given are for the convenience of the user. The controlling dimensions are in inches for nominal inch bearings and in millimeters for nominal metric bearings.



BEARING DIMENSIONS						MECHANICALLY RETAINED ROLLERS						BEARING MOUNTING						
F _w Bore		D Outside Diameter		C Width		Bearing Designation		Load Ratings				X End Thickness		Inch Mounting				
(nom.)		(nom.)		+0.000	+0.00	open end	closed end	Basic Dynamic C _r	Basic Static C ₀	Working Load	Limiting Speed Full Complement Bearings	(max.)		S Shaft Raceway Diameter		H Housing Bore		
inch	mm	inch	mm	-0.010	-0.25			Ⓓ	ISO 281	ISO 76	(max.)	rpm	inch	mm	max.	min.	min.	max.
7/16	11.11	5/16	15.88	0.375	9.52	B-76	—	906	1 390	1 930	1 080	6 300	—	—	0.4375	0.4370	0.6245	0.6255
7/16	11.11	5/16	15.88	0.438	11.13	B-77	—	1 100	1 700	2 480	1 390	6 300	—	—	0.4375	0.4370	0.6245	0.6255
7/16	11.11	5/16	15.88	0.500	12.70	B-78	M-781	1 290	1 980	3 030	1 690	6 300	0.08	2.0	0.4375	0.4370	0.6245	0.6255
7/16	11.11	5/16	15.88	0.625	15.88	B-710	—	1 640	2 520	4 130	2 310	6 300	—	—	0.4375	0.4370	0.6245	0.6255
7/16	11.11	11/16	17.46	0.500	12.70	BH-78	—	1 470	2 260	2 780	1 660	8 300	—	—	0.4375	0.4370	0.6870	0.6880
0.47	12	0.63	16	0.394	10	—	—	—	—	—	—	—	—	—	0.4724	0.4720	0.6290	0.6297
0.47	12	0.71	18	0.472	12	—	—	—	—	—	—	—	—	—	0.4724	0.4720	0.7078	0.7085
1/2	12.70	11/16	17.46	0.312	7.92	B-85	—	754	1 160	1 580	870	5 500	—	—	0.5000	0.4995	0.6870	0.6880
1/2	12.70	11/16	17.46	0.375	9.52	B-86	M-861	976	1 500	2 200	1 210	5 500	0.08	2.0	0.5000	0.4995	0.6870	0.6880
1/2	12.70	11/16	17.46	0.438	11.13	B-87	M-871	1 190	1 830	2 840	1 560	5 500	0.08	2.0	0.5000	0.4995	0.6870	0.6880
1/2	12.70	11/16	17.46	0.500	12.70	B-88	M-881	1 390	2 130	3 460	1 910	5 500	0.08	2.0	0.5000	0.4995	0.6870	0.6880
1/2	12.70	11/16	17.46	0.625	15.88	B-810	M-8101	1 770	2 720	4 720	2 600	5 500	0.08	2.0	0.5000	0.4995	0.6870	0.6880
1/2	12.70	11/16	17.46	0.750	19.05	B-812	M-8121	2 120	3 260	5 980	3 290	5 500	0.08	2.0	0.5000	0.4995	0.6870	0.6880
1/2	12.70	3/4	19.05	0.438	11.13	BH-87	—	1 340	2 060	2 550	1 490	7 500	—	—	0.5000	0.4995	0.7495	0.7505
1/2	12.70	3/4	19.05	0.500	12.70	BH-88	—	1 590	2 450	3 180	1 850	7 500	—	—	0.5000	0.4995	0.7495	0.7505
1/2	12.70	3/4	19.05	0.625	15.88	BH-810	—	2 060	3 180	4 440	2 590	7 500	—	—	0.5000	0.4995	0.7495	0.7505
1/2	12.70	3/4	19.05	0.750	19.05	BH-812	—	2 510	3 850	5 690	3 290	7 500	—	—	0.5000	0.4995	0.7495	0.7505
0.51	13	0.75	19	0.472	12	—	—	—	—	—	—	—	—	—	0.5118	0.5114	0.7469	0.7477
0.55	14	0.79	20	0.472	12	—	—	—	—	—	—	—	—	—	0.5512	0.5508	0.7863	0.7871
5/16	14.29	3/4	19.05	0.312	7.92	B-95	M-951	804	1 240	1 780	966	5 000	0.08	2.0	0.5625	0.5620	0.7495	0.7505
5/16	14.29	3/4	19.05	0.375	9.52	B-96	—	1 040	1 600	2 480	1 350	5 000	—	—	0.5625	0.5620	0.7495	0.7505
5/16	14.29	3/4	19.05	0.438	11.13	B-97	—	1 270	1 950	3 190	1 740	5 000	—	—	0.5625	0.5620	0.7495	0.7505
5/16	14.29	3/4	19.05	0.500	12.70	B-98	—	1 480	2 280	3 900	2 120	5 000	—	—	0.5625	0.5620	0.7495	0.7505
5/16	14.29	3/4	19.05	0.625	15.88	B-910	—	1 880	2 900	5 310	2 890	5 000	—	—	0.5625	0.5620	0.7495	0.7505
5/16	14.29	3/4	19.05	0.750	19.05	B-912	M-9121	2 260	3 480	6 730	3 660	5 000	0.08	2.0	0.5625	0.5620	0.7495	0.7505
5/16	14.29	13/16	20.64	0.500	12.70	BH-98	—	1 710	2 630	3 580	2 050	6 800	—	—	0.5625	0.5620	0.8120	0.8130
5/16	14.29	13/16	20.64	0.625	15.88	BH-910	—	2 210	3 400	5 000	2 860	6 800	—	—	0.5625	0.5620	0.8120	0.8130
5/16	14.29	13/16	20.64	0.750	19.05	BH-912	—	2 690	4 130	6 410	3 670	6 800	—	—	0.5625	0.5620	0.8120	0.8130
0.59	15	0.83	21	0.472	12	—	—	—	—	—	—	—	—	—	0.5906	0.5902	0.8257	0.8265
0.59	15	0.83	21	0.630	16	—	—	—	—	—	—	—	—	—	0.5906	0.5902	0.8257	0.8265
5/8	15.88	13/16	20.64	0.312	7.92	B-105	—	851	1 310	1 980	1 060	4 500	—	—	0.6250	0.6245	0.8120	0.8130
5/8	15.88	13/16	20.64	0.438	11.13	B-107	M-1071	1 340	2 070	3 550	1 910	4 500	0.08	2.0	0.6250	0.6245	0.8120	0.8130
5/8	15.88	13/16	20.64	0.500	12.70	B-108	M-1081	1 570	2 410	4 330	2 330	4 500	0.08	2.0	0.6250	0.6245	0.8120	0.8130
5/8	15.88	13/16	20.64	0.625	15.88	B-1010	—	1 990	3 070	5 900	3 180	4 500	—	—	0.6250	0.6245	0.8120	0.8130
5/8	15.88	13/16	20.64	0.750	19.05	B-1012	M-10121	2 400	3 690	7 480	4 020	4 500	0.08	2.0	0.6250	0.6245	0.8120	0.8130

Ⓓ Symbol denotes Torrington Basic Dynamic Load Rating to be used in load-life calculations taking into consideration the application guidelines and limitations given in this catalog. Applications involving loads approaching this rating or the tabulated working load, whichever is the smaller, should be referred to the Torrington Engineering Sales Office before a final selection is made.

Load ratings are based on a minimum raceway hardness of 58 HRC or equivalent. Load ratings are given in pounds-force: 1 lbf = 0.454kgf = 4.448N. Required Basic Dynamic Load Rating (C_r) = Applied Load • SF • LF • HF (see page E75).

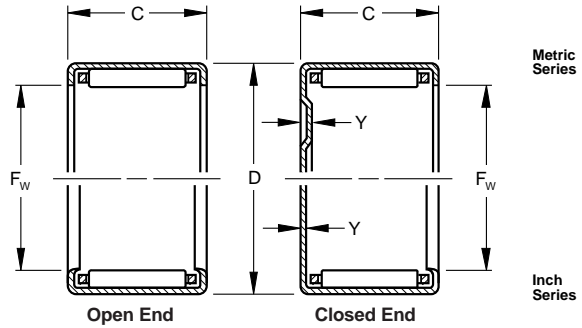




Caged Bearings

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 bearings.

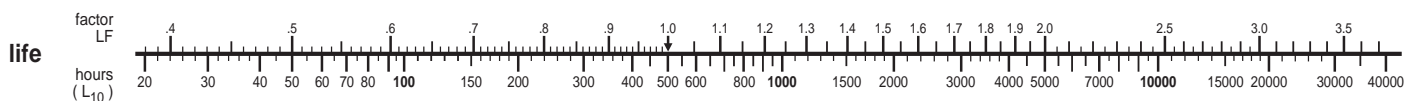


BEARING MOUNTING				CAGE RETAINED ROLLERS								
Metric Mounting				Bearing Designation	Load Ratings				Limiting Speed Caged Bearings	Y End Thickness		
S Shaft Raceway Diameter		H Housing Bore			open end	closed end	Basic Dynamic C_r	Basic Static C_o		Working Load	Y End Thickness	
millimeters		millimeters					①	ISO 281			ISO 76	(max.)
max.	min.	min.	max.			lbf	lbf	lbf	rpm	inch	mm	
11,112	11,099	15,862	15,887	—	—	—	—	—	—	—	—	
11,112	11,099	15,862	15,887	—	—	—	—	—	—	—	—	
11,112	11,099	15,862	15,887	J-78	MJ-781	882	1 210	1 580	883	30 000	0.04 1.0	
11,112	11,099	15,862	15,887	—	—	—	—	—	—	—	—	
11,112	11,099	17,450	17,475	JH-78	—	1 060	1 450	1 510	928	38 000	— —	
12,000	11,989	15,977	15,995	HK-1210	BK-1210	740	1110	1 370	460	28 000	0.06 1.6	
12,000	11,989	17,977	17,995	HK-1212	BK-1212	986	1 350	1 640	547	28 000	0.11 2.7	
12,700	12,687	17,450	17,475	J-85	MJ-851	454	621	697	384	26 000	0.04 1.0	
12,700	12,687	17,450	17,475	J-86	MJ-861	661	906	1130	598	26 000	0.04 1.0	
12,700	12,687	17,450	17,475	—	—	—	—	—	—	—	—	
12,700	12,687	17,450	17,475	J-88	MJ-881	914	1 250	1 710	942	26 000	0.04 1.0	
12,700	12,687	17,450	17,475	—	—	—	—	—	—	—	—	
12,700	12,687	17,450	17,475	J-812	—	1 500	2 060	3 240	1 790	26 000	— —	
12,700	12,687	19,037	19,062	JH-87	—	958	1 310	1 400	816	27 000	— —	
12,700	12,687	19,037	19,062	JH-88	MJH-881	1 160	1 590	1 800	1 050	27 000	0.04 1.0	
12,700	12,687	19,037	19,062	—	—	—	—	—	—	—	—	
12,700	12,687	19,037	19,062	JH-812	—	1 840	2 530	3 250	1 900	27 000	— —	
13,000	12,989	18,972	18,993	HK-1312	BK-1312	1 030	1 410	1 770	590	26 000	0.11 2.7	
14,000	13,989	19,972	19,993	HK-1412	—	1 080	1 470	1 910	640	24 000	— —	
14,288	14,275	19,037	19,062	—	—	—	—	—	—	—	—	
14,288	14,275	19,037	19,062	—	—	—	—	—	—	—	—	
14,288	14,275	19,037	19,062	J-97	—	761	1 040	1 400	758	23 000	— —	
14,288	14,275	19,037	19,062	J-98	—	901	1 230	1 730	942	23 000	— —	
14,288	14,275	19,037	19,062	J-910	—	1 190	1 630	2 490	1 350	23 000	— —	
14,288	14,275	19,037	19,062	—	—	—	—	—	—	—	—	
14,288	14,275	20,625	20,650	—	—	—	—	—	—	—	—	
14,288	14,275	20,625	20,650	—	—	—	—	—	—	—	—	
14,288	14,275	20,625	20,650	—	—	—	—	—	—	—	—	
15,000	14,989	20,972	20,993	HK-1512	BK-1512	1 120	1 530	2 050	680	22 000	0.11 2.7	
15,000	14,989	20,972	20,993	HK-1516	BK-1516	1 590	2 180	3 230	1 080	22 000	0.11 2.7	
15,875	15,862	20,625	20,650	—	—	—	—	—	—	—	—	
15,875	15,862	20,625	20,650	—	—	—	—	—	—	—	—	
15,875	15,862	20,625	20,650	J-108	—	970	1 330	1 970	1 060	21 000	— —	
15,875	15,862	20,625	20,650	J-1010	MJ-10101	1 280	1 760	2 830	1 520	21 000	0.04 1.0	
15,875	15,862	20,625	20,650	J-1012	MJ-10121	1 850	2 540	4 570	2 460	21 000	0.04 1.0	

Mounting dimensions are based on the inner ring rotating and the outer ring being stationary relative to the load. The housing should be of high strength material. See pages E77-78 for discussion of shaft and housing design.

Drawn cup bearings of nominal inch and metric dimensions with one closed end, which are not tabulated, may be made available upon request.

Caged drawn cup bearings of nominal inch and metric dimensions, with an engineered polymer cage, may be made available upon request.

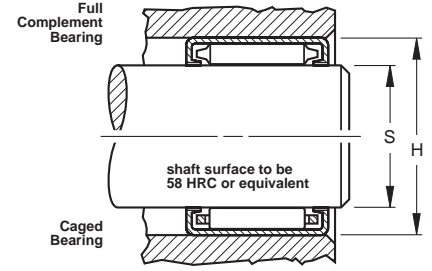
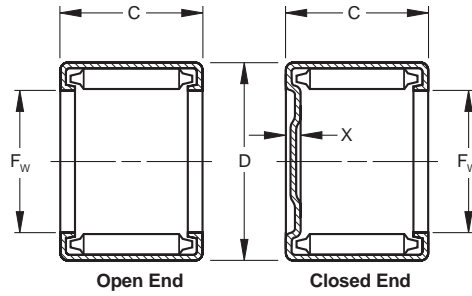




Full Complement Bearings

Check for availability.

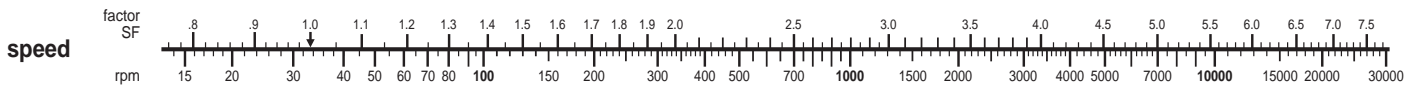
Inch-metric conversions given are for the convenience of the user. The controlling dimensions are in inches for nominal inch bearings and in millimeters for nominal metric bearings.



BEARING DIMENSIONS						MECHANICALLY RETAINED ROLLERS							BEARING MOUNTING					
F _w Bore		D Outside Diameter		C Width		Bearing Designation		Load Ratings				Limiting Speed Full Complement Bearings	X End Thickness		Inch Mounting			
(nom.)	(nom.)	(nom.)	(nom.)	+0.000 -0.010	+0.00 -0.25	open end	closed end	Basic Dynamic C _r	Basic Static C ₀	Working Load	(max.)		(max.)	(max.)	(max.)	S Shaft Raceway Diameter	H Housing Bore	
inch	mm	inch	mm	inch	mm			Ⓓ	ISO 281	ISO 76	(max.)	rpm	inch	mm	max.	min.	min.	max.
5/8	15.88	7/8	22.22	0.500	12.70	BH-108	MH-1081	1 810	2 790	3 980	2 240	6 200	0.09	2.3	0.6250	0.6245	0.8745	0.8755
5/8	15.88	7/8	22.22	0.625	15.88	BH-1010	—	2 350	3 620	5 530	3 130	6 200	—	—	0.6250	0.6245	0.8745	0.8755
5/8	15.88	7/8	22.22	0.750	19.05	BH-1012	—	2 850	4 390	7 130	4 010	6 200	—	—	0.6250	0.6245	0.8745	0.8755
5/8	15.88	7/8	22.22	1.000	25.40	BH-1016	—	3 790	5 830	10 300	5 780	6 200	—	—	0.6250	0.6245	0.8745	0.8755
0.63	16	0.87	22	0.472	12	—	—	—	—	—	—	—	—	—	0.6299	0.6295	0.8650	0.8658
0.63	16	0.87	22	0.630	16	—	—	—	—	—	—	—	—	—	0.6299	0.6295	0.8650	0.8658
0.67	17	0.91	23	0.472	12	—	—	—	—	—	—	—	—	—	0.6693	0.6689	0.9044	0.9052
11/16	17.46	7/8	22.22	0.375	9.52	B-116	—	1 160	1 790	3 030	1 620	4 200	—	—	0.6875	0.6870	0.8745	0.8755
11/16	17.46	7/8	22.22	0.500	12.70	B-118	—	1 650	2 540	4 770	2 540	4 200	—	—	0.6875	0.6870	0.8745	0.8755
11/16	17.46	7/8	22.22	0.625	15.88	B-1110	M-11101	2 100	3 230	6 500	3 460	4 200	0.08	2.0	0.6875	0.6870	0.8745	0.8755
11/16	17.46	7/8	22.22	0.750	19.05	B-1112	M-11121	2 520	3 880	8 230	4 390	4 200	0.08	2.0	0.6875	0.6870	0.8745	0.8755
11/16	17.46	15/16	23.81	0.438	11.13	BH-117	—	1 610	2 480	3 510	1 950	5 700	—	—	0.6875	0.6870	0.9370	0.9380
11/16	17.46	15/16	23.81	0.625	15.88	BH-1110	MH-11101	2 480	3 820	6 110	3 400	5 700	0.09	2.3	0.6875	0.6870	0.9370	0.9380
11/16	17.46	15/16	23.81	0.750	19.05	BH-1112	—	3 010	4 640	7 840	4 360	5 700	—	—	0.6875	0.6870	0.9370	0.9380
0.71	18	0.94	24	0.472	12	—	—	—	—	—	—	—	—	—	0.7087	0.7083	0.9438	0.9446
0.71	18	0.94	24	0.630	16	—	—	—	—	—	—	—	—	—	0.7087	0.7083	0.9438	0.9446
3/4	19.05	1	25.40	0.375	9.52	B-126	—	1 360	2 100	2 900	1 600	5 500	—	—	0.7500	0.7495	0.9995	1.0005
3/4	19.05	1	25.40	0.500	12.70	B-128	M-1281	2 010	3 100	4 790	2 630	5 500	0.09	2.3	0.7500	0.7495	0.9995	1.0005
3/4	19.05	1	25.40	0.625	15.88	B-1210	M-12101	2 610	4 010	6 670	3 670	5 500	0.09	2.3	0.7500	0.7495	0.9995	1.0005
3/4	19.05	1	25.40	0.750	19.05	B-1212	M-12121	3 160	4 870	8 560	4 710	5 500	0.09	2.3	0.7500	0.7495	0.9995	1.0005
0.79	20	1.02	26	0.472	12	—	—	—	—	—	—	—	—	—	0.7874	0.7869	1.0225	1.0233
0.79	20	1.02	26	0.630	16	—	—	—	—	—	—	—	—	—	0.7874	0.7869	1.0225	1.0233
0.79	20	1.02	26	0.787	20	—	—	—	—	—	—	—	—	—	0.7874	0.7869	1.0225	1.0233
13/16	20.64	1 1/16	26.99	0.375	9.52	B-136	—	1 420	2 190	3 140	1 710	5 200	—	—	0.8125	0.8120	1.0620	1.0630
13/16	20.64	1 1/16	26.99	0.500	12.70	B-138	M-1381	2 100	3 240	5 190	2 830	5 200	0.09	2.3	0.8125	0.8120	1.0620	1.0630
13/16	20.64	1 1/16	26.99	0.875	22.22	B-1314	—	3 860	5 940	11 300	6 180	5 200	—	—	0.8125	0.8120	1.0620	1.0630
13/16	20.64	1 1/16	26.99	1.000	25.40	B-1316	M-13161	4 390	6 760	13 400	7 290	5 200	0.09	2.3	0.8125	0.8120	1.0620	1.0630
13/16	20.64	1 1/8	28.58	0.625	15.88	BH-1310	—	2 810	4 320	6 510	3 640	6 200	—	—	0.8125	0.8120	1.1245	1.1255
13/16	20.64	1 1/8	28.58	0.750	19.05	BH-1312	—	3 470	5 340	8 550	4 790	6 200	—	—	0.8125	0.8120	1.1245	1.1255
0.87	22	1.1	28	0.472	12	—	—	—	—	—	—	—	—	—	0.8661	0.8656	1.1013	1.1021
0.87	22	1.1	28	0.630	16	—	—	—	—	—	—	—	—	—	0.8661	0.8656	1.1013	1.1021
0.87	22	1.1	28	0.787	20	—	—	—	—	—	—	—	—	—	0.8661	0.8656	1.1013	1.1021

Ⓓ Symbol denotes Torrington Basic Dynamic Load Rating to be used in load-life calculations taking into consideration the application guidelines and limitations given in this catalog. Applications involving loads approaching this rating or the tabulated working load, whichever is the smaller, should be referred to the Torrington Engineering Sales Office before a final selection is made.

Load Ratings are based on a minimum raceway hardness of 58 HRC or equivalent. Load ratings are given in pounds-force: 1 lbf = 0.454kgf = 4.448N
Required Basic Dynamic Load Rating (Cr) = Applied Load • SF • LF • HF (see page E75).

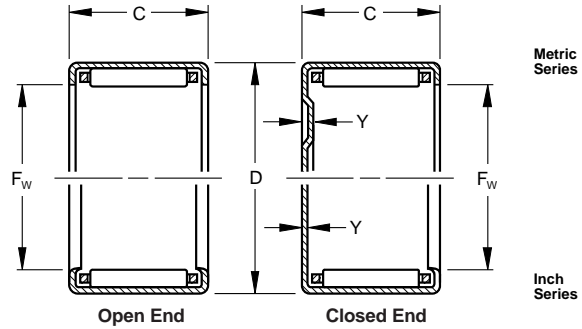




Caged Bearings

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 bearings.

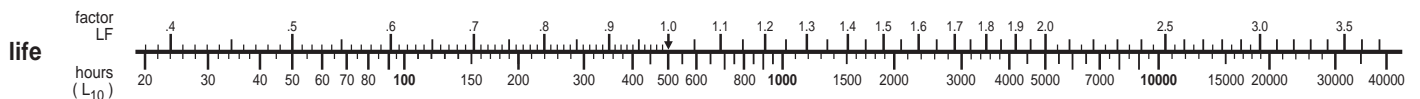


BEARING MOUNTING				CAGE RETAINED ROLLERS								
Metric Mounting				Bearing Designation	Load Ratings				Limiting Speed Caged Bearings	Y End Thickness		
S Shaft Raceway Diameter	H Housing Bore				open end	closed end	Basic Dynamic C_r	Basic Static C_o		Working Load	Y End Thickness	
	millimeters		millimeters								inch	mm
max.	min.	min.	max.			lbf	lbf	lbf	rpm	inch	mm	
15,875	15,862	22,212	22,237	—	—	—	—	—	—	—	—	
15,875	15,862	22,212	22,237	JH-1010	—	1 730	2 370	3 180	1 790	21 000	—	
15,875	15,862	22,212	22,237	—	—	—	—	—	—	—	—	
15,875	15,862	22,212	22,237	JH-1016	—	2 960	4 050	6 330	3 560	21 000	—	
16,000	15,989	21,972	21,993	HK-1612	—	1 160	1 590	2 180	730	21 000	—	
16,000	15,989	21,972	21,993	HK-1616	—	1 650	2 260	3 450	1 150	21 000	—	
17,000	16,989	22,972	22,993	HK-1712	—	1 210	1 660	2 350	780	20 000	—	
17,462	17,449	22,212	22,237	—	—	—	—	—	—	—	—	
17,462	17,449	22,212	22,237	—	—	—	—	—	—	—	—	
17,462	17,449	22,212	22,237	—	—	—	—	—	—	—	—	
17,462	17,449	22,212	22,237	J-1112	—	1 830	2 500	4 610	2 460	19 000	—	
17,462	17,449	23,800	23,825	—	—	—	—	—	—	—	—	
17,462	17,449	23,800	23,825	JH-1110	—	1 800	2 470	3 430	1 910	19 000	—	
17,462	17,449	23,800	23,825	JH-1112	—	2 410	3 300	5 000	2 780	19 000	—	
18,000	17,989	23,972	23,993	HK-1812	—	1 250	1 720	2 500	830	18 000	—	
18,000	17,989	23,972	23,993	HK-1816	—	1 910	2 620	4 290	1 430	18 000	—	
19,050	19,037	25,387	25,412	J-126	—	975	1 340	1 600	879	18 000	—	
19,050	19,037	25,387	25,412	J-128	—	1 490	2 040	2 760	1 520	18 000	—	
19,050	19,037	25,387	25,412	J-1210	MJ-12101	1 870	2 560	3 690	2 030	18 000	0.04	
19,050	19,037	25,387	25,412	J-1212	MJ-12121	2 320	3 180	4 880	2 680	18 000	0.04	
20,000	19,987	25,972	25,993	HK-2012	—	1 340	1 830	2 810	940	16 000	—	
20,000	19,987	25,972	25,993	HK-2016	—	1 850	2 530	4 240	1 410	16 000	—	
20,000	19,987	25,972	25,993	HK-2020	—	2 320	3 170	5 680	1 890	16 000	—	
20,638	20,625	26,975	27,000	—	—	—	—	—	—	—	—	
20,638	20,625	26,975	27,000	—	—	—	—	—	—	—	—	
20,638	20,625	26,975	27,000	—	—	—	—	—	—	—	—	
20,638	20,625	26,975	27,000	—	—	—	—	—	—	—	—	
20,638	20,625	28,562	28,587	—	—	—	—	—	—	—	—	
20,638	20,625	28,562	28,587	JH-1312	—	2 780	3 810	5 460	3 060	16 000	—	
22,000	21,987	27,972	27,993	HK-2212	—	1 460	2 010	3 250	1 080	15 000	—	
22,000	21,987	27,972	27,993	HK-2216	—	1 950	2 680	4 710	1 570	15 000	—	
22,000	21,987	27,972	27,993	HK-2220	—	2 280	3 130	5 730	1 910	15 000	—	

Mounting dimensions are based on the inner ring rotating and the outer ring being stationary relative to the load. The housing should be of high strength material. See pages E77-78 for discussion of shaft and housing design.

Drawn cup bearings of nominal inch and metric dimensions with one closed end, which are not tabulated, may be made available upon request.

Caged drawn cup bearings of nominal inch and metric dimensions, with engineered polymer cage, may be made available upon request.

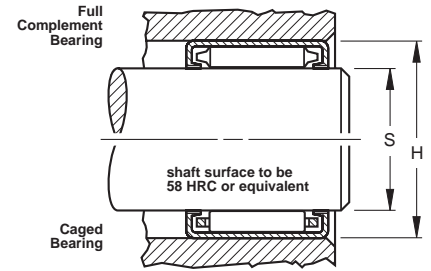
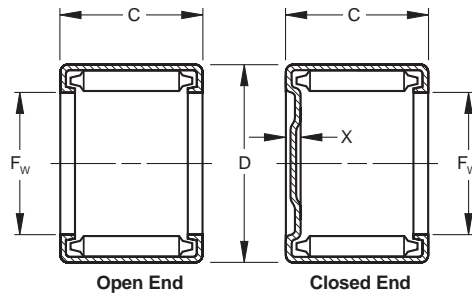




Full Complement Bearings

Check for availability.

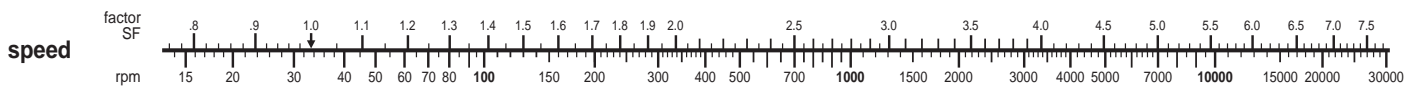
Inch-metric conversions given are for the convenience of the user. The controlling dimensions are in inches for nominal inch bearings and in millimeters for nominal metric bearings.



BEARING DIMENSIONS						MECHANICALLY RETAINED ROLLERS						BEARING MOUNTING						
F _w Bore	D Outside Diameter		C Width		Bearing Designation	Load Ratings	Limiting Speed Full Complement Bearings	X End Thickness	Inch Mounting									
	S Shaft Raceway Diameter		H Housing Bore															
	Inch Mounting		Inch Mounting															
(nom.)	(nom.)	+0.000 -0.010	+0.00 -0.25	open end	closed end	Basic Dynamic C _r	Basic Static C ₀	Working Load	rpm	inch	mm	inch	mm					
inch	mm	inch	mm			lbf	lbf	lbf				max.	min.	min.	max.			
7/8	22.22	1 1/8	28.58	0.375	9.52	B-146	—	1 480	2 280	3 380	1 830	4 800	—	—	0.8750	0.8745	1.1245	1.1255
7/8	22.22	1 1/8	28.58	0.500	12.70	B-148	—	2 190	3 370	5 590	3 030	4 800	—	—	0.8750	0.8745	1.1245	1.1255
7/8	22.22	1 1/8	28.58	0.750	19.05	B-1412	M-14121	3 440	5 300	9 990	5 410	4 800	0.09	2.3	0.8750	0.8745	1.1245	1.1255
7/8	22.22	1 1/8	28.58	1.000	25.40	B-1416	M-14161	4 570	7 040	14 400	7 800	4 800	0.09	2.3	0.8750	0.8745	1.1245	1.1255
7/8	22.22	1 1/8	28.58	1.125	28.58	B-1418	—	5 110	7 860	16 600	8 990	4 800	—	—	0.8750	0.8745	1.1245	1.1255
7/8	22.22	1 3/16	30.16	0.625	15.88	BH-1410	—	2 910	4 470	7 030	3 890	5 880	—	—	0.8750	0.8745	1.1870	1.1880
7/8	22.22	1 3/16	30.16	0.750	19.05	BH-1412	—	3 590	5 530	9 230	5 110	5 880	—	—	0.8750	0.8745	1.1870	1.1880
7/8	22.22	1 3/16	30.16	1.000	25.40	BH-1416	—	4 860	7 480	13 600	7 550	5 880	—	—	0.8750	0.8745	1.1870	1.1880
15/16	23.81	1 3/16	30.16	0.500	12.70	B-158	—	2 270	3 500	5 990	3 220	4 500	—	—	0.9375	0.9370	1.1870	1.1880
15/16	23.81	1 3/16	30.16	1.000	25.40	B-1516	M-15161	4 750	7 300	15 400	8 300	4 500	0.09	2.3	0.9375	0.9370	1.1870	1.1880
0.98	25	1.26	32	0.472	12	—	—	—	—	—	—	—	—	—	0.9843	0.9838	1.2585	1.2595
0.98	25	1.26	32	0.630	16	—	—	—	—	—	—	—	—	—	0.9843	0.9838	1.2585	1.2595
0.98	25	1.26	32	0.787	20	—	—	—	—	—	—	—	—	—	0.9843	0.9838	1.2585	1.2595
0.98	25	1.26	32	1.024	26	—	—	—	—	—	—	—	—	—	0.9842	0.9837	1.2585	1.2595
1	25.40	1 1/4	31.75	0.375	9.52	B-166	—	1 590	2 450	3 870	2 070	4 300	—	—	1.0000	0.9995	1.2495	1.2505
1	25.40	1 1/4	31.75	0.438	11.13	B-167	—	1 980	3 050	5 120	2 740	4 300	—	—	1.0000	0.9995	1.2495	1.2505
1	25.40	1 1/4	31.75	0.500	12.70	B-168	—	2 350	3 620	6 390	3 420	4 300	—	—	1.0000	0.9995	1.2495	1.2505
1	25.40	1 1/4	31.75	0.625	15.88	B-1610	—	3 050	4 690	8 910	4 760	4 300	—	—	1.0000	0.9995	1.2495	1.2505
1	25.40	1 1/4	31.75	0.750	19.05	B-1612	M-16121	3 700	5 690	11 400	6 110	4 300	0.09	2.3	1.0000	0.9995	1.2495	1.2505
1	25.40	1 1/4	31.75	1.000	25.40	B-1616	M-16161	4 910	7 560	16 500	8 800	4 300	0.09	2.3	1.0000	0.9995	1.2495	1.2505
1	25.40	1 3/16	33.34	0.500	12.70	BH-168	MH-1681	2 340	3 600	5 500	3 000	5 200	0.11	2.8	1.0000	0.9995	1.3120	1.3130
1	25.40	1 3/16	33.34	0.625	15.88	BH-1610	—	3 140	4 830	8 020	4 370	5 200	—	—	1.0000	0.9995	1.3120	1.3130
1	25.40	1 3/16	33.34	0.750	19.05	BH-1612	MH-16121	3 880	5 970	10 500	5 750	5 200	0.11	2.8	1.0000	0.9995	1.3120	1.3130
1	25.40	1 3/16	33.34	1.000	25.40	BH-1616	MH-16161	5 260	8 090	15 600	8 500	5 200	0.11	2.8	1.0000	0.9995	1.3120	1.3130
1	25.40	1 3/16	33.34	1.250	31.75	BH-1620	—	6 540	10 100	20 600	11 200	5 200	—	—	1.0000	0.9995	1.3120	1.3130
1	25.40	1 3/16	33.34	1.500	38.10	BH-1624	—	7 750	11 900	25 600	14 000	5 200	—	—	1.0000	0.9995	1.3120	1.3130
1 1/16	26.99	1 3/16	33.34	0.625	15.88	B-1710	—	3 150	4 840	9 470	5 030	4 000	—	—	1.0625	1.0620	1.3120	1.3130
1.10	28	1.38	35	0.630	16	—	—	—	—	—	—	—	—	—	1.1024	1.1019	1.3767	1.3777
1.10	28	1.38	35	0.787	20	—	—	—	—	—	—	—	—	—	1.1024	1.1019	1.3767	1.3777
1 1/8	28.58	1 3/8	34.92	0.375	9.52	B-186	—	1 700	2 610	4 350	2 310	3 800	—	—	1.1250	1.1245	1.3745	1.3755
1 1/8	28.58	1 3/8	34.92	0.500	12.70	B-188	—	2 510	3 850	7 190	3 810	3 800	—	—	1.1250	1.1245	1.3745	1.3755
1 1/8	28.58	1 3/8	34.92	0.750	19.05	B-1812	—	3 940	6 060	12 900	6 810	3 800	—	—	1.1250	1.1245	1.3745	1.3755
1 1/8	28.58	1 3/8	34.92	1.000	25.40	B-1816	M-18161	5 230	8 050	18 500	9 810	3 800	0.09	2.3	1.1250	1.1245	1.3745	1.3755
1 1/8	28.58	1 1/2	38.10	0.750	19.05	BH-1812	—	4 500	6 920	11 500	6 350	5 500	—	—	1.1250	1.1245	1.4995	1.5005
1 1/8	28.58	1 1/2	38.10	1.000	25.40	BH-1816	—	6 120	9 420	17 100	9 430	5 500	—	—	1.1250	1.1245	1.4995	1.5005
1 1/8	28.58	1 1/2	38.10	1.125	28.58	—	—	—	—	—	—	—	—	—	1.1250	1.1245	1.4995	1.5005
1 1/8	28.58	1 1/2	38.10	1.250	31.75	BH-1820	—	7 660	11 800	22 900	12 600	5 500	—	—	1.1250	1.1245	1.4995	1.5005

Ⓣ Symbol denotes Torrington Basic Dynamic Load Rating to be used in load-life calculations taking into consideration the application guidelines and limitations given in this catalog. Applications involving loads approaching this rating or the tabulated working load, whichever is the smaller, should be referred to the Torrington Engineering Sales Office before a final selection is made.

Load Ratings are based on a minimum raceway hardness of 58 HRC or equivalent. Load ratings are given in pounds-force: 1 lbf = 0.454kgf = 4.448N. Required Basic Dynamic Load Rating (C_r) = Applied Load • SF • LF • HF (see page E75).

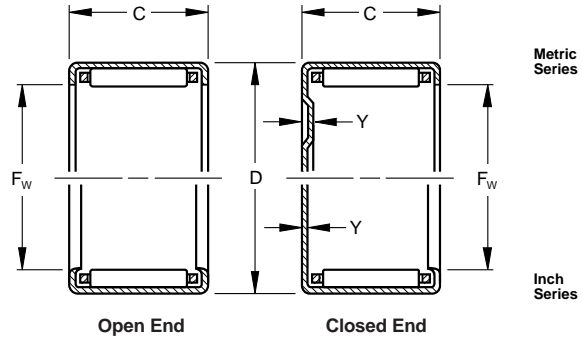




Caged Bearings

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 bearings.

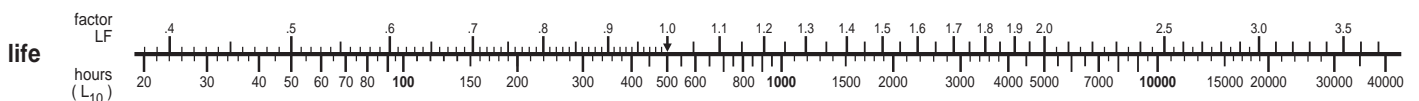


BEARING MOUNTING				CAGE RETAINED ROLLERS								
Metric Mounting				Bearing Designation	Load Ratings				Limiting Speed Caged Bearings	Y End Thickness		
S Shaft Raceway Diameter	H Housing Bore				open end	closed end	Basic Dynamic C_r	Basic Static C_o		Working Load	Y End Thickness	
millimeters	millimeters					Ⓣ	ISO 281	ISO 76	(max.)	rpm	inch	mm
max.	min.	min.	max.			lbf	lbf	lbf	lbf			
22,225	22,212	28,562	28,587	J-146	—	1 080	1 480	1 910	1 030	15 000	—	—
22,225	22,212	28,562	28,587	J-148	—	1 640	2 250	3 270	1 770	15 000	—	—
22,225	22,212	28,562	28,587	J-1412	MJ-14121	2 570	3 530	5 830	3 160	15 000	0.04	1.0
22,225	22,212	28,562	28,587	J-1416	MJ-14161	3 540	4 850	8 780	4 750	15 000	0.04	1.0
22,225	22,212	28,562	28,587	—	—	—	—	—	—	—	—	—
22,225	22,212	30,150	30,175	—	—	—	—	—	—	—	—	—
22,225	22,212	30,150	30,175	JH-1412	—	2 710	3 710	5 450	3 020	15 000	—	—
22,225	22,212	30,150	30,175	JH-1416	—	3 770	5 160	8 330	4 610	15 000	—	—
23,812	23,799	30,150	30,175	—	—	—	—	—	—	—	—	—
23,812	23,799	30,150	30,175	—	—	—	—	—	—	—	—	—
25,000	24,987	31,967	31,992	HK-2512	—	1 660	2 270	3 410	1 140	13 000	—	—
25,000	24,987	31,967	31,992	HK-2516	—	2 730	3 240	5 390	1 800	13 000	—	—
25,000	24,987	31,967	31,992	HK-2520	—	3 100	4 250	7 620	2 540	13 000	—	—
25,000	24,987	31,967	31,992	HK-2526	BK-2526	3 860	5 280	10 100	3 370	13 000	.11	2.7
25,400	25,387	31,737	31,762	—	—	—	—	—	—	—	—	—
25,400	25,387	31,737	31,762	—	—	—	—	—	—	—	—	—
25,400	25,387	31,737	31,762	—	—	—	—	—	—	—	—	—
25,400	25,387	31,737	31,762	—	—	—	—	—	—	—	—	—
25,400	25,387	31,737	31,762	J-1612	—	2 710	3 720	6 500	3 470	13 000	—	—
25,400	25,387	31,737	31,762	J-1616	—	3 730	5 110	9 780	5 230	13 000	—	—
25,400	25,387	33,325	33,350	—	—	—	—	—	—	—	—	—
25,400	25,387	33,325	33,350	—	—	—	—	—	—	—	—	—
25,400	25,387	33,325	33,350	JH-1612	MJH-16121	3 060	4 190	6 570	3 590	13 000	0.05	1.3
25,400	25,387	33,325	33,350	JH-1616	MJH-16161	4 090	5 610	9 570	5 220	13 000	0.05	1.3
25,400	25,387	33,325	33,350	—	—	—	—	—	—	—	—	—
25,400	25,387	33,325	33,350	—	—	—	—	—	—	—	—	—
26,988	26,975	33,325	33,350	—	—	—	—	—	—	—	—	—
28,000	27,987	34,967	34,992	HK-2816	—	2 410	3 300	5 690	1 900	12 000	—	—
28,000	27,987	34,967	34,992	HK-2820	—	3 150	4 310	8 040	2 680	12 000	—	—
28,575	28,562	34,912	34,937	—	—	—	—	—	—	—	—	—
28,575	28,562	34,912	34,937	J-188	—	1 790	2 460	3 960	2 100	11 000	—	—
28,575	28,562	34,912	34,937	J-1812	—	2 840	3 890	7 160	3 790	11 000	—	—
28,575	28,562	34,912	34,937	J-1816	—	3 910	5 350	10 800	5 700	11 000	—	—
28,575	28,562	38,087	38,112	JH-1812	—	3 510	4 810	7 120	3 920	12 000	—	—
28,575	28,562	38,087	38,112	JH-1816	MJH-18161	4 970	6 810	11 100	6 140	12 000	0.05	1.3
28,575	28,562	38,087	38,112	JH-1818	—	5 440	7 460	12 500	6 890	12 000	—	—
28,575	28,562	38,087	38,112	—	—	—	—	—	—	—	—	—

Mounting dimensions are based on the inner ring rotating and the outer ring being stationary relative to the load. The housing should be of high strength material. See pages E77-78 for discussion of shaft and housing design.

Drawn cup bearings of nominal inch and metric dimensions with one closed end, which are not tabulated, may be made available upon request.

Caged drawn cup bearings of nominal inch and metric dimensions, with engineered polymer cage, may be made available upon request.

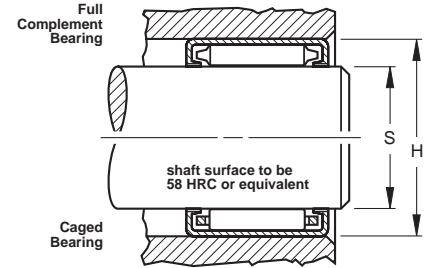
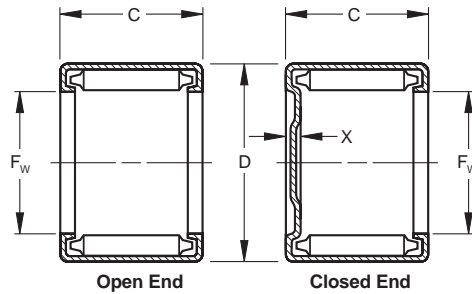




Full Complement Bearings

Check for availability.

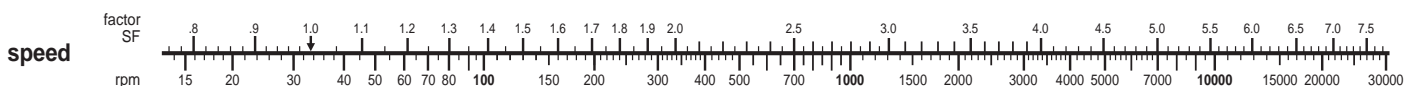
Inch-metric conversions given are for the convenience of the user. The controlling dimensions are in inches for nominal inch bearings and in millimeters for nominal metric bearings.



BEARING DIMENSIONS						MECHANICALLY RETAINED ROLLERS						BEARING MOUNTING						
F _w Bore		D Outside Diameter		C Width		Bearing Designation		Load Ratings			Limiting Speed Full Complement Bearings	X End Thickness		Inch Mounting				
(nom.)	(nom.)	(nom.)	(nom.)	+0.000 -0.010	+0.00 -0.25	open end	closed end	Basic Dynamic C _r	Basic Static C ₀	Working Load		(max.)	(max.)	S Shaft Raceway Diameter	H Housing Bore			
inch	mm	inch	mm	inch	mm			Ⓣ	ISO 281	ISO 76	(max.)	rpm	inch	mm	max.	min.	min.	max.
1.18	30	1.46	37	0.472	12	—	—	—	—	—	—	—	—	—	1.1811	1.1806	1.4554	1.4564
1.18	30	1.46	37	0.787	20	—	—	—	—	—	—	—	—	—	1.1811	1.1806	1.4554	1.4564
1.18	30	1.46	37	1.024	26	—	—	—	—	—	—	—	—	—	1.1811	1.1806	1.4554	1.4564
1 3/16	30.16	1 1/2	38.10	1.000	25.40	B-1916	—	5 760	8 860	18 500	9 920	4 400	—	—	1.1875	1.1870	1.4995	1.5005
1 1/4	31.75	1 1/2	38.10	0.500	12.70	B-208	—	2 650	4 080	7 990	4 200	3 500	—	—	1.2500	1.2495	1.4995	1.5005
1 1/4	31.75	1 1/2	38.10	0.625	15.88	B-2010	—	3 430	5 280	11 100	5 850	3 500	—	—	1.2500	1.2495	1.4995	1.5005
1 1/4	31.75	1 1/2	38.10	0.750	19.05	B-2012	—	4 160	6 410	14 300	7 510	3 500	—	—	1.2500	1.2495	1.4995	1.5005
1 1/4	31.75	1 1/2	38.10	1.000	25.40	B-2016	M-20161	5 530	8 510	20 600	10 800	3 500	0.09	2.3	1.2500	1.2495	1.4995	1.5005
1 1/4	31.75	1 1/2	38.10	1.250	31.75	B-2020	M-20201	6 810	10 500	26 900	14 100	3 500	0.09	2.3	1.2500	1.2495	1.4995	1.5005
1 1/4	31.75	1 5/8	41.28	0.500	12.70	BH-208	—	2 730	4 200	6 320	3 440	5 000	—	—	1.2500	1.2495	1.6245	1.6255
1 1/4	31.75	1 5/8	41.28	0.750	19.05	BH-2012	—	4 720	7 250	12 700	6 930	5 000	—	—	1.2500	1.2495	1.6245	1.6255
1 1/4	31.75	1 5/8	41.28	1.000	25.40	BH-2016	MH-20161	6 440	9 910	19 000	10 400	5 000	0.12	3.0	1.2500	1.2495	1.6245	1.6255
1 1/4	31.75	1 5/8	41.28	1.250	31.75	BH-2020	MH-20201	8 070	12 400	25 400	13 800	5 000	0.12	3.0	1.2500	1.2495	1.6245	1.6255
1 3/16	33.34	1 5/8	41.28	0.500	12.70	B-218	—	2 720	4 180	7 220	3 840	4 000	—	—	1.3125	1.3120	1.6245	1.6255
1 3/16	33.34	1 5/8	41.28	0.625	15.88	B-2110	—	3 640	5 600	10 500	5 600	4 000	—	—	1.3125	1.3120	1.6245	1.6255
1 3/16	33.34	1 5/8	41.28	1.250	31.75	B-2120	—	7 620	11 700	27 200	14 500	4 000	—	—	1.3125	1.3120	1.6245	1.6255
1 3/8	34.92	1 5/8	41.28	0.500	12.70	B-228	—	2 780	4 280	8 790	4 590	3 200	—	—	1.3750	1.3745	1.6245	1.6255
1 3/8	34.92	1 5/8	41.28	0.750	19.05	B-2212	—	4 380	6 730	15 700	8 200	3 200	—	—	1.3750	1.3745	1.6245	1.6255
1 3/8	34.92	1 5/8	41.28	1.000	25.40	B-2216	—	5 820	8 950	22 700	11 800	3 200	—	—	1.3750	1.3745	1.6245	1.6255
1 3/8	34.92	1 5/8	41.28	1.250	31.75	B-2220	—	7 160	11 000	29 600	15 400	3 200	—	—	1.3750	1.3745	1.6245	1.6255
1 3/8	34.92	1 3/4	44.45	0.625	15.88	BH-2210	—	4 060	6 240	10 600	5 740	4 700	—	—	1.3750	1.3745	1.7495	1.7505
1 3/8	34.92	1 3/4	44.45	0.750	19.05	BH-2212	—	5 050	7 770	14 100	7 610	4 700	—	—	1.3750	1.3745	1.7495	1.7505
1 3/8	34.92	1 3/4	44.45	1.000	25.40	BH-2216	—	6 870	10 600	20 900	11 300	4 700	—	—	1.3750	1.3745	1.7495	1.7505
1 3/8	34.92	1 3/4	44.45	1.250	31.75	BH-2220	—	8 600	13 200	28 000	15 100	4 700	—	—	1.3750	1.3745	1.7495	1.7505
1.38	35	1.65	42	0.472	12	—	—	—	—	—	—	—	—	—	1.3779	1.3774	1.6522	1.6532
1.38	35	1.65	42	0.630	16	—	—	—	—	—	—	—	—	—	1.3780	1.3774	1.6522	1.6532
1.38	35	1.65	42	0.787	20	—	—	—	—	—	—	—	—	—	1.3780	1.3774	1.6522	1.6532
1 1/2	38.10	1 7/8	47.62	0.500	12.70	B-248	—	3 110	4 780	7 830	4 190	4 300	—	—	1.5000	1.4995	1.8745	1.8755
1 1/2	38.10	1 7/8	47.62	0.625	15.88	B-2410	—	4 220	6 500	11 600	6 200	4 300	—	—	1.5000	1.4995	1.8745	1.8755
1 1/2	38.10	1 7/8	47.62	0.750	19.05	B-2412	—	5 260	8 090	15 400	8 220	4 300	—	—	1.5000	1.4995	1.8745	1.8755
1 1/2	38.10	1 7/8	47.62	0.875	22.22	B-2414	—	6 240	9 590	19 200	10 200	4 300	—	—	1.5000	1.4995	1.8745	1.8755
1 1/2	38.10	1 7/8	47.62	1.000	25.40	B-2416	M-24161	7 150	11 000	22 800	12 200	4 300	0.12	3.0	1.5000	1.4995	1.8745	1.8755
1 1/2	38.10	1 7/8	47.62	1.250	31.75	B-2420	M-24201	8 950	13 800	30 500	16 300	4 300	0.12	3.0	1.5000	1.4995	1.8745	1.8755
1.57	40	1.85	47	0.472	12	—	—	—	—	—	—	—	—	—	1.5748	1.5742	1.8491	1.8501
1.57	40	1.85	47	0.630	16	—	—	—	—	—	—	—	—	—	1.5748	1.5742	1.8491	1.8501
1.57	40	1.85	47	0.787	20	—	—	—	—	—	—	—	—	—	1.5748	1.5742	1.8491	1.8501

Ⓣ Symbol denotes Torrington Basic Dynamic Load Rating to be used in load-life calculations taking into consideration the application guidelines and limitations given in this catalog. Applications involving loads approaching this rating or the tabulated working load, whichever is the smaller, should be referred to the Torrington Engineering Sales Office before a final selection is made.

Load Ratings are based on a minimum raceway hardness of 58 HRC or equivalent. Load ratings are given in pounds-force: 1 lbf = 0.454kgf = 4.448N. Required Basic Dynamic Load Rating (Cr) = Applied Load • SF • LF • HF (see page E75).

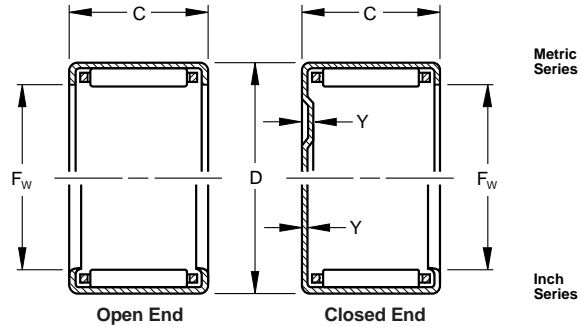




Caged Bearings

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 bearings.

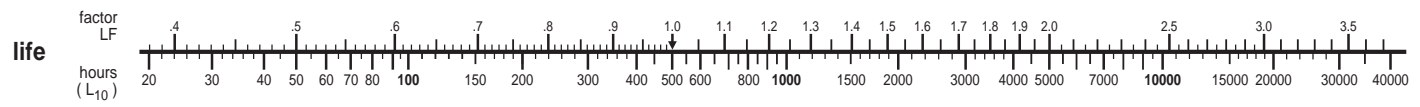


BEARING MOUNTING				CAGE RETAINED ROLLERS								
Metric Mounting				Bearing Designation	Load Ratings				Limiting Speed Caged Bearings	Y End Thickness		
S Shaft Raceway Diameter		H Housing Bore			Basic Dynamic C_r	Basic Static C_o	Working Load	Y End Thickness				
max.	min.	min.	max.					open end		closed end	inch	mm
30,000	29,987	36,967	36,992	HK-3012	—	1 830	2 500	4 100	1 370	11 000	—	—
30,000	29,987	36,967	36,992	HK-3020	—	3 410	4 680	9 140	3 050	11 000	—	—
30,000	29,987	36,967	36,992	HK-3026	—	4 120	5 640	11 600	3 870	11 000	—	—
30,162	30,149	38,087	38,112	—	—	—	—	—	—	—	—	—
31,750	31,737	38,087	38,112	—	—	—	—	—	—	—	—	—
31,750	31,737	38,087	38,112	—	—	—	—	—	—	—	—	—
31,750	31,737	38,087	38,112	—	—	—	—	—	—	—	—	—
31,750	31,737	38,087	38,112	J-2016	MJ-20161	4 310	5 900	12 700	6 650	10 000	—	—
31,750	31,737	38,087	38,112	—	—	—	—	—	—	—	—	—
31,750	31,737	41,262	41,287	—	—	—	—	—	—	—	—	—
31,750	31,737	41,262	41,287	JH-2012	—	3 620	4 960	7 710	4 190	10 000	—	—
31,750	31,737	41,262	41,287	JH-2016	—	5 090	6 970	11 900	6 490	10 000	—	—
31,750	31,737	41,262	41,287	JH-2020	—	6 370	8 730	15 900	8 660	10 000	—	—
33,338	33,325	41,262	41,287	—	—	—	—	—	—	—	—	—
33,338	33,325	41,262	41,287	—	—	—	—	—	—	—	—	—
33,338	33,325	41,262	41,287	—	—	—	—	—	—	—	—	—
34,925	34,912	41,262	41,287	J-228	—	2 090	2 870	5 170	2 700	9 200	—	—
34,925	34,912	41,262	41,287	J-2212	—	3 410	4 670	9 690	4 890	9 200	—	—
34,925	34,912	41,262	41,287	—	—	—	—	—	—	—	—	—
34,925	34,912	41,262	41,287	—	—	—	—	—	—	—	—	—
34,925	34,912	44,437	44,462	—	—	—	—	—	—	—	—	—
34,925	34,912	44,437	44,462	JH-2212	—	3 950	5 410	8 740	4 720	9 400	—	—
34,925	34,912	44,437	44,462	JH-2216	MJH-22161	5 480	7 510	13 300	7 190	9 400	0.05	1.3
34,925	34,912	44,437	44,462	—	—	—	—	—	—	—	—	—
35,000	34,987	41,967	41,992	HK-3512	—	2 040	2 790	4 950	1 650	9 100	—	—
35,000	34,987	41,967	41,992	HK-3516	—	2 630	3 600	6 840	2 280	9 100	—	—
35,000	34,987	41,967	41,992	HK-3520	—	3 700	5 070	10 700	3 570	9 100	—	—
38,100	38,087	47,612	47,637	—	—	—	—	—	—	—	—	—
38,100	38,087	47,612	47,637	—	—	—	—	—	—	—	—	—
38,100	38,087	47,612	47,637	J-2412	—	4 260	5 830	9 970	5 330	8 600	—	—
38,100	38,087	47,612	47,637	—	—	—	—	—	—	—	—	—
38,100	38,087	47,612	47,637	J-2416	—	5 890	8 080	15 100	8 100	8 600	—	—
38,100	38,087	47,612	47,637	J-2420	—	7 410	10 200	20 300	10 900	8 600	—	—
40,000	39,984	46,967	46,992	HK-4012	—	2 040	2 800	5 170	1 720	7 900	—	—
40,000	39,984	46,967	46,992	HK-4016	—	2 860	3 910	7 960	2 650	7 900	—	—
40,000	39,984	46,967	46,992	HK-4020	—	3 790	5 190	11 500	3 830	7 900	—	—

Mounting dimensions are based on the inner ring rotating and the outer ring being stationary relative to the load. The housing should be of high strength material. See pages E77-E78 for discussion of shaft and housing design.

Drawn cup bearings of nominal inch and metric dimensions with one closed end, which are not tabulated, may be made available upon request.

Caged drawn cup bearings of nominal inch and metric dimensions, with engineered polymer cage, may be made available upon request.

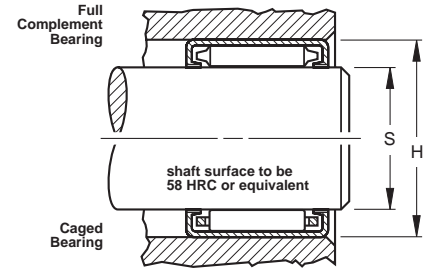
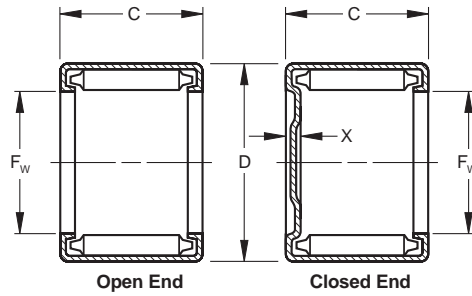




Full Complement Bearings

Check for availability.

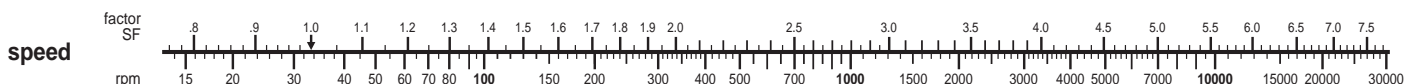
Inch-metric conversions given are for the convenience of the user. The controlling dimensions are in inches for nominal inch bearings and in millimeters for nominal metric bearings.



BEARING DIMENSIONS						MECHANICALLY RETAINED ROLLERS						BEARING MOUNTING						
F _w Bore		D Outside Diameter		C Width		Bearing Designation		Load Ratings			Limiting Speed Full Complement Bearings	X End Thickness		Inch Mounting				
(nom.)	(nom.)	(nom.)	(nom.)	+0.000 -0.010	+0.00 -0.25	open end	closed end	Basic Dynamic C _r	Basic Static C ₀	Working Load		inch	mm	S Shaft Raceway Diameter		H Housing Bore		
inch	mm	inch	mm	inch	mm			Ⓣ	ISO 281	ISO 76	(max.)	rpm		mm	max.	min.	min.	max.
1 1/8	41.28	2	50.8	0.500	12.70	B-268	—	3 200	4 920	8 390	4 450	3 900	—	—	1.6250	1.6245	1.9995	2.0005
1 1/8	41.28	2	50.8	0.625	15.88	B-2610	—	4 360	6 710	12 500	6 630	3 900	—	—	1.6250	1.6245	1.9995	2.0005
1 1/8	41.28	2	50.80	1.000	25.40	B-2616	—	7 430	11 400	24 800	13 100	3 900	—	—	1.6250	1.6245	1.9995	2.0005
1 1/8	41.28	2	50.80	1.250	31.75	B-2620	—	9 280	14 300	33 000	17 500	3 900	—	—	1.6250	1.6245	1.9995	2.0005
1 3/4	44.45	2 1/2	53.98	0.750	19.05	B-2812	—	5 630	8 660	17 900	9 410	3 700	—	—	1.7500	1.7495	2.1245	2.1255
1 3/4	44.45	2 1/2	53.98	1.000	25.40	B-2816	M-28161	7 690	11 800	26 700	14 100	3 700	0.12	3.0	1.7500	1.7495	2.1245	2.1255
1 3/4	44.45	2 1/2	53.98	1.250	31.75	B-2820	—	9 600	14 800	35 500	18 700	3 700	—	—	1.7500	1.7495	2.1245	2.1255
1 3/4	44.45	2 1/2	53.98	1.500	38.10	B-2824	—	11 400	17 600	44 300	23 400	3 700	—	—	1.7500	1.7495	2.1245	2.1255
1.77	45	2.05	52	0.472	12	—	—	—	—	—	—	—	—	—	1.7717	1.7711	2.0457	2.0469
1.77	45	2.05	52	0.630	16	—	—	—	—	—	—	—	—	—	1.7717	1.7711	2.0457	2.0469
1.77	45	2.05	52	0.787	20	—	—	—	—	—	—	—	—	—	1.7717	1.7711	2.0457	2.0469
1 7/8	47.62	2 1/4	57.15	0.500	12.70	B-308	—	3 500	5 380	9 790	5 140	3 500	—	—	1.8750	1.8745	2.2495	2.2505
1 7/8	47.62	2 1/4	57.15	0.750	19.05	B-3012	—	5 920	9 100	19 200	10 100	3 500	—	—	1.8750	1.8745	2.2495	2.2505
1 7/8	47.62	2 1/4	57.15	1.000	25.40	B-3016	—	8 050	12 400	28 600	15 000	3 500	—	—	1.8750	1.8745	2.2495	2.2505
1.97	50	2.28	58	0.787	20	—	—	—	—	—	—	—	—	—	1.9685	1.9679	2.2819	2.2831
2	50.80	2 3/8	60.32	0.500	12.70	B-328	—	3 570	5 490	10 300	5 390	3 300	—	—	2.0000	1.9994	2.3745	2.3755
2	50.80	2 3/8	60.32	1.000	25.40	B-3216	M-32161	8 290	12 700	30 500	15 900	3 300	0.12	3.0	2.0000	1.9994	2.3745	2.3755
2	50.80	2 3/8	60.32	1.250	31.75	B-3220	—	10 300	15 900	40 600	21 200	3 300	—	—	2.0000	1.9994	2.3745	2.3755
2	50.80	2 3/8	60.32	1.750	44.45	B-3228	M-32281	14 200	21 800	60 700	31 700	3 300	0.12	3.0	2.0000	1.9994	2.3745	2.3755
2 1/16	52.39	2 1/16	64.29	0.750	19.05	BH-3312	—	6 590	10 100	19 000	10 100	4 000	—	—	2.0625	2.0619	2.5307	2.5317
2 1/16	52.39	2 1/16	64.29	1.000	25.40	BH-3316	—	9 250	14 200	29 400	15 600	4 000	—	—	2.0625	2.0619	2.5307	2.5317
2 1/8	53.98	2 1/2	63.50	0.500	12.70	B-348	—	3 670	5 650	11 000	5 710	3 100	—	—	2.1250	2.1244	2.4995	2.5005
2 1/8	53.98	2 1/2	63.50	1.000	25.40	B-3416	—	8 530	13 100	32 400	16 900	3 100	—	—	2.1250	2.1244	2.4995	2.5005
2 1/8	53.98	2 1/2	63.50	1.500	38.10	B-3424	—	12 700	19 500	53 900	28 000	3 100	—	—	2.1250	2.1244	2.4995	2.5005
2.17	55	2.48	63	0.787	20	—	—	—	—	—	—	—	—	—	2.1654	2.1647	2.4788	2.4800
2 1/4	57.15	2 3/8	66.68	0.750	19.05	B-3612	—	6 590	10 100	23 100	12 000	3 000	—	—	2.2500	2.2494	2.6245	2.6255
2 1/4	57.15	2 3/8	66.68	1.000	25.40	—	—	—	—	—	—	—	—	—	2.2500	2.2494	2.6245	2.6255
2 1/4	57.15	2 3/8	66.68	1.250	31.75	B-3620	—	11 200	17 300	45 800	23 800	3 000	—	—	2.2500	2.2494	2.6245	2.6255
2 1/4	57.15	2 3/8	66.68	1.500	38.10	B-3624	—	13 300	20 500	57 200	29 700	3 000	—	—	2.2500	2.2494	2.6245	2.6255
2.36	60	2.68	68	0.472	12	—	—	—	—	—	—	—	—	—	2.3622	2.3618	2.7150	2.7162
2 3/8	66.68	3	76.20	1.000	25.40	B-4216	M-42161	9 590	14 800	40 100	20 600	2 500	0.13	3.3	2.6250	2.6244	2.9995	3.0005
2 3/4	69.85	3 1/8	79.38	0.625	15.88	B-4410	—	5 840	8 980	21 300	10 900	2 500	—	—	2.7500	2.7494	3.1245	3.1255
2 3/4	69.85	3 1/8	79.38	0.750	19.05	—	—	—	—	—	—	—	—	—	2.7500	2.7494	3.1245	3.1255
2 3/4	69.85	3 1/8	79.38	1.000	25.40	B-4416	—	9 920	15 300	42 100	21 600	2 500	—	—	2.7500	2.7494	3.1245	3.1255
2 3/4	69.85	3 1/8	79.38	1.250	31.75	B-4420	—	12 400	19 000	56 000	28 700	2 500	—	—	2.7500	2.7494	3.1245	3.1255
3 1/2	88.90	4	101.60	0.750	19.05	B-5612	—	9 310	14 300	32 800	16 900	2 700	—	—	3.5000	3.4994	3.9995	4.0005
5 1/2	139.7	6	152.40	0.750	19.05	B-8812	—	10 900	16 700	49 900	25 100	1 600	—	—	5.5000	5.4993	5.9990	6.0010

Ⓣ Symbol denotes Torrington Basic Dynamic Load Rating to be used in load-life calculations taking into consideration the application guidelines and limitations given in this catalog. Applications involving loads approaching this rating or the tabulated working load, whichever is the smaller, should be referred to the Torrington Engineering Sales Office before a final selection is made.

Load Ratings are based on a minimum raceway hardness of 58 HRC or equivalent. Load ratings are given in pounds-force: 1 lbf = 0.454kgf = 4.448N. Required Basic Dynamic Load Rating (Cr) = Applied Load • SF • LF • HF (see page E75).

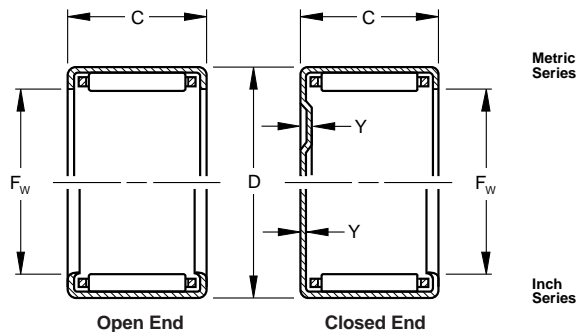




Caged Bearings

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 bearings.

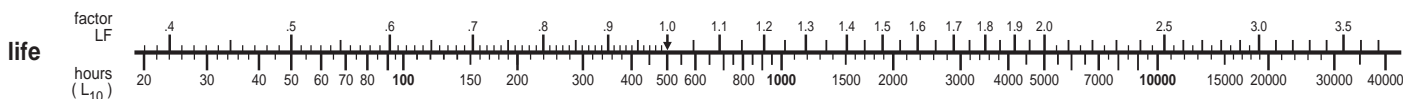


BEARING MOUNTING				CAGE RETAINED ROLLERS								
Metric Mounting				Bearing Designation	Load Ratings				Limiting Speed Caged Bearings	Y End Thickness		
S Shaft Raceway Diameter		H Housing Bore			open end	closed end	Basic Dynamic C_r	Basic Static C_o		Working Load	Y End Thickness	
max.	min.	min.	max.				①	ISO 281		ISO 76	(max.)	inch
41,275	41,262	50,787	50,812	—	—	—	—	—	—	—	—	
41,275	41,262	50,787	50,812	J-2610	—	3 930	5 390	9 620	4 930	7 900	—	
41,275	41,262	50,787	50,812	J-2616	—	5 890	8 060	15 600	8 280	7 900	—	
41,275	41,262	50,787	50,812	—	—	—	—	—	—	—	—	
44,450	44,437	53,962	53,987	J-2812	—	4 440	6 080	11 200	5 890	7 300	—	
44,450	44,437	53,962	53,987	J-2816	—	6 000	8 230	16 500	8 690	7 300	—	
44,450	44,437	53,962	53,987	—	—	—	—	—	—	—	—	
44,450	44,437	53,962	53,987	J-2824	—	8 940	12 200	27 500	14 500	7 300	—	
45,000	44,984	51,961	51,991	HK-4512	—	2 140	2 670	5 720	1 910	7 000	—	
45,000	44,984	51,961	51,991	FJ-4516	—	3 490	4 780	10 300	3 430	7 000	—	
45,000	44,984	51,961	51,991	HK-4520	—	3 960	5 430	12 600	4 200	7 000	—	
47,625	47,612	57,137	57,162	—	—	—	—	—	—	—	—	
47,625	47,612	57,137	57,162	—	—	—	—	—	—	—	—	
47,625	47,612	57,137	57,162	J-3016	—	6 160	8 440	17 200	9 040	6 800	—	
50,000	49,984	57,961	57,991	FJ-5020	—	4 760	6 520	14 100	4 700	6 300	—	
50,800	50,785	60,312	60,337	—	—	—	—	—	—	—	—	
50,800	50,785	60,312	60,337	J-3216	—	6 350	8 700	18 400	9 600	6 300	—	
50,800	50,785	60,312	60,337	—	—	—	—	—	—	—	—	
50,800	50,785	60,312	60,337	—	—	—	—	—	—	—	—	
52,388	52,373	64,280	64,305	—	—	—	—	—	—	—	—	
52,388	52,373	64,280	64,305	—	—	—	—	—	—	—	—	
53,975	53,960	63,487	63,512	—	—	—	—	—	—	—	—	
53,975	53,960	63,487	63,512	—	—	—	—	—	—	—	—	
53,975	53,960	63,487	63,512	—	—	—	—	—	—	—	—	
55,000	54,981	62,961	62,991	FJ-5520	—	5 000	6 850	15 500	8 040	5 700	—	
57,150	57,135	66,662	66,687	J-3612	—	5 110	7 000	14 200	7 360	5 600	—	
57,150	57,135	66,662	66,687	J-3616	—	6 930	9 490	20 900	10 900	5 600	—	
57,150	57,135	66,662	66,687	—	—	—	—	—	—	—	—	
57,150	57,135	66,662	66,687	—	—	—	—	—	—	—	—	
60,000	59,991	67,961	67,991	HK-6012	—	2 690	3 680	7 410	2 470	5 200	—	
66,675	66,660	76,187	76,212	—	—	—	—	—	—	—	—	
69,850	69,835	79,362	79,387	—	—	—	—	—	—	—	—	
69,850	69,835	79,362	79,387	J-4412	—	5 460	7 480	16 000	8 520	4 500	—	
69,850	69,835	79,362	79,387	—	—	—	—	—	—	—	—	
69,850	69,835	79,362	79,387	—	—	—	—	—	—	—	—	
88,900	88,885	101,587	101,612	—	—	—	—	—	—	—	—	
139,700	139,682	152,375	152,426	—	—	—	—	—	—	—	—	

Mounting dimensions are based on the inner ring rotating and the outer ring being stationary relative to the load. The housing should be of high strength material. See pages E77- E78 for discussion of shaft and housing design.

Drawn cup bearings of nominal inch and metric dimensions with one closed end, which are not tabulated, may be made available upon request.

Caged drawn cup bearings of nominal inch and metric dimensions, with engineered polymer cage, may be made available upon request.





Extraprecision Bearings

Open end full complement mechanically retained drawn cup needle roller bearings, manufactured to inch standards, are offered with extraprecision specifications. The manufacturing tolerance of these bearings is one-third that of the precision bearings. In production operations using closer tolerances on shaft and housing, they will assemble with consistently lower radial internal clearances than can be expected with the precision series bearings.

Extraprecision bearings are suitable for those applications requiring close control of radial play and eccentricity. They are also preferred when two bearings are mounted adjacent to each other since the greater accuracy in manufacture will provide better load distribution between the bearings.

Nominal dimensions, load ratings, limiting speeds and other general specifications for extraprecision bearings are the same as for the corresponding "B" or "BH" sizes of drawn cup needle bearings. Consequently, the tabular data on pages 364 to 375 can be used in bearing size selection.

When ordering an extraprecision bearing, add the prefix letter "G" to the bearing designation. For example, after following the size selection procedure outlined on pages E72 to E76, bearing B-1212 is selected, but extraprecision tolerances are required. These are designated by ordering a GB-1212 bearing.

To realize the advantages of the expected closer radial internal clearance of the extraprecision bearing, the user must have the capability of producing housing bore and shaft raceway diameters to the close tolerances indicated by the tabular data on the facing page.

The resulting total radial internal clearance within the installed GB-1212 extraprecision drawn cup needle roller bearing will lie in the range from 0.0002" (0,005 mm) to 0.0012" (0,030 mm).

Inspection dimensions for the extraprecision bearings are given in the table at the right. Note that these bearings must be inspected while mounted in the specified ring gauge. Bearing bores are checked with "GO" and "NO GO" plug gauges. The "GO" gauge size is the minimum diameter inside the needle rollers. The "NO GO" gauge size is 0.0001" (0,0025 mm) larger than the maximum diameter inside the needle rollers.

Procedures for selecting ring and plug gauge dimensions are the same as for those involving precision needle bearings as shown on page 363, except that the ring gauge diameters and diameters inside the needle rollers must be drawn from the table on this page.

GAUGING						
Nominal Bore Diameter	Dimensions-inch			Dimensions-mm		
	Ring Gauge	Diameter inside Needle Rollers inch		Ring Gauge	Diameter inside Needle Rollers mm	
		min.	max.		mm	min.
inch	inch	min.	max.	mm	min.	max.
1/8	0.2473	0.1256	0.1260	6,2814	3,1902	3,2004
5/32	0.2785	0.1569	0.1573	7,0739	3,9853	3,9954
3/16	0.3390	0.1881	0.1885	8,6106	4,7777	4,7879
1/4	0.4328	0.2506	0.2510	10,9931	6,3652	6,3754
5/16	0.4953	0.3131	0.3135	12,5806	7,9527	7,9629
H 3/16	0.5578	0.3131	0.3135	14,1681	7,9527	7,9629
	0.5578	0.3756	0.3760	14,1681	9,5402	9,5504
H 3/8	0.6203	0.3756	0.3760	15,7556	9,5402	9,5504
	0.6203	0.4381	0.4385	15,7556	11,1277	11,1379
H 7/16	0.6828	0.4381	0.4385	17,3431	11,1277	11,1379
1/2	0.6828	0.5006	0.5010	17,3431	12,7152	12,7254
H 1/2	0.7453	0.5006	0.5010	18,9306	12,7152	12,7254
	0.7453	0.5631	0.5635	18,9306	14,3027	14,3129
H 9/16	0.8078	0.5631	0.5635	20,5181	14,3027	14,3129
	0.8078	0.6256	0.6260	20,5181	15,8902	15,9004
H 5/8	0.8703	0.6256	0.6260	22,1056	15,8902	15,9004
	0.8703	0.6881	0.6885	22,1056	17,4777	17,4879
H 11/16	0.9328	0.6881	0.6885	23,6931	17,4777	17,4879
	0.9950	0.7503	0.7507	25,2730	19,0576	19,0678
H 3/4	1.0575	0.7503	0.7507	26,8605	19,0576	19,0678
	1.0575	0.8128	0.8132	26,8605	20,6451	20,6553
H 13/16	1.1200	0.8128	0.8132	28,4480	20,6451	20,6553
	1.1200	0.8753	0.8757	28,4480	22,2326	22,2428
H 7/8	1.1825	0.8753	0.8757	30,0355	22,2326	22,2428
	1.1825	0.9378	0.9382	30,0355	23,8201	23,8303
1	1.2450	1.0003	1.0007	31,6230	25,4076	25,4178
H 1	1.3075	1.0003	1.0007	33,2105	25,4076	25,4178
	1.3075	1.0628	1.0632	33,2105	26,9951	27,0053
1 1/16	1.3700	1.1253	1.1257	34,7980	28,5826	28,5928
H 1 1/16	1.4950	1.1253	1.1257	37,9730	28,5826	28,5928
	1.4950	1.1878	1.1882	37,9730	30,1701	30,1803
1 1/4	1.4950	1.2503	1.2507	37,9730	31,7576	31,7678
H 1 1/4	1.6200	1.2503	1.2507	41,1480	31,7576	31,7678
	1.6200	1.3128	1.3132	41,1480	33,3451	33,3553
1 1/2	1.6200	1.3753	1.3757	41,1480	34,9326	34,9428
H 1 1/2	1.7450	1.3753	1.3757	44,3230	34,9326	34,9428
	1.7450	1.5003	1.5008	47,4980	38,1076	38,1203
1 3/4	1.9950	1.6253	1.6258	50,6730	41,2826	41,2953
H 1 3/4	2.1200	1.7503	1.7508	53,8480	44,4576	44,4703
	2.2450	1.8753	1.8758	57,0230	47,6326	47,6453
2	2.3700	2.0003	2.0008	60,1980	50,8076	50,8203
H 2 1/16	2.5262	2.0628	2.0633	64,1655	52,3951	52,4078
	2.4950	2.1253	2.1258	63,3730	53,9826	53,9953
2 1/4	2.6200	2.2503	2.2508	66,5480	57,1576	57,1703
NB 2 1/2	2.8745	2.5006	2.5012	73,0123	63,5152	63,5305
	2.9950	2.6254	2.6260	76,0730	66,6852	66,7004
2 3/4	3.1200	2.7504	2.7510	79,2480	69,8602	69,8754
NBH 3	3.4995	3.0006	3.0012	88,8873	76,2152	76,2305
	3.9950	3.5004	3.5010	101,4730	88,9102	88,9254



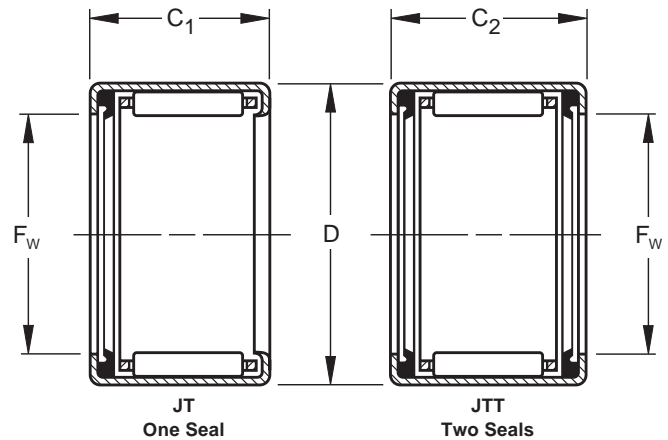
MOUNTING												
Bearing Bore Designation	Inch Dimensions						Metric Dimensions					
	Nominal bore	Nominal o.d.	Shaft Diameter		Raceway Diameter		Nominal bore	Nominal o.d.	Shaft Diameter		Raceway Diameter	
			inch	inch	inch	inch			mm	mm	mm	mm
	inch	inch	max.	min.	min.	max.	mm	mm	max	min.	min.	max.
GB-2	1/8	1/4	0.1251	0.1248	0.2470	0.2473	3,18	6,35	3,178	3,170	6,274	6,281
GB-2 1/2	5/32	1/8	0.1564	0.1561	0.2782	0.2785	3,97	7,14	3,973	3,965	7,066	7,074
GB-3	3/16	11/32	0.1876	0.1873	0.3387	0.3390	4,76	8,73	4,765	4,757	8,603	8,611
GB-4	1/4	7/16	0.2501	0.2498	0.4325	0.4328	6,35	11,11	6,352	6,345	10,986	10,993
GB-5	5/16	1/2	0.3126	0.3123	0.4950	0.4953	7,94	12,70	7,940	7,932	12,573	12,581
GBH-5	5/16	5/16	0.3126	0.3123	0.5575	0.5578	7,94	14,29	7,940	7,932	14,160	14,168
GB-6	3/8	5/8	0.3751	0.3748	0.5575	0.5578	9,53	14,29	9,528	9,520	14,160	14,168
GBH-6	3/8	3/8	0.3751	0.3748	0.6200	0.6203	9,53	15,88	9,528	9,520	15,748	15,756
GB-7	7/16	5/8	0.4376	0.4373	0.6200	0.6203	11,11	15,88	11,115	11,107	15,748	15,756
GBH-7	7/16	11/16	0.4376	0.4373	0.6825	0.6828	11,11	17,46	11,115	11,107	17,336	17,343
GB-8	1/2	11/16	0.5001	0.4998	0.6825	0.6828	12,70	17,46	12,702	12,695	17,336	17,343
GBH-8	1/2	3/4	0.5001	0.4998	0.7450	0.7453	12,70	19,05	12,702	12,695	18,923	18,931
GB-9	5/8	3/4	0.5626	0.5623	0.7450	0.7453	14,29	19,05	14,290	14,282	18,923	18,931
GBH-9	5/8	13/16	0.5626	0.5623	0.8075	0.8078	14,29	20,64	14,290	14,282	20,510	20,518
GB-10	3/4	13/16	0.6251	0.6248	0.8075	0.8078	15,88	20,64	15,878	15,870	20,510	20,518
GBH-10	3/4	7/8	0.6251	0.6248	0.8700	0.8703	15,88	22,23	15,878	15,870	22,098	22,106
GB-11	11/16	7/8	0.6876	0.6873	0.8700	0.8703	17,46	22,23	17,465	17,457	22,098	22,106
GBH-11	11/16	15/16	0.6876	0.6873	0.9325	0.9328	17,46	23,81	17,465	17,457	23,686	23,693
GB-12	3/4	1	0.7501	0.7498	0.9950	0.9953	19,05	25,40	19,053	19,045	25,273	25,281
GBH-12	3/4	1 1/16	0.7501	0.7498	1.0575	1.0578	19,05	26,99	19,053	19,045	26,860	26,868
GB-13	13/16	1 1/16	0.8126	0.8123	1.0575	1.0578	20,64	26,99	20,640	20,632	26,860	26,868
GBH-13	13/16	1 1/8	0.8126	0.8123	1.1200	1.1203	20,64	28,58	20,640	20,632	28,448	28,456
GB-14	7/8	1 1/8	0.8751	0.8748	1.1200	1.1203	22,23	28,58	22,228	22,220	28,448	28,456
GBH-14	7/8	1 3/16	0.8751	0.8748	1.1825	1.1829	22,23	30,16	22,228	22,220	30,036	30,044
GB-15	15/16	1 3/16	0.9376	0.9373	1.1825	1.1829	23,81	30,16	23,815	23,807	30,036	30,044
GB-16	1	1 1/4	1.0001	0.9998	1.2450	1.2454	25,40	31,75	25,403	25,395	31,623	31,633
GBH-16	1	1 1/2	1.0001	0.9998	1.3075	1.3079	25,40	33,34	25,403	25,395	33,210	33,221
GB-17	1 1/16	1 5/16	1.0626	1.0623	1.3075	1.3079	26,99	33,34	26,990	26,982	33,210	33,221
GB-18	1 1/8	1 7/8	1.1251	1.1248	1.3700	1.3704	28,58	34,93	28,578	28,570	34,798	34,808
GBH-18	1 1/8	1 1/2	1.1251	1.1248	1.4950	1.4955	28,58	38,10	28,578	28,570	37,973	37,986
GB-19	1 3/16	1 1/2	1.1876	1.1873	1.4950	1.4955	30,16	38,10	30,165	30,157	37,973	37,986
GB-20	1 1/4	1 1/2	1.2501	1.2498	1.4950	1.4955	31,75	38,10	31,753	31,745	37,973	37,986
GBH-20	1 1/4	1 5/8	1.2501	1.2498	1.6200	1.6205	31,75	41,28	31,753	31,745	41,148	41,161
GB-21	1 5/16	1 5/8	1.3126	1.3123	1.6200	1.6205	33,34	41,28	33,340	33,332	41,148	41,161
GB-22	1 3/8	1 5/8	1.3750	1.3747	1.6200	1.6205	34,93	41,28	34,925	34,917	41,148	41,161
GBH-22	1 3/8	1 3/4	1.3750	1.3747	1.7450	1.7455	34,93	44,45	34,925	34,917	44,323	44,336
GB-24	1 1/2	1 7/8	1.5000	1.4997	1.8700	1.8705	38,10	47,63	38,100	38,092	47,498	47,511
GB-26	1 5/8	2	1.6250	1.6247	1.9950	1.9955	41,28	50,80	41,275	41,267	50,673	50,686
GB-28	1 3/4	2 1/8	1.7500	1.7497	2.1200	2.1205	44,45	53,98	44,450	44,442	53,848	53,861
GB-30	1 7/8	2 1/4	1.8750	1.8747	2.2450	2.2455	47,63	57,15	47,625	47,617	57,023	57,036
GB-32	2	2 3/8	2.0000	1.9997	2.3700	2.3705	50,80	60,33	50,800	50,792	60,198	60,211
GBH-33	2 1/16	2 17/32	2.0624	2.0621	2.5262	2.5267	52,39	64,29	52,385	52,377	64,165	64,178
GB-34	2 1/8	2 1/2	2.1249	2.1246	2.4950	2.4955	53,98	63,50	53,972	53,965	63,373	63,386
GB-36	2 1/4	2 5/8	2.2499	2.2496	2.6200	2.6205	57,15	66,68	57,147	57,140	66,548	66,561
GNB-40	2 1/2	2 7/8	2.5000	2.4997	2.8745	2.8751	63,50	73,03	63,500	63,492	73,012	73,028
GB-42	2 3/8	3	2.6248	2.6245	2.9950	2.9956	66,68	76,20	66,670	66,662	76,073	76,088
GB-44	2 3/4	3 1/8	2.7498	2.7495	3.1200	3.1206	69,85	79,38	69,845	69,837	79,248	79,263
GNB-48	3	3 1/2	3.0000	2.9997	3.4995	3.5001	76,20	88,90	76,200	76,192	88,887	88,902
GB-56	3 1/2	4	3.4998	3.4995	3.9950	3.9956	88,90	101,60	88,895	88,887	101,473	101,488

* Check for availability as not every size may be in production.



Sealed Drawn Cup Bearings

Check for availability. Not all bearings are in production.

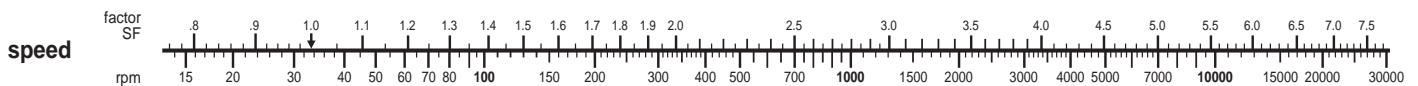


BEARING DESIGNATION AND WIDTH

F _w Bore (nom.)		D Outside Diameter (nom.)		Bearings with one seal			Bearings with two seals		
				Bearing Designation Open End	C ₁ Width		Bearing Designation	C ₂ Width	
inch	mm	inch	mm		inch	mm		inch	mm
3/16	7,94	1/2	12,70	JT-56	0.375	9,52	JTT-57	0.438	11,13
3/16	7,94	1/2	12,70	—	—	—	JTT-59	0.562	14,27
3/8	9,52	5/16	14,29	JT-66	0.375	9,52	JTT-67	0.438	11,13
3/8	9,52	5/16	14,29	JT-69	0.562	14,27	—	—	—
1/2	12,70	11/16	17,46	JT-86	0.375	9,52	JTT-87	0.438	11,13
1/2	12,70	11/16	17,46	JT-89	0.562	14,27	JTT-810	0.625	15,88
1/2	12,70	11/16	17,46	—	—	—	JTT-814	0.875	22,22
5/16	14,29	3/4	19,05	JT-99	0.562	14,27	JTT-910	0.625	15,88
5/16	14,29	3/4	19,05	—	—	—	JTT-912	0.750	19,05
3/8	15,88	13/16	20,64	JT-109	0.562	14,27	JTT-1010	0.625	15,88
3/8	15,88	13/16	20,64	—	—	—	JTT-1012	0.750	19,05
3/8	15,88	13/16	20,64	—	—	—	JTT-1014	0.875	22,22
11/16	17,46	7/8	22,22	—	—	—	JTT-1114	0.875	22,22
3/4	19,05	1	25,40	JT-129	0.562	14,27	JTT-1210	0.625	15,88
3/4	19,05	1	25,40	JT-1211	0.688	17,48	—	—	—
3/4	19,05	1	25,40	JT-1213	0.812	20,62	JTT-1214	0.875	22,22
5/8	22,22	1 1/8	28,58	JT-149	0.562	14,27	JTT-1410	0.625	15,88
5/8	22,22	1 1/8	28,58	JT-1417	1.062	26,97	—	—	—
1	25,40	1 1/4	31,75	JT-1613	0.812	20,62	JTT-1614	0.875	22,22
1 1/8	28,58	1 3/8	34,92	JT-1813	0.812	20,62	JTT-1814	0.875	22,22
1 1/4	31,75	1 1/2	38,10	JT-2013	0.812	20,62	—	—	—
1 1/4	31,75	1 1/2	38,10	—	—	—	JTT-2018	1.125	28,58
1 1/2	38,10	1 5/8	47,62	JT-2421	1.312	33,34	—	—	—

Drawn cup bearings of nominal inch and metric dimensions, with one seal and one end closed, may be made available upon request.

Drawn cup bearings of nominal metric dimensions, with one or two seals, may be made available upon request.

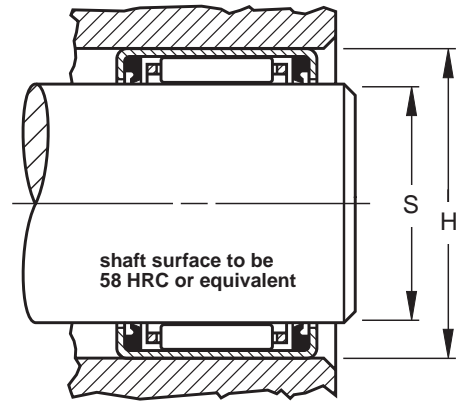




GENERAL NOTES

Sealed drawn cup needle bearings are prepacked with a general purpose ball and roller bearing grease unless otherwise specified.

Lip contact seals limit the bearing operating temperature between -25°F and +225°F (-30°C and +110° C). If the operating temperature must be outside of the above range or if the seals are exposed to unusual fluids please consult the Torrington Engineering Department. Limiting speed is based on a shaft contact speed of 2000 fpm (610 m/min.). For outer ring rotation, reduce the listed limiting speed by one-half.



BEARING LOAD RATING							BEARING MOUNTING DIMENSIONS							
Bearing Designation		Load Ratings				Limiting Speed	Inch Mounting				Metric Mounting			
		Basic Dynamic C _r	Basic Static C _o	Working load			S Shaft Raceway Diameter		H Housing Bore		S Shaft Raceway Diameter		H Housing Bore	
One Seal	Two Seals	Ⓣ	ISO 281	ISO 76	(max.)	inches		inches		millimeter		millimeter		
		lbf	lbf	lbf	lbf	rpm	max.	min.	min.	max.	max.	min.	min.	max.
JT-56	JTT-57	315	431	383	226	24 000	0.3125	0.3120	0.4995	0.5005	7,938	7,925	12,687	12,712
—	JTT-59	560	767	805	474	24 000	0.3125	0.3120	0.4995	0.5005	7,938	7,925	12,687	12,712
JT-66	JTT-67	358	491	474	271	20 000	0.3750	0.3745	0.5620	0.5630	9,525	9,512	14,275	14,300
JT-69	—	755	1 030	1 240	707	20 000	0.3750	0.3745	0.5620	0.5630	9,525	9,512	14,275	14,300
JT-86	JTT-87	454	621	697	384	15 000	0.5000	0.4995	0.6870	0.6880	12,700	12,687	17,450	17,475
JT-89	JTT-810	914	1 250	1 710	942	15 000	0.5000	0.4995	0.6870	0.6880	12,700	12,687	17,450	17,475
—	JTT-814	1 500	2 060	3 240	1 790	15 000	0.5000	0.4995	0.6870	0.6880	12,700	12,687	17,450	17,475
JT-99	JTT-910	901	1 230	1 730	942	14 000	0.5625	0.5620	0.7495	0.7505	14,288	14,275	19,037	19,062
—	JTT-912	1 190	1 630	2 490	1 350	14 000	0.5625	0.5620	0.7495	0.7505	14,288	14,275	19,037	19,062
JT-109	JTT-1010	970	1 330	1 970	1 060	12 000	0.6250	0.6245	0.8120	0.8130	15,875	15,862	20,625	20,650
—	JTT-1012	1 280	1 760	2 830	1 520	12 000	0.6250	0.6245	0.8120	0.8130	15,875	15,862	20,625	20,650
—	JTT-1014	1 850	2 540	4 570	2 460	12 000	0.6250	0.6245	0.8120	0.8130	15,875	15,862	20,625	20,650
—	JTT-1114	1 830	2 500	4 610	2 460	11 000	0.6875	0.6870	0.8745	0.8755	17,462	17,449	22,212	22,237
JT-129	JTT-1210	1 490	2 040	2 760	1 520	10 000	0.7500	0.7495	0.9995	1.0005	19,050	19,037	25,387	25,412
JT-1211	—	1 870	2 560	3 690	2 030	10 000	0.7500	0.7495	0.9995	1.0005	19,050	19,037	25,387	25,412
JT-1213	JTT-1214	2 320	3 180	4 880	2 680	10 000	0.7500	0.7495	0.9995	1.0005	19,050	19,037	25,387	25,412
JT-149	JTT-1410	1 640	2 250	3 270	1 770	8 700	0.8750	0.8745	1.1245	1.1255	22,225	22,212	28,562	28,587
JT-1417	—	3 540	4 850	8 780	4 750	8 700	0.8750	0.8745	1.1245	1.1255	22,225	22,212	28,562	28,587
JT-1613	JTT-1614	2 710	3 720	6 500	3 470	7 600	1.0000	0.9995	1.2495	1.2505	25,400	25,387	31,737	31,762
JT-1813	JTT-1814	2 840	3 890	7 160	3 790	6 800	1.1250	1.1245	1.3745	1.3755	28,575	28,562	34,912	34,937
JT-2013	—	2 970	4 060	7 820	4 110	6 100	1.2500	1.2495	1.4995	1.5005	31,750	31,737	38,087	38,112
—	JTT-2018	4 310	5 900	12 700	6 650	6 100	1.2500	1.2495	1.4995	1.5005	31,750	31,737	38,087	38,112
JT-2421	—	7 410	10 200	20 300	10 900	5 100	1.5000	1.4995	1.8745	1.8755	38,100	38,087	47,612	47,637

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

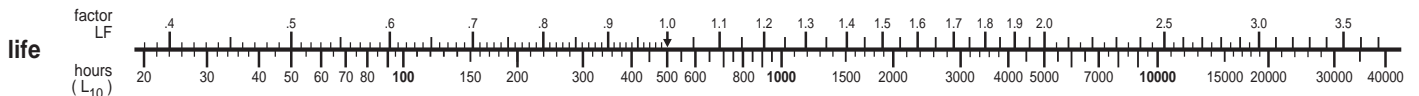
Required Basic Dynamic Load Rating (C_r) = Applied Load • SF • LF • HF (see page E75).

Ⓣ Symbol denotes Torrington Basic Dynamic Load Rating to be used in load-life calculations taking into consideration the application guidelines and limitations given in this catalog. Applications involving loads approaching this rating or the tabulated working load, whichever is the smaller, should be referred to the Torrington Engineering Sales Office before a final selection is made.

Load Ratings are based on a minimum raceway hardness of 58 HRC or equivalent.

Mounting dimensions are based on the inner ring rotating and the outer ring being stationary relative to the load. The housing should be of high strength material. See pages E77-78 for discussion of shaft and housing design.

See page 361 for mounting procedure.





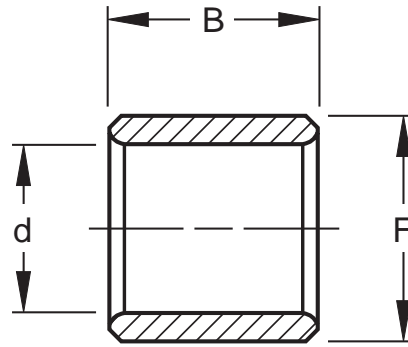
Inner Rings for Drawn Cup Bearings

Check for availability

Hardened inner rings may be used where it is impossible to use the shaft as the inner raceway. Inner rings for use with drawn cup bearings are provided in inch (IR, IRA) nominal dimensions, designed to meet established inch tolerances.

The inner rings are designed to be wider than the matching drawn cup bearing. Shaft fillet radii (r_a) listed in the tables of dimensions are the maximum allowable to clear the minimum inner ring bore chamfers.

Most inner rings can be provided with a lubrication hole in the center and a lubrication groove in the bore. When ordering, please specify if lubrication groove and hole are desired.



BORE, O.D. AND WIDTH DIMENSIONS

d Bore (nominal)		Inner Ring Designation	d Bore †				F O.D. †				B Width			
inch	mm		inch min.	inch max.	mm min.	mm max.	inch max.	inch min.	mm max.	mm min.	inch max.	inch min.	mm max.	mm min.
3/16	4,76	IRA-3	0.1895	0.1900	4,813	4,826	0.3750	0.3745	9,525	9,512	0.536	0.526	13,61	13,36
1/4	6,35	IRA-4	0.2495	0.2500	6,337	6,350	0.4375	0.4370	11,112	11,099	0.536	0.526	13,61	13,36
5/16	7,94	IRA-5	0.3120	0.3125	7,925	7,938	0.5000	0.4995	12,700	12,687	0.536	0.526	13,61	13,36
3/8	9,52	IR-68	0.3745	0.3750	9,512	9,525	0.5625	0.5620	14,288	14,275	0.515	0.505	13,08	12,83
3/8	9,52	IR-612	0.3745	0.3750	9,512	9,525	0.5625	0.5620	14,288	14,275	0.765	0.755	19,43	19,18
3/8	9,52	IRA-6	0.3745	0.3750	9,512	9,525	0.5625	0.5620	14,288	14,275	0.786	0.776	19,96	19,71
3/8	9,52	IR-68-1	0.3745	0.3750	9,512	9,525	0.6250	0.6245	15,875	15,862	0.515	0.505	13,08	12,83
3/8	9,52	IR-612-1	0.3745	0.3750	9,512	9,525	0.6250	0.6245	15,875	15,862	0.765	0.755	19,43	19,18
7/16	11,11	IRA-7	0.4370	0.4375	11,100	11,113	0.6250	0.6245	15,875	15,862	0.786	0.776	19,96	19,71
1/2	12,70	IR-88	0.4995	0.5000	12,687	12,700	0.7500	0.7495	19,050	19,037	0.515	0.505	13,08	12,83
1/2	12,70	IR-812	0.4995	0.5000	12,687	12,700	0.7500	0.7495	19,050	19,037	0.765	0.755	19,43	19,18
1/2	12,70	IRA-8	0.4995	0.5000	12,687	12,700	0.7500	0.7495	19,050	19,037	0.786	0.776	19,96	19,71
5/8	15,88	IR-1012	0.6245	0.6250	15,862	15,875	0.8750	0.8745	22,225	22,212	0.765	0.755	19,43	19,18
5/8	15,88	IRA-10	0.6245	0.6250	15,862	15,875	0.8750	0.8745	22,225	22,212	0.786	0.776	19,96	19,71
5/8	15,88	IR-1016	0.6245	0.6250	15,862	15,875	0.8750	0.8745	22,225	22,212	1.015	1.005	25,78	25,53
3/4	19,05	IR-128	0.7495	0.7500	19,037	19,050	1.0000	0.9995	25,400	25,387	0.515	0.505	13,08	12,83
3/4	19,05	IR-1212	0.7495	0.7500	19,037	19,050	1.0000	0.9995	25,400	25,387	0.765	0.755	19,43	19,18
3/4	19,05	IR-1216	0.7495	0.7500	19,037	19,050	1.0000	0.9995	25,400	25,387	1.015	1.005	25,78	25,53
3/4	19,05	IRA-12	0.7495	0.7500	19,037	19,050	1.0000	0.9995	25,400	25,387	1.036	1.026	26,31	26,06
3/4	19,05	IR-1220	0.7495	0.7500	19,037	19,050	1.0000	0.9995	25,400	25,387	1.265	1.255	32,13	31,88
3/4	19,05	IR-1224	0.7495	0.7500	19,037	19,050	1.0000	0.9995	25,400	25,387	1.515	1.505	38,48	38,23
13/16	20,64	IR-1312	0.8120	0.8125	20,625	20,638	1.0000	0.9995	25,400	25,387	0.765	0.755	19,43	19,18
13/16	20,64	IR-1316	0.8120	0.8125	20,625	20,638	1.0000	0.9995	25,400	25,387	1.015	1.005	25,78	25,53
7/8	22,22	IR-1416	0.8745	0.8750	22,212	22,225	1.1250	1.1245	28,575	28,562	1.015	1.005	25,78	25,53
7/8	22,22	IRA-14	0.8745	0.8750	22,212	22,225	1.1250	1.1245	28,575	28,562	1.036	1.026	26,31	26,06

Inner rings for use with drawn cup bearings of nominal metric dimensions, may be made available on request.

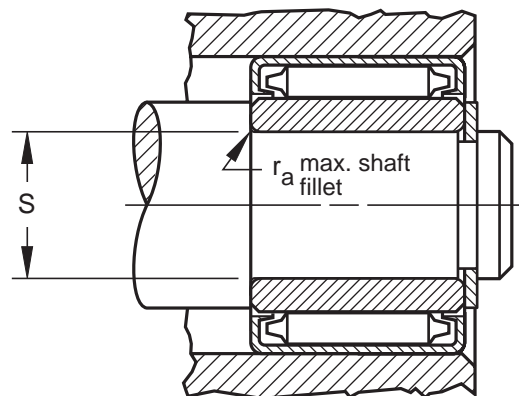
† Bore and o.d. tolerance limits correspond to the single mean diameter (the arithmetical mean of the largest and smallest diameters in a single radial plane).



Inner rings for drawn cup bearings are designed to provide a loose transition fit on the shaft, and should be axially clamped against a shoulder. If a tight transition fit must be used to keep the inner ring from rotating relative to the shaft, the inner ring o.d., after being mounted on the shaft, must not exceed the raceway diameter required for the matching drawn cup bearing. See tables of bearing dimensions for the required raceway diameter. In case the o.d. of the inner ring, when mounted on the shaft, exceeds the required raceway diameter for the matching drawn cup bearing, it should be ground to proper diameter while mounted on the shaft.

The unstamped end of the inner ring should be assembled against the shaft shoulder to assure clearing the maximum allowable shaft fillet (r_a) indicated in the tables.

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



MOUNTING DIMENSIONS

r_a Shaft Fillet* (max.)		Inner Ring Designation	S Shaft Diameter							
			Transition Fit Loose				Transition Fit Tight			
inch	mm		inch	mm	inch	mm	inch	mm	inch	mm
			max.	min.	max.	min.	max.	min.	max.	min.
0.025	0.64	IRA-3	0.1897	0.1892	4,818	4,805	0.1901	0.1896	4,829	4,816
0.025	0.64	IRA-4	0.2497	0.2492	6,342	6,329	0.2501	0.2496	6,353	6,340
0.025	0.64	IRA-5	0.3122	0.3117	7,930	7,917	0.3126	0.3121	7,940	7,927
0.025	0.64	IR-68	0.3747	0.3742	9,517	9,504	0.3751	0.3746	9,528	9,515
0.025	0.64	IR-612	0.3747	0.3742	9,517	9,504	0.3751	0.3746	9,528	9,515
0.025	0.64	IRA-6	0.3747	0.3742	9,517	9,504	0.3751	0.3746	9,528	9,515
0.025	0.64	IR-68-1	0.3747	0.3742	9,517	9,504	0.3751	0.3746	9,528	9,515
0.025	0.64	IR-612-1	0.3747	0.3742	9,517	9,504	0.3751	0.3746	9,528	9,515
0.025	0.64	IRA-7	0.4372	0.4367	11,105	11,092	0.4376	0.4371	11,115	11,102
0.040	1.02	IR-88	0.4997	0.4992	12,692	12,679	0.5001	0.4996	12,703	12,690
0.040	1.02	IR-812	0.4997	0.4992	12,692	12,679	0.5001	0.4996	12,703	12,690
0.040	1.02	IRA-8	0.4997	0.4992	12,692	12,679	0.5001	0.4996	12,703	12,690
0.040	1.02	IR-1012	0.6247	0.6242	15,867	15,854	0.6251	0.6246	15,878	15,865
0.040	1.02	IRA-10	0.6247	0.6242	15,867	15,854	0.6251	0.6246	15,878	15,865
0.040	1.02	IR-1016	0.6247	0.6242	15,867	15,854	0.6251	0.6246	15,878	15,865
0.040	1.02	IR-128	0.7497	0.7492	19,042	19,029	0.7501	0.7496	19,053	19,040
0.040	1.02	IR-1212	0.7497	0.7492	19,042	19,029	0.7501	0.7496	19,053	19,040
0.040	1.02	IR-1216	0.7497	0.7492	19,042	19,029	0.7501	0.7496	19,053	19,040
0.040	1.02	IRA-12	0.7497	0.7492	19,042	19,029	0.7501	0.7496	19,053	19,040
0.040	1.02	IR-1220	0.7497	0.7492	19,042	19,029	0.7501	0.7496	19,053	19,040
0.040	1.02	IR-1224	0.7497	0.7492	19,042	19,029	0.7501	0.7496	19,053	19,040
0.040	1.02	IR-1312	0.8122	0.8117	20,630	20,617	0.8126	0.8121	20,640	20,627
0.040	1.02	IR-1316	0.8122	0.8117	20,630	20,617	0.8126	0.8121	20,640	20,627
0.040	1.02	IR-1416	0.8747	0.8742	22,217	22,204	0.8751	0.8746	22,228	22,215
0.040	1.02	IRA-14	0.8747	0.8742	22,217	22,204	0.8751	0.8746	22,228	22,215

*Equal to minimum inner ring bore chamfer at unmarked end.

Continued on the next page.



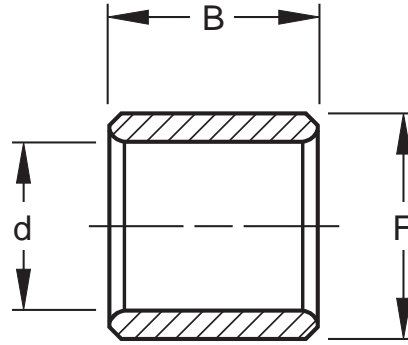
Inner Rings for Drawn Cup Bearings

Check for availability.

Hardened inner rings may be used where it is impossible to use the shaft as the inner raceway. Inner rings for use with drawn cup bearings are provided in inch (IR, IRA) nominal dimensions, designed to meet established inch tolerances.

The inner rings are designed to be wider than the matching drawn cup bearing. Shaft fillet radii (r_a) listed in the tables of dimensions are the maximum allowable to clear the minimum inner ring bore chamfers.

Most inner rings can be provided with a lubrication hole in the center and a lubrication groove in the bore. When ordering, please specify if lubrication groove and hole are desired.



BORE, O.D. AND WIDTH DIMENSIONS

d Bore (nominal)		Inner Ring Designation	d Bore†				F O.D.†				B Width			
inch	mm		inch min.	inch max.	mm min.	mm max.	inch max.	inch min.	mm max.	mm min.	inch max.	inch min.	mm max.	mm min.
¹⁵ / ₁₆	23,81	IR-1516	0.9370	0.9375	23,800	23,813	1.1250	1.1245	28,575	28,562	1.015	1.005	25,78	25,53
1	25,40	IR-1612	0.9995	1.0000	25,387	25,400	1.2500	1.2495	31,750	31,737	0.765	0.755	19,43	19,18
1	25,40	IR-1616	0.9995	1.0000	25,387	25,400	1.2500	1.2495	31,750	31,737	1.015	1.005	25,78	25,53
1	25,40	IRA-16	0.9995	1.0000	25,387	25,400	1.2500	1.2495	31,750	31,737	1.036	1.026	26,31	26,06
1 1/8	28,58	IR-1812	1.1245	1.1250	28,562	28,575	1.3750	1.3745	34,925	34,912	0.765	0.755	19,43	19,18
1 1/8	28,58	IR-1816	1.1245	1.1250	28,562	28,575	1.3750	1.3745	34,925	34,912	1.015	1.005	25,78	25,53
1 1/8	28,58	IR-1820	1.1245	1.1250	28,562	28,575	1.3750	1.3745	34,925	34,912	1.265	1.255	32,13	31,88
1 3/16	30,16	IR-1916	1.1870	1.1875	30,150	30,163	1.5000	1.4995	38,100	38,087	1.015	1.005	25,78	25,53
1 3/16	30,16	IR-1920	1.1870	1.1875	30,150	30,163	1.5000	1.4995	38,100	38,087	1.265	1.255	32,13	31,88
1 1/4	31,75	IR-2016	1.2495	1.2500	31,737	31,750	1.5000	1.4995	38,100	38,087	1.015	1.005	25,78	25,53
1 1/4	31,75	IR-2020	1.2495	1.2500	31,737	31,750	1.5000	1.4995	38,100	38,087	1.265	1.255	32,13	31,88
1 1/4	31,75	IRA-20	1.2495	1.2500	31,737	31,750	1.5000	1.4995	38,100	38,087	1.286	1.276	32,66	32,41
1 3/8	34,92	IR-2220	1.3745	1.3750	34,912	34,925	1.6250	1.6245	41,275	41,262	1.265	1.255	32,13	31,88
1 7/16	36,51	IR-2316	1.4370	1.4375	36,500	36,513	1.7500	1.7495	44,450	44,437	1.015	1.005	25,78	25,53
1 7/16	36,51	IR-2324	1.4370	1.4375	36,500	36,513	1.7500	1.7495	44,450	44,437	1.515	1.505	38,48	38,23
1 1/2	38,10	IR-2416	1.4995	1.5000	38,087	38,100	1.7500	1.7495	44,450	44,437	1.015	1.005	25,78	25,53
1 1/2	38,10	IR-2424	1.4995	1.5000	38,087	38,100	1.7500	1.7495	44,450	44,437	1.515	1.505	38,48	38,23
1 11/16	42,86	IR-2724	1.6870	1.6875	42,850	42,863	2.0625	2.0620	52,388	52,375	1.515	1.505	38,48	38,23
1 3/4	44,45	IR-2824	1.7495	1.7500	44,437	44,450	2.0625	2.0620	52,388	52,375	1.515	1.505	38,48	38,23
1 13/16	46,04	IR-2916	1.8120	1.8125	46,025	46,038	2.0625	2.0620	52,388	52,375	1.015	1.005	25,78	25,53
1 13/16	46,04	IR-2924	1.8120	1.8125	46,025	46,038	2.0625	2.0620	52,388	52,375	1.515	1.505	38,48	38,23
1 7/8	47,62	IR-3024	1.8745	1.8750	47,612	47,625	2.1250	2.1245	53,975	53,962	1.515	1.505	38,48	38,23
2 1/2	63,50	IR-4016	2.4995	2.5000	63,487	63,500	2.7500	2.7495	69,850	69,837	1.015	1.005	25,78	25,53

Inner rings for use with drawn cup bearings of nominal metric dimensions, may be made available on request.

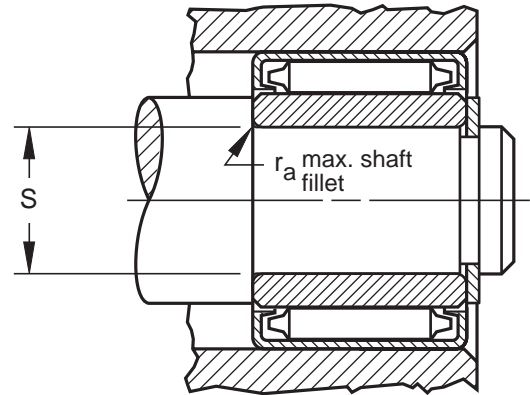
†Bore and o.d. tolerance limits correspond to the single mean diameter (the arithmetical mean of the largest and smallest diameters in a single radial plane).



Inner rings for drawn cup bearings are designed to provide a loose transition fit on the shaft, and should be axially clamped against a shoulder. If a tight transition fit must be used to keep the inner ring from rotating relative to the shaft, the inner ring o.d., after being mounted on the shaft, must not exceed the raceway diameter required for the matching drawn cup bearing. See tables of bearing dimensions for the required raceway diameter. In case the o.d. of the inner ring, when mounted on the shaft, exceeds the required raceway diameter for the matching drawn cup bearing, it should be ground to proper diameter while mounted on the shaft.

The unstamped end of the inner ring should be assembled against the shaft shoulder to assure clearing the maximum allowable shaft fillet (r_a) indicated in the tables.

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



MOUNTING DIMENSIONS

r_a Shaft Fillet* (max.)		Inner Ring Designation	S Shaft Diameter							
			Transition Fit Loose				Transition Fit Tight			
inch	mm		inch	mm	inch	mm	inch	mm	inch	mm
			max.	min.	max.	min.	max.	min.	max.	min.
0.040	1,02	IR-1516	0.9372	0.9367	23,805	23,792	0.9376	0.9371	23,815	23,802
0.040	1,02	IR-1612	0.9997	0.9992	25,392	25,379	1.0001	0.9996	25,403	25,390
0.040	1,02	IR-1616	0.9997	0.9992	25,392	25,379	1.0001	0.9996	25,403	25,390
0.040	1,02	IRA-16	0.9997	0.9992	25,392	25,379	1.0001	0.9996	25,403	25,390
0.040	1,02	IR-1812	1.1247	1.1242	28,567	28,554	1.1251	1.1246	28,578	28,565
0.040	1,02	IR-1816	1.1247	1.1242	28,567	28,554	1.1251	1.1246	28,578	28,565
0.040	1,02	IR-1820	1.1247	1.1242	28,567	28,554	1.1251	1.1246	28,578	28,565
0.040	1,02	IR-1916	1.1872	1.1867	30,155	30,142	1.1876	1.1871	30,165	30,152
0.040	1,02	IR-1920	1.1872	1.1867	30,155	30,142	1.1876	1.1871	30,165	30,152
0.060	1,52	IR-2016	1.2497	1.2492	31,742	31,729	1.2501	1.2496	31,753	31,740
0.060	1,52	IR-2020	1.2497	1.2492	31,742	31,729	1.2501	1.2496	31,753	31,740
0.060	1,52	IRA-20	1.2497	1.2492	31,742	31,729	1.2501	1.2496	31,753	31,740
0.060	1,52	IR-2220	1.3747	1.3742	34,917	34,904	1.3751	1.3746	34,928	34,915
0.060	1,52	IR-2316	1.4372	1.4367	36,505	36,492	1.4376	1.4371	36,515	36,502
0.060	1,52	IR-2324	1.4372	1.4367	36,505	36,492	1.4376	1.4371	36,515	36,502
0.060	1,52	IR-2416	1.4997	1.4992	38,092	38,079	1.5001	1.4996	38,103	38,090
0.060	1,52	IR-2424	1.4997	1.4992	38,092	38,079	1.5001	1.4996	38,103	38,090
0.060	1,52	IR-2724	1.6872	1.6867	42,855	42,842	1.6876	1.6871	42,865	42,852
0.060	1,52	IR-2824	1.7497	1.7492	44,442	44,429	1.7501	1.7496	44,453	44,440
0.060	1,52	IR-2916	1.8122	1.8117	46,030	46,017	1.8126	1.8121	46,040	46,027
0.060	1,52	IR-2924	1.8122	1.8117	46,030	46,017	1.8126	1.8121	46,040	46,027
0.060	1,52	IR-3024	1.8747	1.8742	47,617	47,604	1.8751	1.8746	47,628	47,615
0.060	1,52	IR-4016	2.4998	2.4991	63,495	63,477	2.5002	2.4995	63,505	63,487

*Equal to minimum inner ring bore chamfer at unmarked end.



Inner Rings, Inch Series

Check for availability.

These inner rings meet Military Standard MS 51962

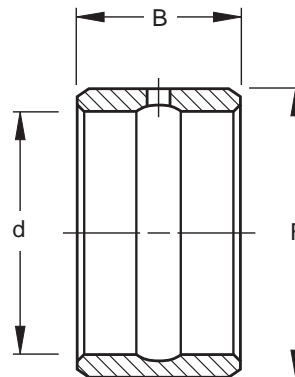
Inch-metric conversions given are for the convenience of the user.

The controlling dimensions are in inches for nominal inch bearings.

Load ratings are given in pounds-force:

1 lbf = 0.454 kgf = 4.448 N

Inner ring diameters and widths listed below are nominal. For inspection purposes, see tolerance tables on page 405.



BORE, O.D., AND WIDTH DIMENSIONS

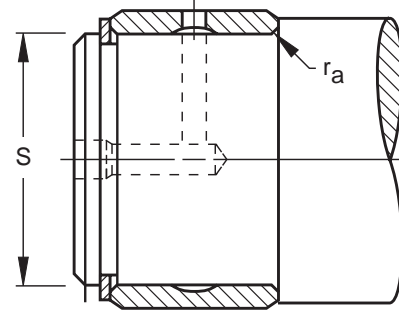
d Bore (nom.)		F Outside Diameter (nom.)		B Width (nom.)		Inner Ring Designation	Used with Bearing Designation
inch	mm	inch	mm	inch	mm		
0.3750	9,525	0.6250	15,875	0.750	19,05	IR-061012	HJ-101812
0.5000	12,700	0.7500	19,050	0.750	19,05	IR-081212	HJ-122012
0.5000	12,700	0.7500	19,050	1.000	25,40	IR-081216	HJ-122016
0.6250	15,875	0.8750	22,225	0.750	19,05	IR-101412	HJ-142212
0.6250	15,875	0.8750	22,225	1.000	25,40	IR-101416	HJ-142216
0.6875	17,462	0.8750	22,225	0.750	19,05	IR-111412	HJ-142212
0.7500	19,050	1.0000	25,400	0.750	19,05	IR-121612	HJ-162412
0.7500	19,050	1.0000	25,400	1.000	25,40	IR-121616	HJ-162416
0.8125	20,638	1.0000	25,400	1.000	25,40	IR-131616	HJ-162416
0.8750	22,225	1.1250	28,575	1.000	25,40	IR-141816	HJ-182616
0.8750	22,225	1.1250	28,575	1.250	31,75	IR-141820	HJ-182620
0.9375	23,812	1.1250	28,575	1.000	25,40	IR-151816	HJ-182616
0.9375	23,812	1.1250	28,575	1.250	31,75	IR-151820	HJ-182620
1.0000	25,400	1.2500	31,750	1.000	25,40	IR-162016	HJ-202816
1.0000	25,400	1.2500	31,750	1.250	31,75	IR-162020	HJ-202820
1.1250	28,575	1.3750	34,925	1.000	25,40	IR-182216	HJ-223016
1.1250	28,575	1.3750	34,925	1.250	31,75	IR-182220	HJ-223020
1.1875	30,162	1.5000	38,100	1.250	31,75	IR-192420	HJ-243320
1.2500	31,750	1.5000	38,100	1.000	25,40	IR-202416	HJ-243316
1.2500	31,750	1.5000	38,100	1.250	31,75	IR-202420	HJ-243320
1.3125	33,338	1.6250	41,275	1.000	25,40	IR-212616	HJ-263516
1.3125	33,338	1.6250	41,275	1.250	31,75	IR-212620	HJ-263520
1.3750	34,925	1.6250	41,275	1.250	31,75	IR-222620	HJ-263520
1.3750	34,925	1.7500	44,450	1.250	31,75	IR-222820	HJ-283720
1.4375	36,512	1.7500	44,450	1.000	25,40	IR-232816	HJ-283716
1.4375	36,512	1.7500	44,450	1.250	31,75	IR-232820	HJ-283720
1.5000	38,100	1.7500	44,450	1.000	25,40	IR-242816	HJ-283716
1.5000	38,100	1.7500	44,450	1.250	31,75	IR-242820	HJ-283720
1.5000	38,100	2.0000	50,800	1.250	31,75	IR-243220	HJ-324120
1.5625	39,688	1.8750	47,625	1.250	31,75	IR-253020	HJ-303920
1.5625	39,688	2.0000	50,800	1.250	31,75	IR-253220	HJ-324120
1.6250	41,275	2.0000	50,800	1.250	31,75	IR-263220	HJ-324120
1.6875	42,862	2.0000	50,800	1.000	25,40	IR-273216	HJ-324116
1.6875	42,862	2.0000	50,800	1.250	31,75	IR-273220	HJ-324120
1.7500	44,450	2.2500	57,150	1.500	38,10	IR-283624	HJ-364824
1.7500	44,450	2.2500	57,150	1.750	44,45	IR-283628	HJ-364828
1.9375	49,212	2.5000	63,500	1.500	38,10	IR-314024	HJ-405224
1.9375	49,212	2.5000	63,500	1.750	44,45	IR-314028	HJ-405228



These inner rings are designed for either a loose transition fit or an interference fit on the shaft. These fits, used in conjunction with the proper outer ring fit, will provide the correct operating clearances for most applications. If an interference fit is used for the inner ring, the outer ring should be mounted with a clearance fit. See page 403 for further discussion of mounting fits.

The shaft shoulder diameter adjacent to the inner ring must not exceed the inner ring O.D.

The unmarked end of the inner ring should be assembled against the shaft shoulder to assure clearing the maximum allowable shaft fillet (r_a) indicated in the tables.



MOUNTING DIMENSIONS

r_a^* Shaft Fillet	S					Inner Ring Designation	S			
	Loose Transition Fit		Shaft Diameter		Inner Ring Designation		Interference Fit		Shaft Diameter	
	(inches)	(millimeters)	(inches)	(millimeters)			(inches)	(millimeters)	(inches)	(millimeters)
in.	mm	max.	min.	max.	min.		max.	min.	max.	min.
0.025	0.6	0.3748	0.3744	9.520	9.510	IR-061012	0.3755	0.3752	9.538	9.530
0.04	1.0	0.4997	0.4993	12.692	12.682	IR-081212	0.5006	0.5003	12.715	12.707
0.04	1.0	0.4997	0.4993	12.692	12.682	IR-081216	0.5006	0.5003	12.715	12.707
0.04	1.0	0.6247	0.6243	15.867	15.857	IR-101412	0.6256	0.6253	15.890	15.882
0.04	1.0	0.6247	0.6243	15.867	15.857	IR-101416	0.6256	0.6253	15.890	15.882
0.04	1.0	0.6872	0.6868	17.455	17.445	IR-111412	0.6881	0.6878	17.478	17.470
0.04	1.0	0.7497	0.7492	19.042	19.029	IR-121612	0.7507	0.7503	19.068	19.058
0.04	1.0	0.7497	0.7492	19.042	19.029	IR-121616	0.7507	0.7503	19.068	19.058
0.04	1.0	0.8122	0.8117	20.630	20.617	IR-131616	0.8132	0.8128	20.655	20.645
0.04	1.0	0.8747	0.8742	22.217	22.204	IR-141816	0.8757	0.8753	22.243	22.233
0.04	1.0	0.8747	0.8742	22.217	22.204	IR-141820	0.8757	0.8753	22.243	22.233
0.04	1.0	0.9372	0.9367	23.805	23.792	IR-151816	0.9382	0.9378	23.830	23.820
0.04	1.0	0.9372	0.9367	23.805	23.792	IR-151820	0.9382	0.9378	23.830	23.820
0.04	1.0	0.9997	0.9992	25.392	25.379	IR-162016	1.0007	1.0003	25.418	25.408
0.04	1.0	0.9997	0.9992	25.392	25.379	IR-162020	1.0007	1.0003	25.418	25.408
0.04	1.0	1.1247	1.1242	28.567	28.554	IR-182216	1.1257	1.1253	28.593	28.583
0.04	1.0	1.1247	1.1242	28.567	28.554	IR-182220	1.1257	1.1253	28.593	28.583
0.06	1.5	1.1872	1.1867	30.155	30.142	IR-192420	1.1882	1.1878	30.180	30.170
0.06	1.5	1.2496	1.2490	31.740	31.725	IR-202416	1.2508	1.2504	31.770	31.760
0.06	1.5	1.2496	1.2490	31.740	31.725	IR-202420	1.2508	1.2504	31.770	31.760
0.06	1.5	1.3121	1.3115	33.327	33.312	IR-212616	1.3133	1.3129	33.358	33.348
0.06	1.5	1.3121	1.3115	33.327	33.312	IR-212620	1.3133	1.3129	33.358	33.348
0.06	1.5	1.3746	1.3740	34.915	34.900	IR-222620	1.3758	1.3754	34.945	34.935
0.06	1.5	1.3746	1.3740	34.915	34.900	IR-222820	1.3758	1.3754	34.945	34.935
0.06	1.5	1.4371	1.4365	36.502	36.487	IR-232816	1.4383	1.4379	36.533	36.523
0.06	1.5	1.4371	1.4365	36.502	36.487	IR-232820	1.4383	1.4379	36.533	36.523
0.06	1.5	1.4996	1.4990	38.090	38.075	IR-242816	1.5008	1.5004	38.120	38.110
0.06	1.5	1.4996	1.4990	38.090	38.075	IR-242820	1.5008	1.5004	38.120	38.110
0.06	1.5	1.4996	1.4990	38.090	38.075	IR-243220	1.5008	1.5004	38.120	38.110
0.06	1.5	1.5621	1.5615	39.677	39.662	IR-253020	1.5633	1.5629	39.708	39.698
0.06	1.5	1.5621	1.5615	39.677	39.662	IR-253220	1.5633	1.5629	39.708	39.698
0.06	1.5	1.6246	1.6240	41.265	41.250	IR-263220	1.6258	1.6254	41.295	41.285
0.06	1.5	1.6871	1.6865	42.852	42.837	IR-273216	1.6883	1.6879	42.883	42.873
0.06	1.5	1.6871	1.6865	42.852	42.837	IR-273220	1.6883	1.6879	42.883	42.873
0.06	1.5	1.7496	1.7490	44.440	44.425	IR-283624	1.7508	1.7504	44.470	44.460
0.06	1.5	1.7496	1.7490	44.440	44.425	IR-283628	1.7508	1.7504	44.470	44.460
0.08	2.0	1.9371	1.9365	49.202	49.187	IR-314024	1.9383	1.9379	49.233	49.223
0.08	2.0	1.9371	1.9365	49.202	49.187	IR-314028	1.9383	1.9379	49.233	49.223

* Equal to minimum inner ring chamfer at unmarked end.



Inner Rings, Inch Series

Check for availability.

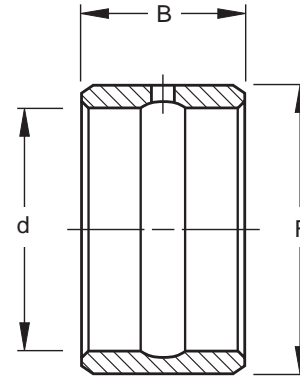
These inner rings meet Military Standard MS 51962

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

Load ratings are given in pounds-force:

$$1 \text{ lbf} = 0.454 \text{ kgf} = 4.448 \text{ N}$$

Inner ring diameters and widths listed below are nominal. For inspection purposes, see tolerance tables on page 405.



BORE, O.D., AND WIDTH DIMENSIONS

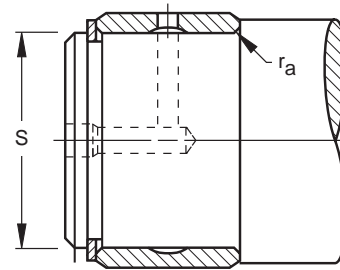
d Bore (nom.)		F Outside Diameter (nom.)		B Width (nom.)		Inner Ring Designation	Used with Bearing Designation
inch	mm	inch	mm	inch	mm		
2.0000	50,800	2.5000	63,500	1.500	38,10	IR-324024	HJ-405224
2.0000	50,800	2.5000	63,500	1.750	44,45	IR-324028	HJ-405228
2.1875	55,562	2.7500	69,850	1.750	44,45	IR-354428	HJ-445628
2.2500	57,150	2.7500	69,850	1.500	38,10	IR-364424	HJ-445624
2.2500	57,150	2.7500	69,850	1.750	44,45	IR-364428	HJ-445628
2.3750	60,325	3.0000	76,200	1.750	44,45	IR-384828	HJ-486028
2.5000	63,500	3.0000	76,200	1.500	38,10	IR-404824	HJ-486024
2.5000	63,500	3.0000	76,200	1.750	44,45	IR-404828	HJ-486028
2.7500	69,850	3.2500	82,550	1.750	44,45	IR-445228	HJ-526828
2.7500	69,850	3.2500	82,550	2.000	50,80	IR-445232	HJ-526832
2.9375	74,612	3.5000	88,900	2.000	50,80	IR-475632	HJ-567232
3.0000	76,200	3.5000	88,900	2.000	50,80	IR-485632	HJ-567232
3.1250	79,375	3.7500	95,250	2.000	50,80	IR-506032	HJ-607632
3.2500	82,550	3.7500	95,250	2.000	50,80	IR-526032	HJ-607632
3.2500	82,550	4.0000	101,600	2.000	50,80	IR-526432	HJ-648032
3.3750	85,725	4.0000	101,600	2.000	50,80	IR-546432	HJ-648032
3.5000	88,900	4.0000	101,600	2.000	50,80	IR-566432	HJ-648032
3.5000	88,900	4.2500	107,950	2.000	50,80	IR-566832	HJ-688432
3.7500	95,250	4.2500	107,950	2.000	50,80	IR-606832	HJ-688432
3.7500	95,250	4.5000	114,300	2.250	57,15	IR-607236	HJ-729636
3.7500	95,250	4.5000	114,300	2.500	63,50	IR-607240	HJ-729640
4.0000	101,600	5.0000	127,000	2.250	57,15	IR-648036	HJ-8010436
4.0000	101,600	5.0000	127,000	2.500	63,50	IR-648040	HJ-8010440
4.2500	107,950	5.0000	127,000	2.250	57,15	IR-688036	HJ-8010436
4.5000	114,300	5.5000	139,700	2.500	63,50	IR-728840	HJ-8811240
4.5000	114,300	5.5000	139,700	3.000	76,20	IR-728848	HJ-8811248
4.7500	120,650	5.7500	146,050	3.000	76,20	IR-769248	HJ-9211648
5.0000	127,000	6.0000	152,400	2.500	63,50	IR-809640	HJ-9612040
5.0000	127,000	6.0000	152,400	3.000	76,20	IR-809648	HJ-9612048
5.5000	139,700	6.5000	165,100	2.500	63,50	IR-8810440	HJ-10412840
5.5000	139,700	6.5000	165,100	3.000	76,20	IR-8810448	HJ-10412848
6.0000	152,400	7.2500	184,150	3.000	76,20	IR-9611648	HJ-11614648
6.5000	165,100	7.7500	196,850	3.000	76,20	IR-10412448	HJ-12415448
7.0000	177,800	8.2500	209,550	3.000	76,20	IR-11213248	HJ-13216248
7.5000	190,500	8.7500	222,250	3.000	76,20	IR-12014048	HJ-14017048
8.0000	203,200	9.2500	234,950	3.000	76,20	IR-12814848	HJ-14817848



These inner rings are designed for either a loose transition fit or an interference fit on the shaft. These fits, used in conjunction with the proper outer ring fit, will provide the correct operating clearances for most applications. If an interference fit is used for the inner ring, the outer ring should be mounted with a clearance fit. See page 403 for further discussion of mounting fits.

The shaft shoulder diameter adjacent to the inner ring must not exceed the inner ring O.D.

The unmarked end of the inner ring should be assembled against the shaft shoulder to assure clearing the maximum allowable shaft fillet (r_a) indicated in the tables.



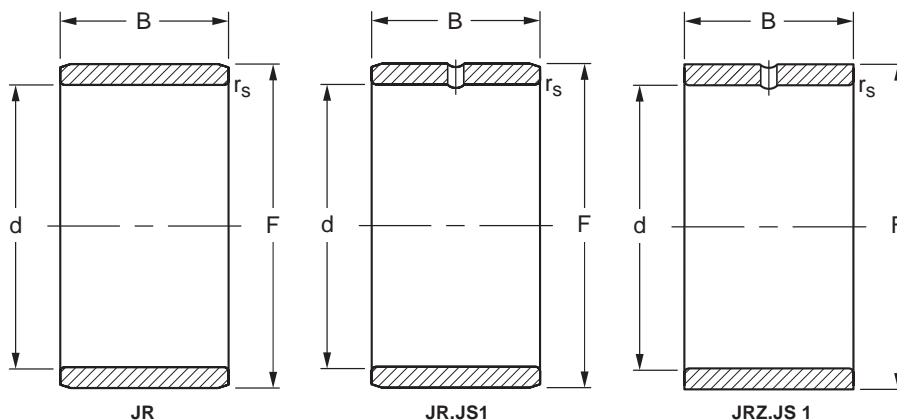
MOUNTING DIMENSIONS

r_a^* Shaft Fillet		S Loose Transition Fit Shaft Diameter				Inner Ring Designation	S Interference Fit Shaft Diameter			
in.	mm	(inches)		(millimeters)			(inches)		(millimeters)	
		max.	min.	max.	min.		max.	min.	max.	min.
0.08	2.0	1.9996	1.9989	50,790	50,772	IR-324024	2.0009	2.0004	50,823	50,810
0.08	2.0	1.9996	1.9989	50,790	50,772	IR-324028	2.0009	2.0004	50,823	50,810
0.08	2.0	2.1871	2.1864	55,552	55,534	IR-354428	2.1884	2.1879	55,585	55,572
0.08	2.0	2.2496	2.2489	57,140	57,122	IR-364424	2.2509	2.2504	57,173	57,160
0.08	2.0	2.2496	2.2489	57,140	57,122	IR-364428	2.2509	2.2504	57,173	57,160
0.08	2.0	2.3746	2.3739	60,315	60,297	IR-384828	2.3759	2.3754	60,348	60,335
0.08	2.0	2.4996	2.4989	63,490	63,472	IR-404824	2.5009	2.5004	63,523	63,510
0.08	2.0	2.4996	2.4989	63,490	63,472	IR-404828	2.5009	2.5004	63,523	63,510
0.08	2.0	2.7496	2.7489	69,840	69,822	IR-445228	2.7509	2.7504	69,873	69,860
0.08	2.0	2.7496	2.7489	69,840	69,822	IR-445232	2.7509	2.7504	69,873	69,860
0.08	2.0	2.9371	2.9364	74,602	74,584	IR-475632	2.9384	2.9379	74,635	74,622
0.08	2.0	2.9996	2.9989	76,190	76,172	IR-485632	3.0009	3.0004	76,223	76,210
0.10	2.5	3.1246	3.1239	79,365	79,347	IR-506032	3.1259	3.1254	79,398	79,385
0.10	2.5	3.2495	3.2487	82,537	82,517	IR-526032	3.2511	3.2505	82,578	82,563
0.10	2.5	3.2495	3.2487	82,537	82,517	IR-526432	3.2511	3.2505	82,578	82,563
0.10	2.5	3.3745	3.3737	85,712	85,692	IR-546432	3.3761	3.3755	85,753	85,738
0.10	2.5	3.4995	3.4987	88,887	88,867	IR-566432	3.5011	3.5005	88,928	88,913
0.10	2.5	3.4995	3.4987	88,887	88,867	IR-566832	3.5011	3.5005	88,928	88,913
0.10	2.5	3.7495	3.7487	95,237	95,217	IR-606832	3.7511	3.7505	95,278	95,263
0.10	2.5	3.7495	3.7487	95,237	95,217	IR-607236	3.7511	3.7505	95,278	95,263
0.10	2.5	3.7495	3.7487	95,237	95,217	IR-607240	3.7511	3.7505	95,278	95,263
0.10	2.5	3.9995	3.9987	101,587	101,567	IR-648036	4.0011	4.0005	101,628	101,613
0.10	2.5	3.9995	3.9987	101,587	101,567	IR-648040	4.0011	4.0005	101,628	101,613
0.10	2.5	4.2495	4.2487	107,937	107,917	IR-688036	4.2511	4.2505	107,978	107,963
0.10	2.5	4.4995	4.4987	114,287	114,267	IR-728840	4.5011	4.5005	114,328	114,313
0.10	2.5	4.4995	4.4987	114,287	114,267	IR-728848	4.5011	4.5005	114,328	114,313
0.12	3.0	4.7494	4.7485	120,635	120,612	IR-769248	4.7513	4.7506	120,683	120,665
0.12	3.0	4.9994	4.9985	126,985	126,962	IR-809640	5.0013	5.0006	127,033	127,015
0.12	3.0	4.9994	4.9985	126,985	126,962	IR-809648	5.0013	5.0006	127,033	127,015
0.12	3.0	5.4994	5.4985	139,685	139,662	IR-8810440	5.5013	5.5006	139,733	139,715
0.12	3.0	5.4994	5.4985	139,685	139,662	IR-8810448	5.5013	5.5006	139,733	139,715
0.12	3.0	5.9994	5.9985	152,385	152,362	IR-9611648	6.0013	6.0006	152,433	152,415
0.12	3.0	6.4994	6.4985	165,085	165,062	IR-10412448	6.5013	6.5006	165,133	165,115
0.12	3.0	6.9994	6.9985	177,785	177,762	IR-11213248	7.0013	7.0006	177,833	177,815
0.16	4.0	7.4994	7.4982	190,485	190,455	IR-12014048	7.5014	7.5006	190,536	190,516
0.16	4.0	7.9994	7.9982	203,185	203,155	IR-12814848	8.0014	8.0006	203,236	203,216

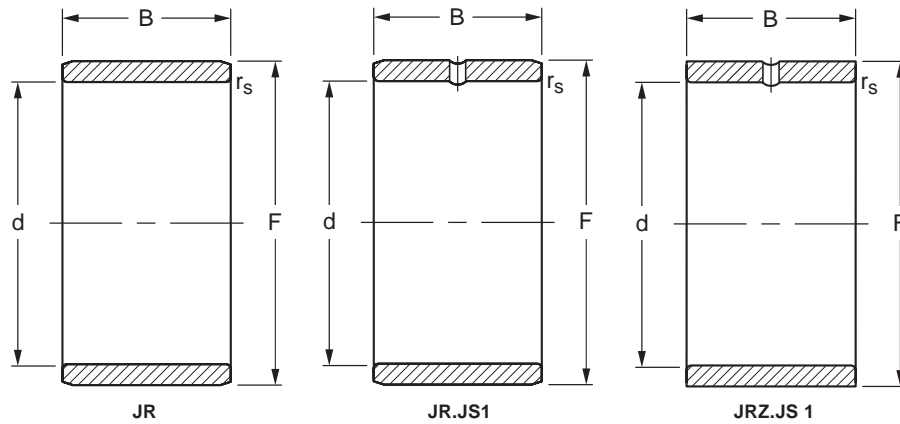
*Equal to minimum inner ring chamfer at unmarked end.



Inner rings



Shaft dia.	Dimensions				Inner ring Designation	Mass
	d	F	B	r _s min		
	mm					kg
5	5	8	8	0,3	JR5x8x8JS1	0,002
	5	8	12	0,3	JR5x8x12	0,003
	5	8	16	0,3	JR5x8x16	0,004
6	6	9	8	0,3	JR6x9x8JS1	0,002
	6	9	12	0,3	JR6x9x12	0,003
	6	9	16	0,3	JR6x9x16	0,004
	6	10	10	0,3	JR6x10x10	0,004
	6	10	10	0,3	JR6x10x10JS1	0,004
	6	10	12	0,3	JRZ6x10x12JS1	0,005
7	7	10	10,5	0,3	JR7x10x10,5	0,003
	7	10	12	0,3	JR7x10x12	0,004
	7	10	16	0,3	JR7x10x16	0,005
8	8	12	10	0,3	JR8x12x10	0,005
	8	12	10	0,3	JR8x12x10JS1	0,005
	8	12	10,5	0,3	JR8x12x10,5	0,005
	8	12	12	0,3	JRZ8x12x12JS1	0,006
	8	12	12,5	0,3	JR8x12x12,5	0,006
9	9	12	12	0,3	JR9x12x12	0,005
	9	12	16	0,3	JR9x12x16	0,006
10	10	13	12,5	0,3	JR10x13x12,5	0,005
	10	14	11	0,3	JR10x14x11JS1	0,007
	10	14	12	0,3	JR10x14x12	0,007
	10	14	12	0,3	JR10x14x12JS1	0,007
	10	14	13	0,3	JR10x14x13	0,007
	10	14	14	0,3	JRZ10x14x14JS1	0,008
	10	14	16	0,3	JR10x14x16	0,009
	10	14	20	0,3	JR10x14x20	0,012
12	12	15	12,5	0,3	JR12x15x12,5	0,006
	12	15	16	0,3	JR12x15x16	0,008
	12	15	16,5	0,3	JR12x15x16,5	0,008
	12	15	18,5	0,3	JR12x15x18,5	0,009
	12	15	22,5	0,3	JR12x15x22,5	0,011
	12	16	12	0,3	JR12x16x12	0,008
	12	16	12	0,3	JR12x16x12JS1	0,008
	12	16	13	0,3	JR12x16x13	0,008
	12	16	14	0,3	JRZ12x16x14JS1	0,01
	12	16	16	0,3	JR12x16x16	0,011
	12	16	20	0,3	JR12x16x20	0,014
	12	16	22	0,3	JR12x16x22	0,015

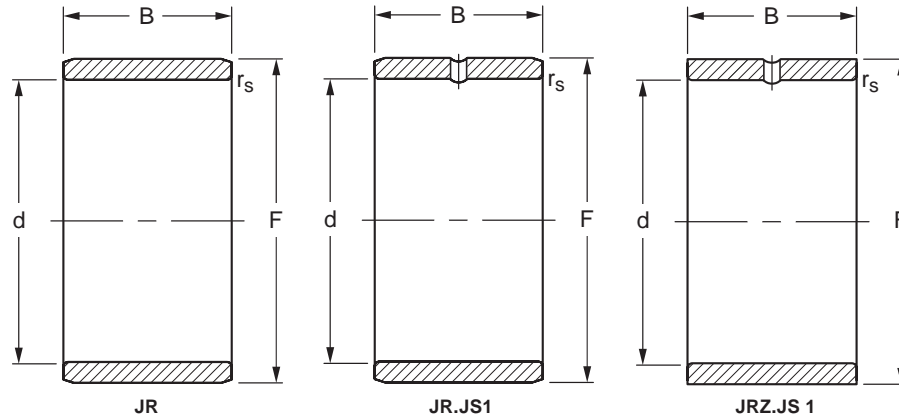


Shaft	Dimensions				Inner ring Designation	Mass
	d	F	B	r _s min		
	mm					kg
14	14	17	17	0,3	JR14x17x17	0,009
15	15	18	16,5	0,3	JR15x18x16,5	0,01
	15	19	16	0,3	JR15x19x16	0,013
	15	19	20	0,3	JR15x19x20	0,017
	15	20	12	0,3	JR15x20x12	0,012
	15	20	12	0,3	JR15x20x12JS1	0,012
	15	20	13	0,3	JR15x20x13	0,014
	15	20	14	0,3	JRZ15x20x14JS1	0,015
	15	20	16	0,3	JR15x20x16	0,017
	15	20	23	0,3	JR15x20x23	0,025
17	17	20	26	0,3	JR15x20x26	0,028
	17	20	16,5	0,3	JR17x20x16,5	0,011
	17	20	20	0,3	JR17x20x20	0,014
	17	20	20,5	0,3	JR17x20x20,5	0,014
	17	20	30,5	0,3	JR17x20x30,5	0,021
	17	21	16	0,3	JR17x21x16	0,015
	17	21	20	0,3	JR17x21x20	0,019
	17	22	13	0,3	JR17x22x13	0,015
	17	22	16	0,3	JR17x22x16	0,019
	17	22	16	0,3	JR17x22x16JS1	0,019
	17	22	16	0,3	JRZ17x22x16JS1	0,019
	17	22	23	0,3	JR17x22x23	0,028
	17	22	26	0,3	JR17x22x26	0,031
20	17	22	32	0,3	JR17x22x32	0,038
	20	24	16	0,3	JR20x24x16	0,018
	20	24	20	0,3	JR20x24x20	0,022
	20	25	16	0,3	JR20x25x16	0,022
	20	25	16	0,3	JR20x25x16JS1	0,022
	20	25	17	0,3	JR20x25x17	0,023
	20	25	18	0,3	JRZ20x25x18JS1	0,025
	20	25	20	0,3	JR20x25x20	0,028
	20	25	20,5	0,3	JR20x25x20,5	0,029
	20	25	26	0,3	JR20x25x26	0,036
	20	25	26,5	0,3	JR20x25x26,5	0,037
	20	25	30	0,3	JR20x25x30	0,042
	20	25	32	0,3	JR20x25x32	0,044
20	25	38,5	0,3	JR20x25x38,5	0,054	



Inner rings

Shaft dia.	Dimensions				Inner ring designation	Mass
	d	F	B	r _s min		
	mm					
22	22	26	16	0,3	JR22x26x16	0,019
	22	26	20	0,3	JR22x26x20	0,023
	22	28	17	0,3	JR22x28x17	0,03
	22	28	20,5	0,3	JR22x28x20,5	0,038
	22	28	30	0,3	JR22x28x30	0,056
25	25	29	20	0,3	JR25x29x20	0,027
	25	29	30	0,3	JR25x29x30	0,04
	25	30	16	0,3	JR25x30x16	0,027
	25	30	16	0,3	JR25x30x16JS1	0,027
	25	30	17	0,3	JR25x30x17	0,028
	25	30	18	0,3	JR25x30x18JS1	0,031
	25	30	20	0,3	JR25x30x20	0,034
	25	30	20,5	0,3	JR25x30x20,5	0,035
	25	30	26	0,3	JR25x30x26	0,044
	25	30	26,5	0,3	JR25x30x26,5	0,045
	25	30	30	0,3	JR25x30x30	0,051
	25	30	32	0,3	JR25x30x32	0,054
	25	30	38,5	0,3	JR25x30x38,5	0,066
28	28	32	17	0,3	JR28x32x17	0,028
	28	32	20	0,3	JR28x32x20	0,03
	28	32	30	0,3	JR28x32x30	0,044
30	30	35	16	0,3	JR30x35x16	0,031
	30	35	17	0,3	JR30x35x17	0,033
	30	35	18	0,3	JRZ30x35x18JS1	0,036
	30	35	20	0,3	JR30x35x20	0,039
	30	35	20	0,3	JRZ30x35x20JS1	0,039
	30	35	20,5	0,3	JR30x35x20,5	0,04
	30	35	26	0,3	JR30x35x26	0,054
	30	35	30	0,3	JR30x35x30	0,057
	30	35	32	0,3	JR30x35x32	0,062
	30	38	20	0,6	JR30x38x20JS1	0,067
32	32	37	20	0,3	JR32x37x20	0,043
	32	37	30	0,3	JR32x37x30	0,064
	32	40	20	0,6	JR32x40x20	0,069
	32	40	36	0,6	JR32x40x36	0,128
35	35	40	17	0,3	JR35x40x17	0,04
	35	40	20	0,3	JR35x40x20	0,046
	35	40	20,5	0,3	JR35x40x20,5	0,049
	35	40	22	0,3	JR35x40x22	0,052
	35	40	30	0,3	JR35x40x30	0,071
	35	40	34	0,3	JR35x40x34	0,08
	35	40	40	0,3	JR35x40x40	0,094
	35	42	20	0,6	JR35x42x20	0,065
	35	42	20	0,6	JR35x42x20JS1	0,065
	35	42	23	0,6	JRZ35x42x23JS1	0,074
	35	42	36	0,6	JR35x42x36	0,122
	35	44	22	0,6	JR35x44x22	0,097

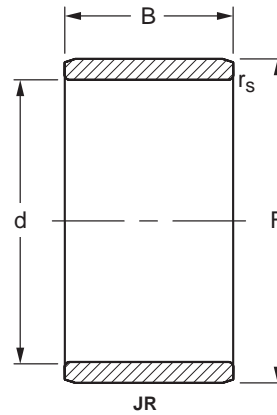


Shaft dia.	Dimensions				Inner ring designation	Mass
	d	F	B	r _s min		
	mm					
38	38	43	20	0,3	JR38x43x20	0,05
	38	43	30	0,3	JR38x43x30	0,075
40	40	45	17	0,3	JR40x45x17	0,044
	40	45	20	0,3	JR40x45x20	0,052
	40	45	20,5	0,3	JR40x45x20,5	0,054
	40	45	30	0,3	JR40x45x30	0,078
	40	45	34	0,3	JR40x45x34	0,089
	40	45	40	0,3	JR40x45x40	0,115
	40	48	22	0,6	JR40x48x22	0,094
	40	48	23	0,6	JRZ40x48x23JS1	0,1
	40	48	40	0,6	JR40x48x40	0,173
	40	50	20	1	JR40x50x20	0,11
42	42	47	20	0,3	JR42x47x20	0,055
	42	47	30	0,3	JR42x47x30	0,083
45	45	50	20	0,3	JR45x50x20	0,058
	45	50	25	0,6	JR45x50x25	0,073
	45	50	25,5	0,3	JR45x50x25,5	0,075
	45	50	25	0,6	JR45x50x35	0,103
	45	50	40	0,3	JR45x50x40	0,117
	45	52	22	0,6	JR45x52x22	0,09
	45	52	23	0,6	JR45x52x23	0,096
	45	52	23	0,6	JRZ45x52x23JS1	0,096
	45	52	40	0,6	JR45x52x40	0,167
	45	55	20	1	JR45x55x20	0,133
	45	55	20	1	JR45x55x20JS1	0,133
	45	55	22	1	JR45x55x22	0,135
	45	55	40	1	JR45x55x40	0,247
50	50	55	20	0,3	JR50x55x20	0,065
	50	55	25	0,6	JR50x55x25	0,081
	50	55	35	0,6	JR50x55x35	0,113
	50	55	40	0,3	JR50x55x40	0,13
	50	58	22	0,6	JR50x58x22	0,117
	50	58	23	0,6	JRZ50x58x23JS1	0,122
	50	58	40	0,6	JR50x58x40	0,213
	50	60	20	1	JR50x60x20	0,155
	50	60	20	1	JR50x60x20JS1	0,155
	50	60	25	1	JR50x60x25	0,17
	50	60	40	1	JR50x60x40	0,31



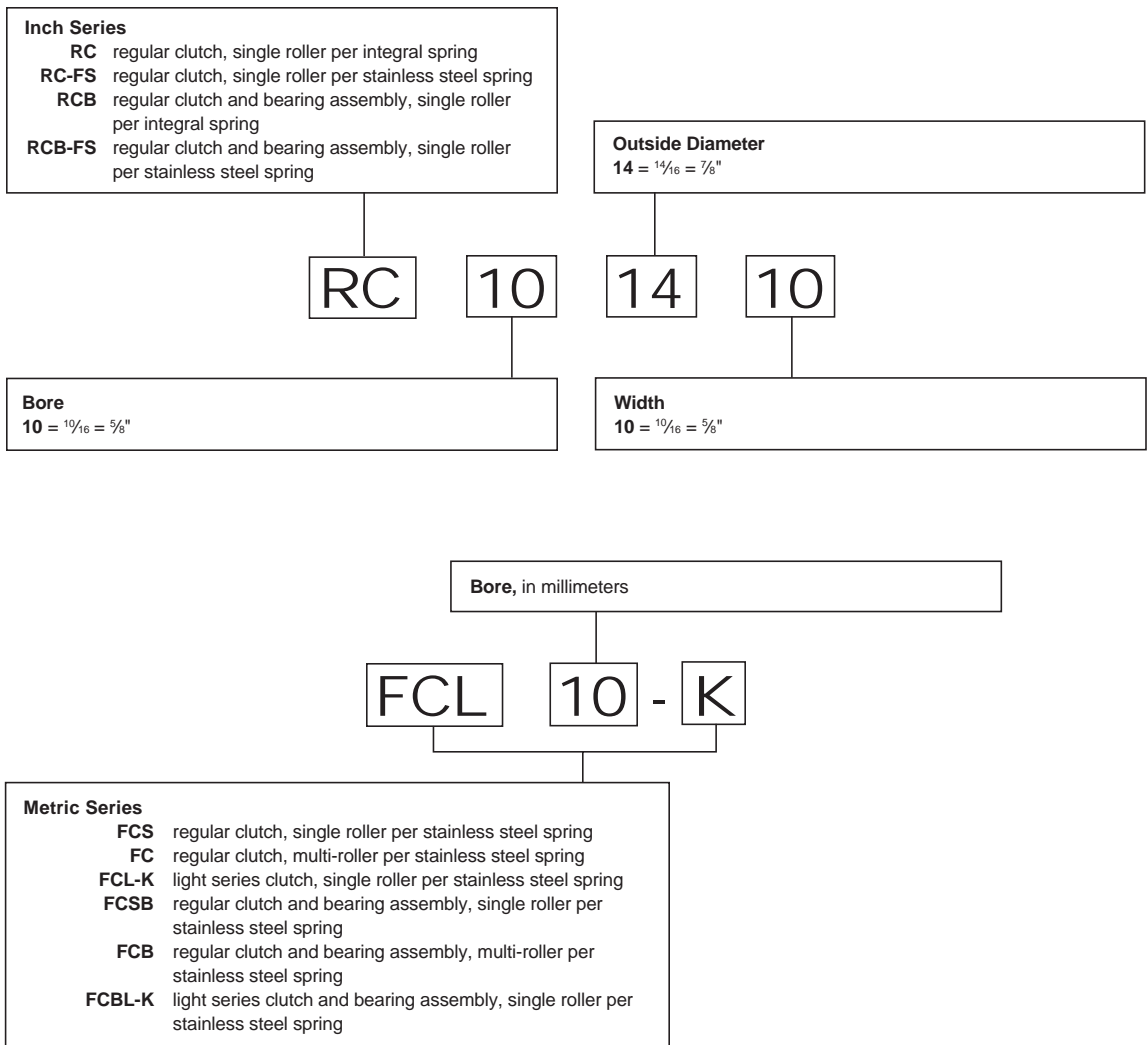
Inner rings

Shaft dia.	Dimensions				Inner ring designation	Mass
	d mm	F	B _i	r _s min		
55	55	60	25	0,6	JR55x60x25	0,088
	55	60	35	0,6	JR55x60x35	0,124
	55	63	25	1	JR55x63x25	0,141
	55	63	45	1	JR55x63x45	0,286
	55	65	30	1	JR55x65x30	0,222
	55	65	60	1	JR55x65x60	0,444
60	60	68	25	0,6	JR60x68x25	0,153
	60	68	35	0,6	JR60x68x35	0,22
	60	68	45	1	JR60x68x45	0,284
	60	70	25	1	JR60x70x25	0,2
	60	70	30	1	JR60x70x30	0,24
	60	70	60	1	JR60x70x60	0,48
65	65	72	25	1	JR65x72x25	0,143
	65	72	45	1	JR65x72x45	0,266
	65	73	25	0,6	JR65x73x25	0,17
	65	73	35	0,6	JR65x73x35	0,24
	65	75	28	1	JR65x75x28	0,24
	65	75	30	1	JR65x75x30	0,26
	65	75	60	1	JR65x75x60	0,52
70	70	80	25	1	JR70x80x25	0,23
	70	80	30	1	JR70x80x30	0,27
	70	80	35	1	JR70x80x35	0,32
	70	80	54	1	JR70x80x54	0,5
	70	80	60	1	JR70x80x60	0,556
75	75	85	25	1	JR75x85x25	0,24
	75	85	30	1	JR75x85x30	0,289
	75	85	35	1	JR75x85x35	0,338
	75	85	54	1	JR75x85x54	0,53
80	80	90	25	1	JR80x90x25	0,26
	80	90	30	1	JR80x90x30	0,306
	80	90	35	1	JR80x90x35	0,355
	80	90	54	1	JR80x90x54	0,565



Shaft dia.	Dimensions				Inner ring designation	Mass
	d	F	B _i	r _s min		
85	85	95	26	1	JR85x95x26	0,29
	85	95	30	1	JR85x95x30	0,334
	85	95	36	1	JR85x95x36	0,397
	85	100	35	1,1	JR85x100x35	0,595
	85	100	63	1,1	JR85x100x63	1,08
90	90	100	26	1	JR90x100x26	0,3
	90	100	30	1	JR90x100x30	0,35
	90	100	36	1	JR90x100x36	0,422
	90	105	32	1,1	JR90x105x32	0,58
	90	105	35	1,1	JR90x105x35	0,624
	90	105	63	1,1	JR90x105x63	1,14
95	95	105	26	1	JR95x105x26	0,31
	95	105	36	1	JR95x105x36	0,43
	95	110	35	1,1	JR95x110x35	0,653
	95	110	63	1,1	JR95x110x63	1,2
100	100	110	30	1,1	JR100x110x30	0,384
	100	110	40	1,1	JR100x110x40	0,51
	100	115	40	1,1	JR100x115x40	0,79
110	110	120	30	1	JR110x120x30	0,425
	110	125	40	1,1	JR110x125x40	0,87
120	120	130	30	1	JR120x130x30	0,46
	120	135	45	1,1	JR120x135x45	1,06
130	130	145	35	1,1	JR130x145x35	0,89
	130	150	50	1,5	JR130x150x50	1,73
140	140	155	35	1,1	JR140x155x35	0,955
	140	160	50	1,5	JR140x160x50	1,86
150	150	165	40	1,1	JR150x165x40	1,17
160	160	175	40	1,1	JR160x175x40	1,24
170	170	185	45	1,1	JR170x185x45	1,48
180	180	195	45	1,1	JR180x195x45	1,56

Drawn Cup Roller Clutches



Drawn Cup Roller Clutches

	Page		Page
Introduction	494	Temperatures	499
Design	494	Backlash	499
Operation	494	Rate of Engagement	499
Identification	495	Overrun Limit Speed	499
Construction	495	Inspection	499
Special Clutches	495		
Application	496-497	DC ROLLER CLUTCHES	
Housing Design	497	Types FC, FCS, FCL-K, RC-FS and RC	
Shaft Design	497	Dimensions, Ratings, Gauging and Mounting	500-501
Installation	498		
Applied Loads	499	DC ROLLER CLUTCH AND BEARING ASSEMBLIES	
Lubrication	499	Types FCB, FCBL-K, RCB-FS and RCB	
		Dimensions, Ratings, Gauging and Mounting	502-503



DRAWN CUP ROLLER CLUTCHES

INTRODUCTION

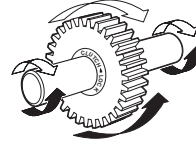
Function

The Torrington drawn cup roller clutch transmits torque between the shaft and housing in one direction and allows free overrun in the opposite direction. When transmitting torque, either the shaft or the housing can be the input member. Applications are generally described as indexing, backstopping or overrunning.

Lock Function

Shaft Drives Gear

Clockwise (White arrows)

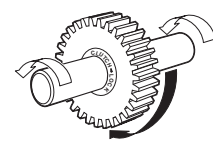


or Gear Can Drive Shaft Counter-Clockwise (Black arrows)

Overrun Function

Shaft Overruns In Gear

Counter-Clockwise (White arrows)



or Gear Overruns on Shaft Clockwise (Black arrow)

DESIGN

The patented design utilizes the same low profile radial section as drawn cup needle roller bearings. The units are compact, light in weight and operate directly on a hardened shaft. Proper mounting is easily accomplished with a simple press fit in the housing.

Precisely formed interior ramps provide surfaces against which the rollers wedge to positively lock the clutch with the shaft when rotated in the proper direction. Transition from the overrun to locked operation normally occurs with minimal lost motion(backlash).

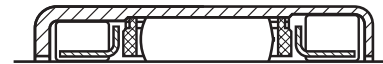
Two basic configurations are produced:

clutch only - Use with external radial support (usually two drawn cup needle roller bearings). Separate bearings position the shaft and housing concentrically and carry the radial load during overrun.



Clutch Only

clutch and bearing assemblies - Use without additional radial support. An integral assembly within a single drawn cup, in which two roller bearings straddle the clutch.



Clutch and Bearing Assembly

OPERATION

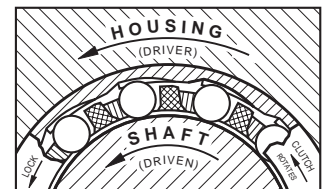
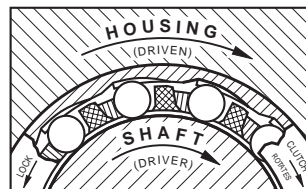
Operation is in two modes; the **overrun** mode and the **lock** mode. Operational mode is controlled by the direction of the clutch or shaft rotation with respect to the locking ramps.

In the **overrun** mode shown in the drawings below, the relative rotation between the housed clutch and the shaft causes the rollers to move away from their locking position against the locking ramps in the drawn cup. The housing and the clutch are thus free to overrun in one direction, or the shaft is free to overrun in the other direction.

In the **lock** mode shown in the drawings below, the relative rotation between the housed clutch and the shaft is opposite to that in the overrun mode. The rollers, assisted by the leaf type springs, become wedged between the locking ramps and the shaft to transmit torque between the two members. Either the member housing the clutch drives the shaft in one direction, or the shaft can drive the clutch and its housing member in the other direction.



Clearance between the rollers and cup ramps is exaggerated in these drawings.





IDENTIFICATION

The prefix letters in the designation of the Torrington drawn cup roller clutches and drawn cup roller clutch and bearing assemblies denote whether these are manufactured to inch or metric nominal dimensions. Designation codes for clutches and clutch and bearing assemblies with inch nominal dimensions begin with the letter "R". Those for clutches and clutch and bearing assemblies with metric nominal dimensions begin with the letter "F".

The basic types of clutches and clutch and bearing assemblies are listed below:

Inch Series

- RC** – regular clutch, single roller per integral spring
- RC-FS** – regular clutch, single roller per stainless steel spring
- RCB** – regular clutch and bearing assembly, single roller per integral spring
- RCB-FS** – regular clutch and bearing assembly, single roller per stainless steel spring

Metric Series

- FCS** – regular clutch, single roller per stainless steel spring
- FC** – regular clutch, multi-roller per stainless steel spring
- FCL-K** – light series clutch, single roller per stainless steel spring
- FCSB** – regular clutch and bearing assembly, single roller per stainless steel spring
- FCB** – regular clutch and bearing assembly, multi-roller per stainless steel spring
- FCBL-K** – light series clutch and bearing assembly, single roller per stainless steel spring

CONSTRUCTION

In many respects, construction is similar to that of drawn cup bearings. Design and manufacture of drawn cup clutches, just as with drawn cup bearings, was pioneered and developed by Torrington.

The interior ramps which control the lockup and free run of the clutch are formed during the operation of drawing the cup. The ramps are case hardened to assure long wear life. The incorporation of ramp forming into the cup drawing operation is a manufacturing innovation that contributes much to the units low cost.

Two types of precision molded clutch cages are employed. Types RC and RCB utilize a one-piece cage of acetal resin plastic with integral leaf style springs. Types FC, FCS, FCL-K, RC-FS, FCB, FCBL-K and RCB-FS use a glass fiber reinforced nylon cage equipped with inserted stainless steel leaf springs. The stainless steel springs permit higher rates of engagement, and achieve a greater spring life. The nylon cage permits operation at higher temperatures than the acetal resin cage.

Types RCB, FCB, FCBL-K and RCB-FS clutch and bearing assemblies have cages for retention and guidance of the rollers in the bearings located on both sides of the clutch unit.



**Drawn Cup Roller Clutch
Type FC
with Steel Springs**



**Drawn Cup Clutch and
Bearing Assembly
Type FCB
with Steel Springs**



**Drawn Cup Roller Clutch
Types FCS, FCL-K and RC-FS
with Steel Springs**



**Drawn Cup Clutch and
Bearing Assembly
Types FCBL-K
and RCB-FS
with Steel Springs**



**Drawn Cup Roller Clutch
Type RC
with Integral Springs**



**Drawn Cup Clutch and
Bearing Assembly Type RCB
with Integral Springs**

SPECIAL CLUTCHES

Torrington manufactures many special clutches not listed in this catalog. Where volume justifies tooling costs, special clutches may result in a lower unit cost or, in the event of additional costs, may provide an economical solution to an unusual design problem. If you think a special clutch is indicated, please contact your local Torrington representative for a review of your application.

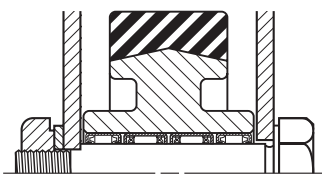


APPLICATION

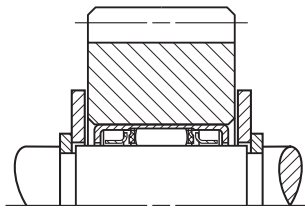
Torrington clutches and clutch and bearing assemblies are successfully applied in a wide range of commercial products where indexing, backstopping and overrunning operations must be performed reliably. The sketches on these pages illustrate some of the many possible uses.

When applying the clutch-only unit, separate bearings on each side of the clutch are required to position the shaft concentrically with the housing and to carry the radial loads during overrun. Drawn cup needle roller bearings with the same radial section as the clutch should be used in the through bored housings for simplicity and economy. Two clutches can be used side by side for greater torque capacity.

Where the radial loads are light, the clutch and bearing assembly can be used without additional support bearings. This reduces the overall assembly width, the number of stocked and ordered parts, and assembly costs as well.



**Clutch and Bearing Arrangement
Heavy Loads**



**Clutch and Bearing Assembly
Light Loads**

Torrington Drawn Cup Roller Clutches are manufactured to commercial hardware standards and are used extensively in appliances, business machines, industrial and recreation equipment and a wide range of other applications.

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

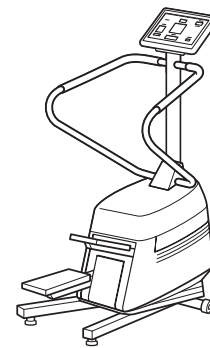
Consideration should be given to operating conditions such as:

- Magnitude of externally applied torque as well as inertial torque
- Magnitude of applied radial loads during overrunning
- Potential for vibration or axial shaft movement within the clutch during engagement
- Engagement rate, as it pertains to the selection of stainless steel or plastic leaf springs
- Oil lubrication supply during high overrunning speeds
- External and internal environmental temperatures that can affect clutch performance
- Lubricant selection effect on clutch engagement
- Indexing inaccuracies resulting from backlash (lost motion)

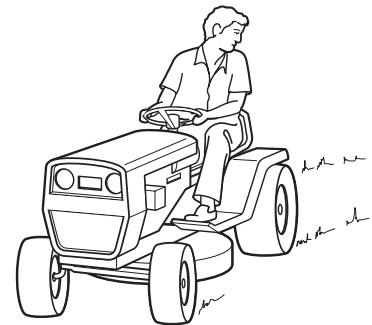
Consideration should be given to the Shaft and Housing design requirements such as:

- Shaft hardness and strength particularly when approaching torque rating limits
- Shaft roundness, taper and surface finish necessary to ensure sufficient fatigue life and torque carrying ability
- Housing strength (hardness and cross section) to support the applied torque loads
- Housing roundness, taper and surface finish necessary to ensure uniform torque and load distribution

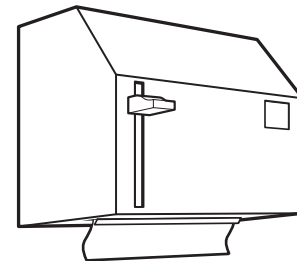
A test program under all expected operating conditions should be carried out before putting a new application into production. Torrington application engineers are constantly working with and testing new applications, therefore, their experience can be of great help to the designer considering the use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



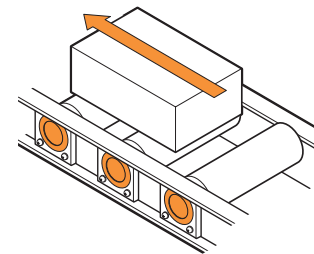
**Stair Steppers
Nordic Trak and other
Athletic Equipment**



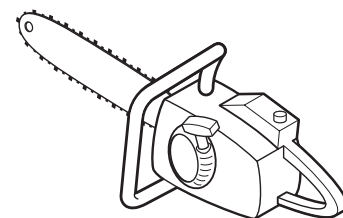
**Lawnmower
Differential**



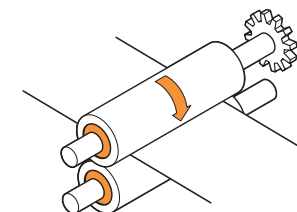
**Tape Dispensers
and Similar
Web Roll Feed
Mechanisms**



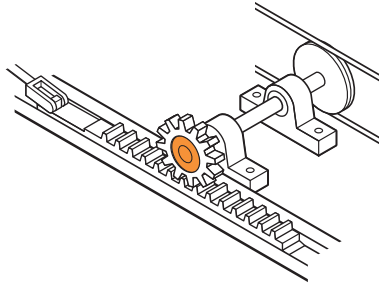
**Conveyor
Rollers**



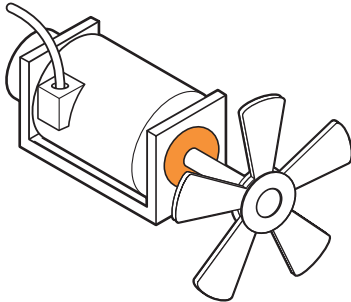
Chainsaw Starters



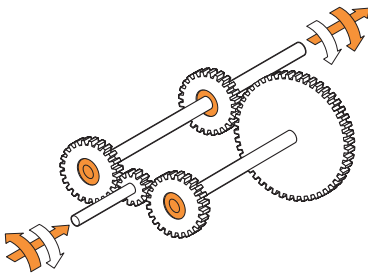
**Paper
Feed Rolls
in Business
Machines**



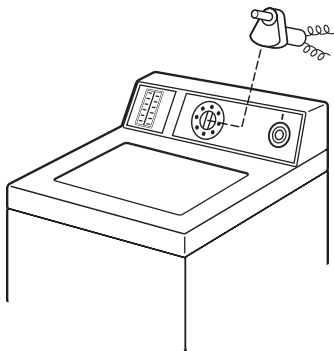
Rack Indexing Drive



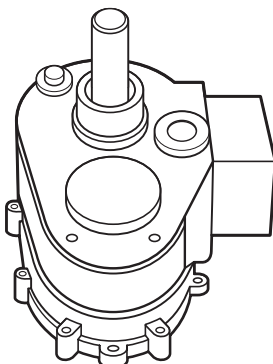
Motor Backstops



2-Speed Gearbox with Reversing Input



Timing Motor Freewheels



Washing Machine Transmission

HOUSING DESIGN

Drawn cup clutches and clutch and bearing assemblies are mounted with a simple press fit in their housings. Through bored and chamfered housings are preferred. Provisions for axial location, such as shoulders or snap rings, are not required. The case hardened cups have a long fatigue life, but must be properly supported to realize this benefit. Steel housings are preferred and must be used for applications involving high torque loads to prevent radial expansion of the clutch cups. The recommended minimum housing outside diameters in the tables of dimensions are for steel.

The housing bore should be round within one-half of the diameter tolerance.

The taper within the length of the outer ring should not exceed 0.0005 inch or 0.013 mm.

The surface finish of the housing bore should not exceed 125 microinches, a.a. (arithmetic average) or 3.2 μ m (on the R_a scale).

Low strength housings (non-steel, sintered metals and some plastics) may be entirely satisfactory in lightly loaded applications. When using non-steel housings, thoroughly test designs.

Adhesive compounds can be used to prevent creeping rotation of the clutch in plastic housings with low friction properties. Adhesives will not provide proper support in oversized metallic housings. When using adhesives, care must be taken to keep the adhesive out of the clutches and bearings.

SHAFT DESIGN

The clutch or clutch and bearing assembly operates directly on the shaft whose specifications of dimensions, hardness and surface finish are well within standard manufacturing limits.

Either case hardening or through hardening grades of good bearing quality steel are satisfactory for raceways. Steels which are modified for free machining, such as those high in sulfur content and particularly those containing lead, are seldom satisfactory for raceways.

For long fatigue life, the shaft raceway, must have a hardness equivalent to 58 HRC (ref, ASTM E-18), and ground to the recommended diameter shown in the tables of dimensions. It may be through hardened, or it may be case hardened, with an effective case depth of 0.030 inch (0.8 mm) (Effective case depth is defined as the distance from the surface inward to the equivalent of 50 HRC hardness level after grinding.)

Taper within the length of the raceway should not exceed 0.0003 inch (0.008 mm), or one-half the diameter tolerance, whichever is smaller. The radial deviation from true circular form of the raceway should not exceed .0001 inch (0.0025 mm) for diameters up to and including 1 inch (25.4 mm). For raceways greater than 1.0 inch or 25mm the allowable radial deviation may be greater than .0001 inch (0.0025 mm) by a factor of raceway diameter (in inches) divided by 1.0 or a factor of raceway diameter (in mm) divided by 25.4. Surface finish on the raceway should not exceed 16 microinches a.a. (arithmetic average) or 0.4 μ m (on the R_a scale). Deviations will reduce the load capacity and fatigue life of the shaft.



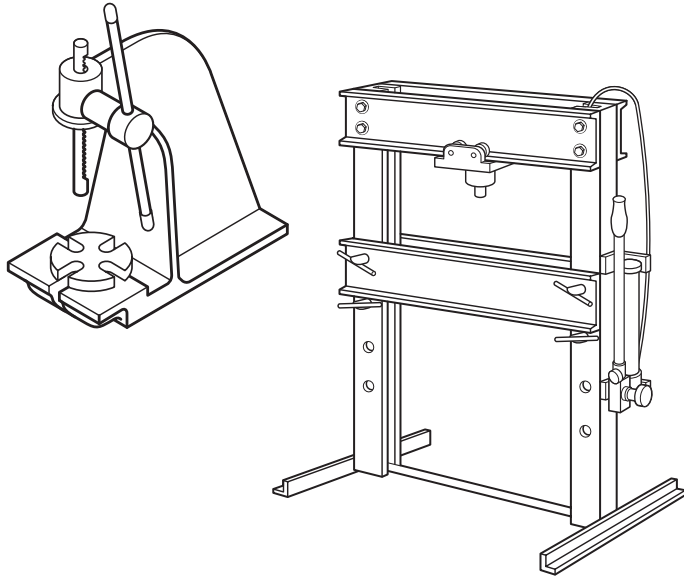
INSTALLATION

Simplicity of installation promotes additional cost savings. The drawn cup roller clutch, or the clutch and bearing assembly, must be pressed into its housing. Procedures are virtually identical with those for installing drawn cup bearings as detailed on page 361. The unit is pressed into the bore of a gear hub or pulley hub, or housing of the proper size, and no shoulders, splines, keys, screws or snap rings are required.

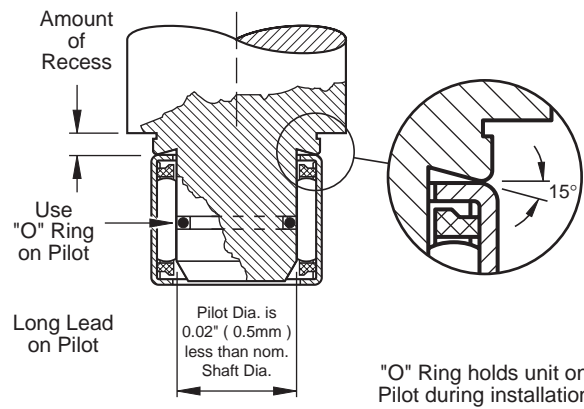
Installation procedures are summarized in the following sketches:



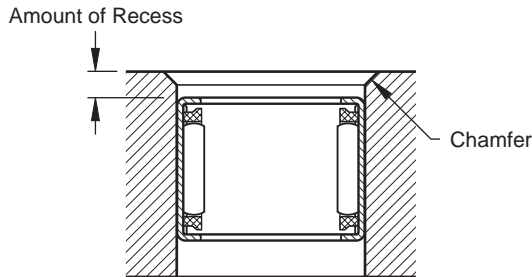
IMPORTANT: The mounted clutch or clutch and bearing assembly engages when the housing is rotated relative to the shaft in the direction of the arrow and LOCK marking (← LOCK) stamped on the cup. Make sure that the unit is oriented properly before pressing it into its housing.



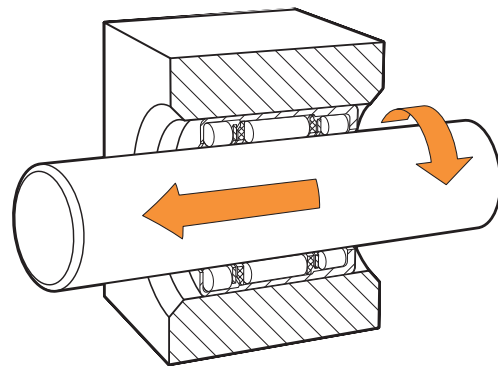
Use an arbor press or hydraulic ram press which will exert steady pressure. Never use a hammer or other tool requiring pounding to drive the clutch into its housing.



Use an installation tool as shown in the diagram above. If clutch is straddled by needle roller bearings, press units into position in proper sequence and preferably leave a small clearance between units.



Make sure that the housing bore is chamfered to permit easy introduction of the clutch and bearing or the clutch unit. Press unit slightly beyond the chamfer in the housing bore to assure full seating. Through bored housings are always preferred. If the housing has a shoulder, never seat the clutch against the shoulder. For further details see page 361.



When assembling the shaft, it should be rotated during insertion. The end of the shaft should have a large chamfer or rounding.



APPLIED LOADS

The clutch-only unit is designed to transmit purely torque loads. Applied torque should not exceed the catalog ratings which are based on the compressive strength of well-aligned clutch components. Bearings on either side of the clutch are required to assure concentricity between the shaft and the housing and to support radial loads during clutch overrun. Integral clutch and bearing assemblies are available for this purpose where the radial loads are light.

In determining the total torque load on a clutch, it is essential to consider the torque due to inertial forces developed in the mechanism, in addition to the externally applied torque. The larger the clutch and the greater the mass of the mechanism controlled by it, the more important this consideration becomes.

Clutch lockup depends upon static friction. For this reason applications involving severe vibrations or axial motion of the shaft within the clutch are to be avoided. Applications in which there are overhanging or overturning loads should incorporate bearings which will maintain alignment between the shaft and the clutch housing. Consult your Torrington Engineering Sales Office for recommendations.

LUBRICATION

Oil is the preferred lubricant, as it minimizes wear and heat generation. For those applications where oil is not practical, clutches are packed with a soft grease containing mineral oil. Thick grease will retard roller engagement and can cause individual rollers to slip, possibly overload any engaged rollers.

TEMPERATURE

Temperature extremes can cause clutch malfunctions and failure. The molded acetal resin plastic cage with integral springs holds its necessary resiliency and strength when the operating temperature within the clutch is kept below 200°F (93°C). The clutch with reinforced nylon cage and separate steel springs operates well at temperatures up to 250°F (121°C) continuously and to 300°F (150°C) intermittently. Excessive thickening of the lubricant at low temperatures may prevent some or all of the rollers from engaging. New applications should be tested under expected operating conditions to determine whether or not temperature problems exist.

BACKLASH

Backlash, or lost motion, prior to engagement is minimal. The variation in backlash from one cycle to another is extremely low. Grease lubrication or improper fitup (housing bore and shaft diameter) may increase backlash. Angular displacement between the shaft and housing increases as an applied torque load is increased.

RATE OF ENGAGEMENT

Clutch lockup depends upon static friction. Axial motion between shaft and clutch rollers prevents lockup.

Clutches with integral springs engage satisfactorily at cyclic rates up to 200 engagements per minute. Intermittent operation at higher rates has been successful. The steel spring type clutches have proven dependability at rates up to 6000 or 7000 engagements per minute. Even higher cyclic rates may be practical. Since grease may impair engagement at high cyclic rates, a light oil should be used.

OVERRUN LIMIT SPEED

Exact limiting speeds are not easily predictable. The value for each clutch given in the tabular data is not absolute but serves as a guide for the designer. Oil lubrication is absolutely necessary for high speed operations. Consultation with the Engineering Sales Office is recommended when overrunning speeds are high.

INSPECTION

Although the outer cup of the clutch is accurately drawn from strip steel, it can go slightly out of round during heat treatment. When the assembly is pressed into a ring gauge or properly prepared housing of correct size and wall thickness, it becomes round and is properly sized. Direct measurement of the outside diameter of a drawn cup assembly is an incorrect inspection procedure. The proper inspection procedure is as follows:

1. Press the assembly into a ring gauge of the proper size as given in the tabular data.
2. Gauge the bore with the specified plug gauges of the proper size, as given in the tables of dimensions.
 - a. The **locking plug** is rotated to insure lockup when the clutch is operated on a low limit shaft and is mounted in a high limit housing strong enough to properly size the clutch.
 - b. The **overrun plug** is rotated to insure free overrunning when the clutch is operated on a high limit shaft and is mounted in a low limit housing.
 - c. The **go plug** and **no go plug** insure proper size of the bearings in the clutch and bearing assemblies.

Gauge sizes are listed in the tables of dimensions. Plug gauge sizes reflect adjustment for the loose and tight conditions resulting from high or low housings and shafts. Inch to metric and metric to inch conversions are listed for the convenience of the user, but the designer should understand that the controlling dimensions are in inches for nominal inch assemblies and millimeters for nominal metric assemblies.



Type DC Roller Clutches

Before ordering any clutch check for availability.

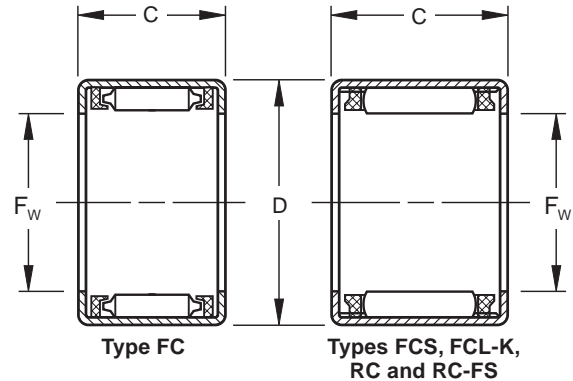
Nominal dimensions with rounded conversions are shown below. Shaft raceway and housing bore diameters necessary for proper mounting and operation are listed on the opposite page.

Types FC, FCS, FCL-K and RC-FS clutches have stainless steel springs inserted in the, molded cage to position the rollers for instantaneous lockup.

Type RC clutches have springs integrally molded with the cage to position the rollers for instantaneous lockup.



The mounted clutch engages when the housing is rotated relative to the shaft in the direction of the arrow marking (←LOCK) stamped on the cup.



DIMENSIONS AND RATINGS

F _w Bore		D O.D.		C Width		Clutch Designation		Torque Rating †	Z Minimum O.D. of Steel Housing for Rated Torque		Overrun Limiting Speed
(nominal)		(nominal)				with Stainless Steel Springs	with Integral Springs				
inch	mm	inch	mm	inch	mm			lbf • in.	inch	mm	rpm
1/8	3,18	3/32	7,14	0.250	6,35	—	RC-02	2.86	0.44	11	50000
0.16	4	0.31	8	0.236	6	FC-4-K	—	2.78	0.44	11	50000
0.24	6	0.39	10	0.472	12	FCS-6	—	18.60	0.55	14	39300
1/4	6,35	7/16	11,11	0.500	12,70	—	RC-040708	17.20	0.62	16	38000
0.31	8	0.47	12	0.472	12	FCL-8-K	—	28.70	0.67	17	28700
0.31	8	0.55	14	0.472	12	FC-8	—	35.80	0.79	20	30500
3/8	9,52	5/8	15,88	0.500	12,70	RC-061008-FS*	RC-061008	45.40	0.88	22	25300
0.39	10	0.55	14	0.472	12	FCL-10-K	—	39.10	0.77	20	22700
0.39	10	0.63	16	0.472	12	FC-10	—	50.40	0.98	25	23700
0.47	12	0.71	18	0.630	16	FC-12	—	118	1.10	27	19300
1/2	12,70	3/4	19,05	0.500	12,70	RC-081208-FS*	RC-081208	73.60	1.10	28	18700
5/8	15,88	7/8	22,22	0.625	15,88	RC-101410-FS*	RC-101410	143	1.20	30	14700
0.63	16	0.87	22	0.630	16	FC-16	—	182	1.20	31	14000
3/4	19,05	1	25,40	0.625	15,88	RC-121610-FS*	RC-121610	196	1.40	36	11300
0.79	20	1.02	26	0.630	16	FC-20	—	274	1.50	38	10700
0.98	25	1.26	32	0.787	20	FC-25	—	605	1.80	46	8670
1	25,40	1 3/16	33,34	0.625	15,88	RC-162110-FS*	RC-162110	412	1.90	48	8670
1.18	30	1.46	37	0.787	20	FC-30	—	845	2.0	51	7330

* Suffix "-FS" is not always stamped on the clutch cup. Type RC-FS with stainless steel springs is always readily identified by RED clutch cage.

† Torque ratings are given in pound force inches: 1 lbf • in = 0.113 N • m = 0.0115 kgf • m



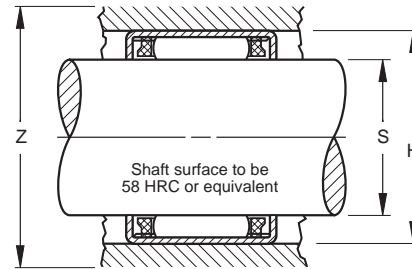
Proper inspection requires installation of the clutch in a ring gauge and then checking the bore with the appropriate plug gauges. Please read the section on "INSPECTION" on page 499.

Types FC, FCS and FCL-K clutch series are manufactured to metric dimensions. Inch dimensions shown are for the convenience of the designer. The controlling dimensions are in millimeters.

Types RC and RC-FS clutch series are manufactured to inch dimensions. Metric dimensions shown are for the convenience of the designer. The controlling dimensions are in inches.

When applying these clutches, it is important that separate bearings be used adjacent to the clutches to carry radial loads and assure concentricity between the shaft and the housing.

For full details on "INSTALLATION" see page 498.



GAUGING				MOUNTING									
Ring gauge	Clutch		Clutch		Inch Mounting				Metric Mounting				
	Locking Plug		Overrun Plug		S		H		S		H		
					Shaft Raceway Diameter	Housing Bore	Shaft Raceway Diameter	Housing Bore					
inch	mm	inch	mm	inch	mm	inches	inches	millimeters	millimeters				
				max	min	min	max	max	min	min	max		
0.28170	7,1552	0.12440	3,1598	0.12580	3,1953	0.1250	0.1247	0.2812	0.2817	3,175	3,167	7,142	7,155
0.31433	7,9840	0.15669	3,9800	0.15764	4,0040	0.1575	0.1572	0.3142	0.3148	4,000	3,992	7,981	7,996
0.39307	9,9840	0.23543	5,9800	0.23638	6,0040	0.2362	0.2359	0.3930	0.3935	6,000	5,992	9,981	9,996
0.43800	11,1252	0.24950	6,3373	0.25130	6,3830	0.2500	0.2495	0.4370	0.4380	6,350	6,337	11,100	11,125
0.47165	11,9800	0.31402	7,9760	0.31516	8,0050	0.3150	0.3146	0.4715	0.4722	8,000	7,991	11,977	11,995
0.55039	13,9800	0.31402	7,9760	0.31516	8,0050	0.3150	0.3146	0.5503	0.5510	8,000	7,991	13,977	13,995
0.62550	15,8877	0.37450	9,5123	0.37630	9,5580	0.3750	0.3745	0.6245	0.6255	9,525	9,512	15,862	15,887
0.55039	13,9800	0.39276	9,9760	0.39390	10,0050	0.3937	0.3933	0.5503	0.5510	10,000	9,991	13,977	13,995
0.62913	15,9800	0.39276	9,9760	0.39390	10,0050	0.3937	0.3933	0.6290	0.6297	10,000	9,991	15,977	15,995
0.70787	17,9800	0.47142	11,9740	0.47268	12,0060	0.4724	0.4720	0.7078	0.7085	12,000	11,989	17,977	17,995
0.75050	19,0627	0.49950	12,6873	0.50130	12,7330	0.5000	0.4995	0.7495	0.7505	12,700	12,687	19,037	19,062
0.87550	22,2377	0.62450	15,8623	0.62630	15,9080	0.6250	0.6245	0.8745	0.8755	15,875	15,862	22,212	22,237
0.86520	21,9760	0.62882	15,9720	0.63016	16,0060	0.6299	0.6295	0.8650	0.8659	16,000	15,989	21,972	21,993
0.99950	25,3873	0.74850	19,0119	0.75030	19,0576	0.7500	0.7495	0.9995	1.0005	19,050	19,037	25,387	25,412
1.02268	25,9760	0.78622	19,9700	0.78768	20,0070	0.7874	0.7869	1.0225	1.0233	20,000	19,987	25,972	25,992
1.25874	31,9720	0.98295	24,9670	0.98453	25,0070	0.9843	0.9838	1.2585	1.2595	25,000	24,987	31,967	31,992
1.31200	33,3248	0.99850	25,3619	1.00030	25,4076	1.0000	0.9995	1.3120	1.3130	25,400	25,387	33,325	33,350
1.45559	36,9720	1.17980	29,9670	1.18138	30,0070	1.1811	1.1806	1.4554	1.4564	30,000	29,987	36,967	36,992



Type DC Roller Clutch and Bearing Assemblies

Nominal dimensions with rounded conversions are shown below. Shaft raceway and housing bore diameters necessary for proper mounting and operation are listed on the opposite page.

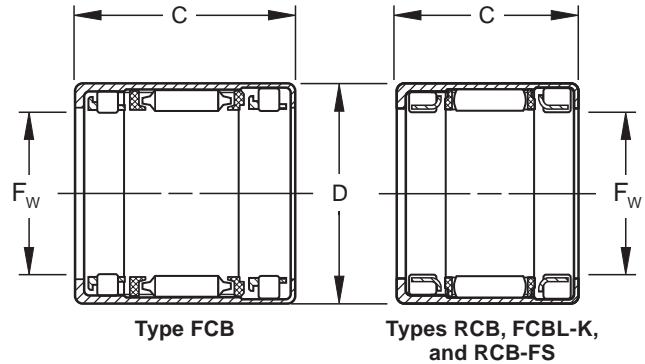
Types FCB, FCBL-K and RCB-FS clutch and bearing assemblies have stainless steel springs inserted in the molded cage to position the rollers for instantaneous lockup.

Type RCB clutch and bearing assemblies have springs integrally molded with the cage to position the rollers for instantaneous lockup.

Before ordering any clutch and bearing assemblies check for availability.



The mounted clutch and bearing assemblies engages when the housing is rotated relative to the shaft in the direction of the arrow marking (←LOCK) stamped on the cup.



DIMENSIONS AND RATINGS

F _w Bore (nominal)		D O.D. (nominal)		C Width		Clutch and Bearing Assembly Designation		Torque Rating †	Z Minimum O.D. of Steel Housing for Rated Torque		Bearing Basic Dynamic Load Rating § Cr ISO 281 (max)		Bearing Working Load	Overrun Limiting Speed
						with Stainless Steel Springs	with Integral Springs		lb·in.	inch	mm	lb		
inch	mm	inch	mm	inch	mm									
0.31	8	0.47	12	0.866	22	FCBL-8K	—	29	0.67	17	523	717	344	28 700
0.31	8	0.55	14	0.787	20	FCB-8	—	35.8	0.79	20	541	742	322	30 500
3/8	9,52	5/8	15,88	0.875	22,22	RCB-061014-FS*	RCB-061014	45.4	0.88	22	848	1 160	566	25 300
0.39	10	0.63	16	0.787	20	FCB-10	—	50.4	0.98	25	628	861	388	23 700
0.47	12	0.71	18	1.024	26	FCB-12	—	118	1.1	28	882	1 210	634	19 300
1/2	12,70	3/4	19,05	0.875	22,22	RCB-081214-FS*	RCB-081214	73.6	1.1	28	1 020	1 400	720	18 700
3/4	15,88	5/8	22,22	1.000	25,40	RCB-101416-FS*	RCB-101416	143	1.2	30	1 140	1 560	914	14 700
0.63	16	0.87	22	1.024	26	FCB-16	—	182	1.2	30	951	1 300	742	14 000
3/4	19,05	1	25,40	1.000	25,40	RCB-121616-FS*	RCB-121616	196	1.4	36	1 270	1 740	1 030	11 300
0.79	20	1.02	26	1.024	26	FCB-20	—	274	1.5	38	1 180	1 610	974	10 700
0.98	25	1.26	32	1.181	30	FCB-25	—	605	1.8	46	1 580	2 170	1 350	8 670
1	25,40	1 3/8	33,34	1.063	27	RCB-162117-FS*	RCB-162117	412	1.9	48	2 240	3 060	1 890	8 670
1.18	30	1.46	37	1.181	30	FCB-30	—	845	2.0	51	1 620	2 210	1 510	7 330

* Suffix "-FS" is not always stamped on the clutch cup. Type RC-FS with stainless steel springs is always readily identified by RED clutch cage.

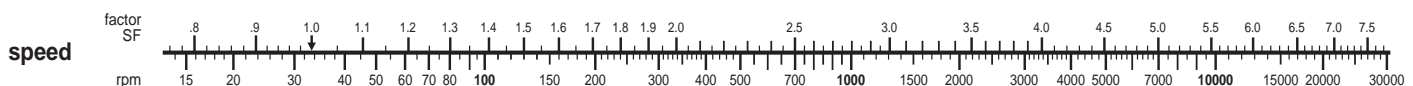
† Torque ratings are given in pound force inches: 1 lbf · in = 0.113 N · m = 0.0115 kgf · m

§ Bearing load ratings are given in pounds-force: 1 lbf = 0.454 kgf = 4.448N. For single roller path use one-half the listed rating.

Required Basic Dynamic Load Rating (C_r) = Applied Load · SF · LF

Ⓣ Symbol denotes Torrington Basic Dynamic Load Rating to be used in load-life calculations taking into consideration the application guidelines and limitations given in this catalog. Applications involving loads approaching this rating or the tabulated working load, whichever is the smaller, should be referred to your Engineering Sales Office before a final selection is made.

Load Ratings are based on a minimum raceway hardness of 58 HRC or equivalent.



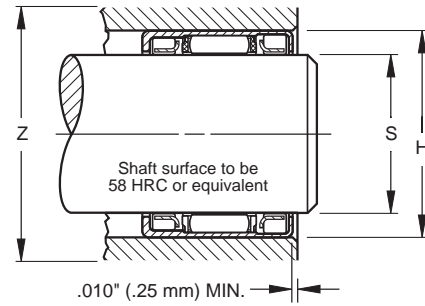


Proper inspection requires installation of the clutch and bearing assembly in a ring gauge and then checking the bore with the appropriate plug gauges. Please read the section on "INSPECTION" on page 499.

Types FCB and FCBL-K clutch and bearing assemblies are manufactured to metric dimensions. Inch dimensions shown are for the convenience of the designer. The controlling dimensions are in millimeters.

Types RCB and RCB-FS clutch and bearing assemblies are manufactured to inch dimensions. Metric dimensions shown are for the convenience of the designer. The controlling dimensions are in inches.

For full details on "INSTALLATION" see page 498.



GAUGING							MOUNTING								
Ring gauge		Clutch Locking Plug		Clutch Overrun and Bearing Go Plug		Bearing No Go Plug		Inch Mounting				Metric Mounting			
								S Shaft Raceway Diameter		H Housing Bore		S Shaft Raceway Diameter		H Housing Bore	
								inches		inches		millimeters		millimeters	
inch	mm	inch	mm	inch	mm	inch	mm	max	min	min	max	max	min	min	max
0.47165	11,9800	0.31402	7,9760	0.31516	8,0050	0.31626	8,0330	0.3150	0.3146	0.4715	0.4722	8,000	7,991	11,977	11,995
0.55039	13,9800	0.31402	7,9760	0.31516	8,0050	0.31626	8,0330	0.3150	0.3146	0.5503	0.5510	8,000	7,991	13,977	13,995
0.6255	15,8877	0.37450	9,5123	0.37610	9,5529	0.37750	9,5885	0.3750	0.3745	0.6245	0.6255	9,525	9,512	15,862	15,888
0.62913	15,9800	0.39276	9,9760	0.39390	10,0050	0.39500	10,0330	0.3937	0.3933	0.6290	0.6297	10,000	9,991	15,977	15,995
0.70787	17,9800	0.47142	11,9740	0.47268	12,0060	0.47386	12,0360	0.4724	0.4720	0.7078	0.7085	12,000	11,989	17,977	17,995
0.7505	19,0627	0.49950	12,6873	0.50110	12,7279	0.50250	12,7635	0.5000	0.4995	0.7495	0.7505	12,700	12,687	19,037	19,062
0.8755	22,2377	0.62450	15,8623	0.62610	15,9089	0.62750	15,9385	0.6250	0.6245	0.8745	0.8755	15,875	15,862	22,212	22,237
0.8652	21,9760	0.62882	15,9720	0.63016	16,0060	0.63134	16,0360	0.6299	0.6295	0.8650	0.8659	16,000	15,989	21,972	21,993
0.9995	25,3873	0.74850	19,0119	0.75010	19,0525	0.75150	19,0881	0.7500	0.7495	0.9995	1.0005	19,050	19,037	25,387	25,412
1.02268	25,9760	0.78622	19,9700	0.78768	20,0070	0.78909	20,0430	0.7874	0.7869	1.0225	1.0233	20,000	19,987	25,972	25,992
1.25874	31,9720	0.98295	24,9670	0.98453	25,0070	0.98594	25,0430	0.9843	0.9838	1.2585	1.2595	25,000	24,987	31,967	31,992
1.312	33,3248	0.99850	25,3619	1.00010	25,4025	1.00150	25,4381	1.0000	0.9995	1.3120	1.3130	25,400	25,387	33,325	33,350
1.45559	36,9720	1.17980	29,9670	1.18138	30,0070	1.18280	30,0430	1.1811	1.1806	1.4554	1.4564	30,000	29,987	36,967	36,992

