
SB 22207 W33 SS
MCGILL

Spherical Roller

Unmounted bearing assembly consisting of through hardened inner and outer raceways with single spherical rolling elements separated by steel land riding retainer (cage) and available with several seal options. SPHERE-ROL® roller bearings provide an antifriction solution when supporting rotating shafts with combination radial and thrust loads.

Bearing Configurations

Sealed / unsealed, straight or tapered bore

Bore Diameter Size Range

20 mm to 150 mm (.5906” to 5.9055”)

Materials

Bearing Quality Steel

Spherical Roller Selection Guide

		Product Series	Material / Roller Complement	Size Range	
				Metric	Inch Equiv
SHERE-ROL		22200 Series	Bearing Steel Spherical Roller	20 - 150	.7674 - 5.9055
		22300 Series	Bearing Steel Spherical Roller	40 - 100	1.5748 - 3.9370

*** For estimating purpose only, individually sizes may vary and are subject to change without notification**

Design Characteristics				Features								
Misalignment	Dynamic Load Rating	High Speed	Relative Base Cost *	Seals	Taper Bore	Oil Holes	High Temp. Seals	Expansion Type	DS Matching	Select OD W22	Standard Clearances C2 thru C4	Page No.
◓	●	◓	$$	O	O	S	O	O	O	O	O	D-11
◓	●	●	$$	O	O	S	O	O	O	O	O	D-15

Several sealing options available
Option for tapered shaft or adapter mounting
Standard "W33" feature includes annular groove and lubrication holes
For applications up to 450°F a high temp seal option is offered
For applications requiring compensation for linear thermal expansion
Recommended for load sharing when mounting bearing pairs
Reduced O.D. tolerance, for improved housing fit control
Depending on the application needs, clearance options are available to help control the internal diametrical clearance

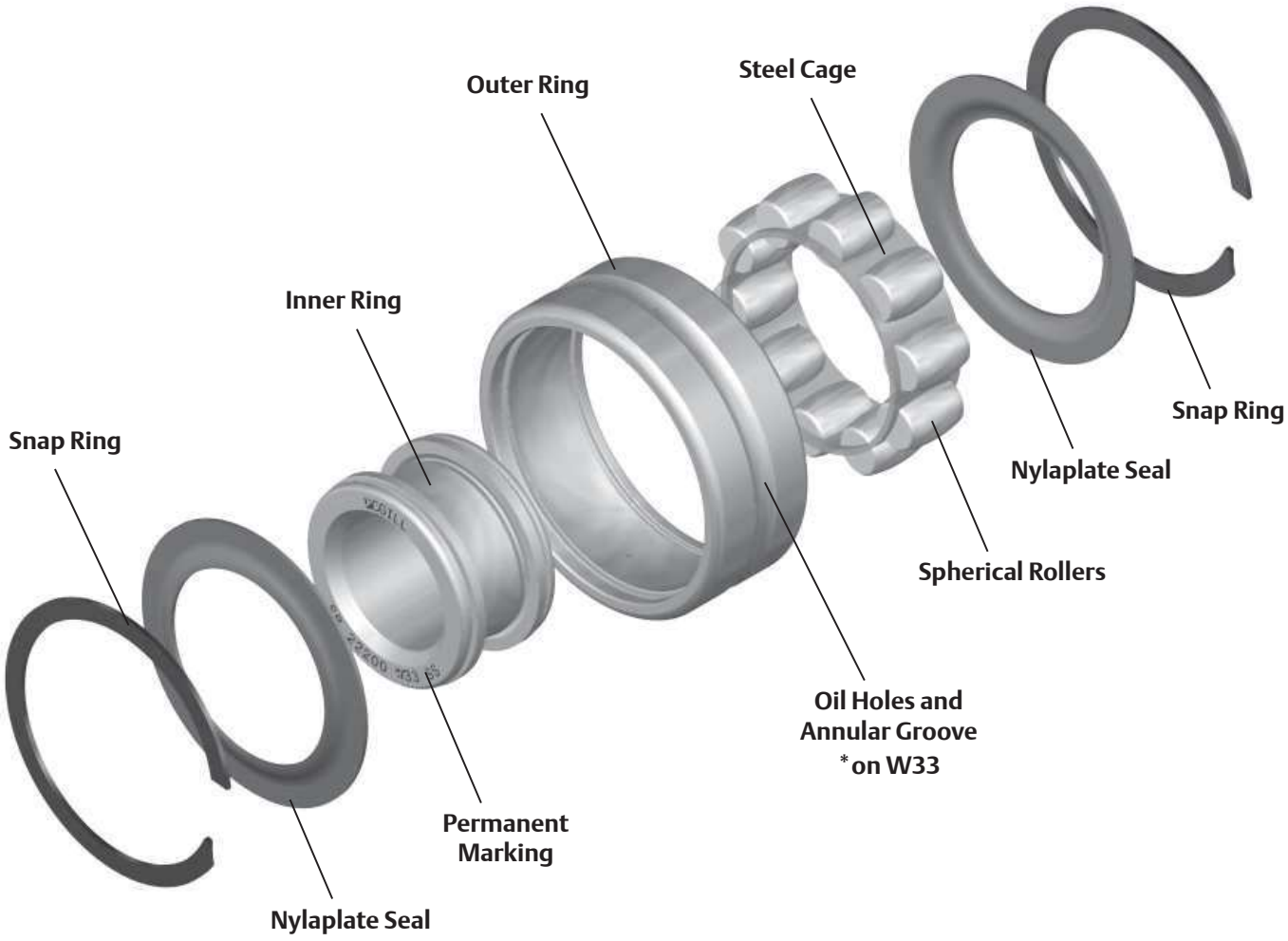
O = Optional
S = Standard
○ = Not Recommended

○ ◔ ◑ ◕ ●

Poor ⟷ Best

McGill SPHERE-ROL® Spherical Bearings

McGill SPHERE-ROL® Bearings feature an optimal diameter of single row spherical rollers separated by a land riding steel retainer within a dimensionally interchangeable (ABMA/ISO specification) envelope. In addition, SPHERE-ROL® bearings feature NYLAPLATE®, NYLAPLATE high temperature and LAMBDA® seal options and misalignment capabilities, further differentiating SPHERE-ROL® bearings from other types. The bearing design and use of tapered bore with adapter option provide diametrical clearance control and installation ease. Depending on your preference, these bearings are available in a wide variety of sizes, clearances and sealing options as illustrated on the pages to follow.



SPHERE-ROL® Nomenclature

Prefix
SB - SPHERE-ROL Bearing
Series Identifier
22200
22300
Bore Size (In 5mm)
Optional Tapered Bore
Internal Clearances
None - Standard
C2 - Less Than Standard
C3 - Greater Than Standard
C4 - Greater Than C3
Optional Expansion Type
Lubrication Feature standard
Sealing Options (see below)
Optional Grease Suffix
VA - High Temp. Grease
- Modification

SB - 22207K - C3E - W33 - SS - VA

Standard Bore
S - Nylaplate Seal One Side
SS - Nylaplate Seal Both Sides
TS - High Temp. Seal One Side
TSS - High Temp. Seal Both Sides
YS - Lambda Seal One Side
YSS - Lambda Seal Both Sides

Tapered Bore
S - Nylaplate Seal On Small End
SSL - Nylaplate Seal On Large End
TS - High Temp. Seal On Small End
TSL - High Temp. Seal On Large End
YS - Lambda Seal On Small End
YSL - Lambda Seal On Large End

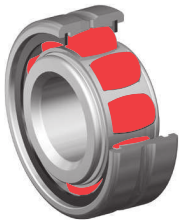
Features and Benefits

Misalignment Capability

As a result of the design geometry, SPHERE-ROL® bearings offer up to ±3˚ misalignment in unsealed versions.

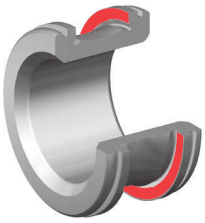
Annular Lubrication Groove and Holes

The groove provides a circumferential path to direct lubricant and to the two oil holes.



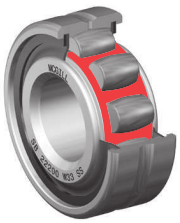
Spherical Roller

Precision spherical rollers provide high radial load capability, while providing the space necessary for seal options within a standard envelope dimension. The design of the roller provides a higher dynamic load rating and optimizes the number of maximum diameter rollers.



Inner Ring Raceway Flanges

Provide roller guidance and surface to support retainer. The raceway width, or distance between the two flanges, also helps define a designed endplay in the bearing. For applications requiring compensation for shaft growth due to linear thermal expansion, SPHERE-ROL bearings are available with increased internal endplay identified by the expansion type(E) option.



Steel Cage

The spacing provided by the heat treated steel cage contributes to the high speed capabilities and provides a lubricant reservoir within the bearing envelope.

Features and Benefits continued

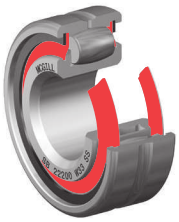
Combination Load Capacity

The SPHERE-ROL® bearing design allows for high radial load capacity and the ability to accommodate a thrust load in combination with a radial load. Thrust load capability is proportional to the amount of radial load and pure thrust loads are not recommended. Typically a ratio less than .20 of axial to radial loads (Fa/Fr < .20) is appropriate for SPHERE-ROL bearings, equivalent load formulas specified in the Engineering Section of this catalog.

Factory Grease Fill

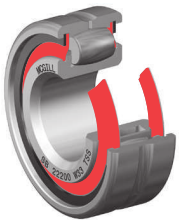
The sealed SPHERE-ROL bearings are factory lubricated with a medium temperature (-30° to 250°F, -34° to 121° C) Polyurea E.P. grease. Unsealed bearings packaged with light oil film as a rust preventative. Contact Application Engineering when application conditions require special lubricants.

Options



"S or SS" Nylaplate Seal

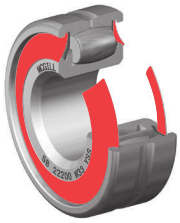
Combination labyrinth and contact seal is capable of 300° F maximum temperature. Bearing misalignment should not to exceed ±2˚ in operation for best seal performance. When ordering seals for tapered bore (-K option) bearing, indication of which side to be sealed must be provided. The "L" in the option suffix defines a seal installed on larger bore diameter side of the taper, no indication will default to seal installed on small bore side.



"TS or TSS" Nylaplate High Temperature Seal

Combination labyrinth and contact seal for operating temperatures up to 450°F. Bearing misalignment should not to exceed ±2˚ in operation for best seal performance. Bearings with this seal option will include a high temperature grease fill designated by the VA grease suffix in the part number When ordering seals for tapered bore (-K option) bearing, indication of which side to be sealed must be provided. The "L" in the option suffix defines a seal installed on larger bore diameter side of the taper, no indication will default to seal installed on small bore side.

Options continued



"YS or YSS" Lambda Seal

Utilizes a Nylaplate seal with an added contact seal for greater lip wiping seal function. Bearing misalignment should not exceed ±1/2˚ in operation for beast seal performance and maximum ±1˚. When ordering seals for tapered bore (-K option) bearing, indication of which side to be sealed must be provided. The "L" in the option suffix defines a seal installed on larger bore diameter side of the taper, no indication will default to seal installed on small bore side.

"E"Expansion –Type E

A special version of the SPHERE-ROL bearing can be provided to accommodate expansion (float) internally to the bearing. The bearing design allows the SPHERE-ROL bearing to be the only spherical roller to have this ability, but does have a 10% reduction in BDR. Typically, application requiring tolerance for linear shaft expansion will have an expansion (Float) and non-expansion (fixed) position as mounted on a common shaft. The expansion-type SPHERE-ROL® bearing will not operate satisfactorily if subjected to thrust loading. Therefore, the expansion-type SPHERE-ROL® bearing must not be used in "fixed" ("held") positions—it is for use only in "expansion" ("float") positions. It is recommended that the end-wise restraint of both race rings of the expansion-type bearing be provided, so that the expansion allowance intended to be available is not lost by error in installation

"K" Tapered bore bearing

SPHERE-ROL® bearings are available with tapered bore feature for applications utilizing tapered adapter sleeve mounting arrangements or tapered shaft seats. This feature facilitates the mounting of SPHERE-ROL® bearings and can be used to prevent the necessity for heating of bearings or to eliminate the need for complicated press fitting practices. Standard tapered adapter sleeves, as well as associated lock nuts and lock washers, are tabulated within the engineering section and are identifiable with the appropriate bearing by the suffix number. The separate items may be called out individually by their part number or the complete tapered bore bearing and associated hardware may be identified by the suffix letter "A" following the bearing number. The standard bore taper of these bearings is 1" in 12", on the diameter, and tapered bore bearings are themselves identified by the suffix letter "K" following the basic bearing number.

Options continued

Diametral Clearance

SPHERE-ROL® bearings are available in internal diametral clearance ranges identified as C2, Standard, C3 and C4. The internal diametral clearances are progressively less than the Standard, while C3 and C4 are progressively looser than Standard. Similarly, four internal clearance ranges are available for tapered bore SPHERE-ROL® bearings. Each of these ranges is somewhat looser than the corresponding cylindrical bore bearing internal diametral clearance range, because of the need to accommodate a somewhat tighter fit with the tapered bore mounting arrangement. The following two charts give the internal diametral clearance ranges normally available with SPHERE-ROL® bearings from McGill. Stock bearings having standard diametral clearance will not be identified by special marking; however, the C2, C3 and C4 clearances will be identified on the bearing inner ring face, following the basic bearing number.

"DS" Matched Bearings

When two SPHERE-ROL bearings are installed with the distance between both bearing less than the width of one bearing, it is recommended the bearings be diametrically matched to prevent unequal load sharing. The option, matches OD and ID tolerances, and Diametral Clearance with high point of runout indicated on the bearing faces. For more information and matching factors please review the engineering section for matched bearings.

Grease Options

When requested, standard bearings can be factory filled with customer specified lubricant or industry equivalent.

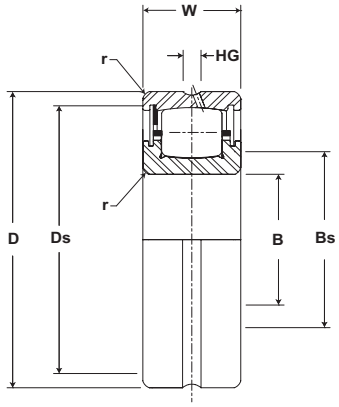
Basic Construction Type: 22300 Series Spherical Bearing With Non-Separable Inner Ring

Rolling Elements: Separated Spherical Rolling Elements

Bearing Material: Bearing Quality Steel

Seal Type: NYLAPLATE or LAMBDA

Lubrication: Sealed Bearings: Polyurea thickened NLGI 2 EP Grease.
Unsealed Bearings: Corrosion Preventive Oil

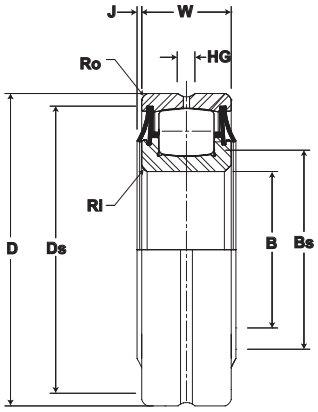


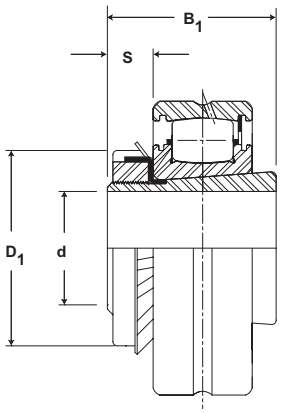
SB 22300 (continued)

Part No.	B		D		W		Bs	Ds	HG	J	r	Limiting Speed (In Oil)	BDR	Bearing Weight
Base Bearing	Bore Diameter		Outside Diameter		Width		Min Shoulder Diameter Inner	Min Shoulder Diameter Outer	Annular Lub Groove	Lambda Seal Minimum Clearance	Maximum radius or fillet to clear		Basic Dynamic Rating	
	mm inch		mm inch		mm inch		mm inch		mm inch			RPM*	N/lb	kg lb
	Nom.	Tol.	Nom.	Tol.	Nom.	Tol.	Ref	Ref	W33	Ref	Ref			
SB-22317	85.000	+0/-.020	180.000	+0/-.025	60.00	+0/-.20	99	163	8	3.3	2.5	2500	423,000	7.35
	3.3465	+0/-.0008	7.0866	+0/-.0010	2.362	+0/-.008	3.9	6.4	.3	.13	.10		95,100	16.20
SB-22318	90.000	+0/-.020	190.000	+0/-.030	64.00	+0/-.20	104	173	10	3.3	2.5	2350	437,680	8.71
	3.5433	+0/-.0008	7.4803	+0/-.0012	2.520	+0/-.008	4.1	6.8	.4	.13	.10		98,400	19.20
SB-22319	95.000	+0/-.020	200.000	+0/-.030	67.00	+0/-.20	112	180	10	4.1	2.5	2200	486,610	10.29
	3.7402	+0/-.0008	7.874	+0/-.0012	2.638	+0/-.008	4.4	7.1	.4	.16	.10		109,400	22.70
SB-22320	100.000	+0/-.020	215.000	+0/-.030	73.00	+0/-.20	117	196	10	4.8	2.5	2050	572,900	12.88
	3.937	+0/-.0008	8.4646	+0/-.0012	2.874	+0/-.008	4.6	7.7	.4	.19	.10		128,800	28.40
SB-22322	110.000	+0/-.203	240.000	+0/-.030	80.00	+0/-.03	130	218	13	4.8	2.5	1800	805,980	19.37
	4.3307	+0/-0080	9.4488	+0/-0012	3.150	+0/-800	5.1	8.6	.5	.19	.10		181,200	42.71

Add K to base number indicate K bore option
Add W22 for select OD
All bearings are supplied with W33 option unless otherwise specified
Refers to oil lubrication and moderate load, use 50% of value for grease lubrication.
Complete adapter number indicated adapter sleeve, locknut, and washer, for components refer to S=sleeve, N= lock Nut, W= lock washer
For Expansion type bearing add E suffix immediately after diametrical clearance specification per nomenclature diagram.
For Sealing options see page D-8
Outside diameter may be oversized, due to internal retaining ring

Metric dimensions for reference only.
Not all parts are available from stock. Please contact customer service for availability (800) 626-2120.
For more information on bearing capabilities outside of our standard offering, please contact Application Engineering (800) 626-2093.





SB 22300 (continued)

Part No.	Straight Bore Internal Radial Clearance								Taper (K) Bore Internal Radial Clearance (1" in 12" on Diameter)								Optional Adapter Dimensions				
Base Bearing	C2		Standard		C3		C4		C2		Standard		C3		C4		Adapter No.	Adapter Shaft Dimension	B1	S	D1
	mm inch		mm inch		mm inch		mm inch		mm inch		mm inch		mm inch		mm inch			mm inch		mm inch	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max		(Ref)	(Ref)	(Ref)	(Ref)
SB-22317	.0356	.0635	.0991	.1346			.1803		.0508	.0813	.1118	.1448			.1905		SNW 117	13.1	14.7	3.1	19.6
	.0014	.0025	.0039	.0053			.0071		.0020	.0032	.0044	.0057			.0075			2.94	3.31	.70	4.41
SB-22318	.0356	.0635	.0991	.1346			.1803		.0508	.0813	.1118	.1448			.1905		SNW 118	14.2	15.8	3.5	20.7
	.0014	.0025	.0039	.0053			.0071		.0020	.0032	.0044	.0057			.0075			3.19	3.55	.78	4.66
SB-22319	.0356	.0635	.0991	.1346			.1803		.0508	.0813	.1118	.1448			.1905		-	-	-	-	-
	.0014	.0025	.0039	.0053			.0071		.0020	.0032	.0044	.0057			.0075						
SB-22320	.0432	.0787	.1219	.1626			.2108		.0635	.0991	.1346	.1753			.2261		SNW 120	15.3	17.7	3.7	23.1
	.0017	.0031	.0048	.0064			.0083		.0025	.0039	.0053	.0069			.0089			3.44	3.97	.84	5.19
SB-22322	.0432	.0787	.1219	.1626			.2108		.0635	.0991	.1346	.1753			.2261		SNW 122	17.5	20.9	4.0	25.4
	.0017	.0031	.0048	.0064			.0083		.0025	.0039	.0053	.0069			.0089			3.94	4.69	.91	5.72

Load Ratings and Life

Life Calculations

The L10 (rating) life for any given application and bearing selection can be calculated in terms of millions of revolutions by using the bearing Basic Dynamic Rating and applied radial load (or, equivalent radial load in the case of radial bearing applications having combined radial and thrust loads). The L10 life for any given application can be calculated in terms of hours, using the bearing Basic Dynamic Rating, applied load (or equivalent radial load) and suitable speed factors, by the following equation:

$$L_{10} = \left(\frac{C}{P}\right) x \frac{1{,}000{,}000}{60 \times n} = \left(\frac{C}{P}\right)^{10/3} x \frac{16667}{n}$$

Where:

L_{10} = The # of hours that 90% of identical bearings under ideal conditions will operate at a specific speed and condition before fatigue is expected to occur.

C = Basic Dynamic Rating (lbs) 1,000,000 Revolutions

P = Constant Equivalent Radial Load (lbs)

n = Speed (RPM)

Additionally, the ABMA provides application factors for all types of bearings which need to be considered to determine an adjusted Rated Life (Lna). L10 life rating is based on laboratory conditions yet other factors are encountered in actual bearing application that will reduce bearing life. Lna life rating takes into account reliability factors, material type, and operating conditions.

$$L_{na} = a_1 \times a_2 \times a_3 \times L_{10}$$

Where:

L_{na} = Adjusted Rated Life.

a_1 = Reliability Factor. Adjustment factor applied where estimated fatigue life is based on reliability other than 90% (See Table No 1).

Table No. 1 Life Adjustment Factor for Reliability

Reliability %	L_{na}	a_1
90	L10	1
95	L5	0.62
96	L4	0.53
97	L3	0.44
98	L2	0.33
99	L1	0.21
50	L50	5

a_2 =Material Factor. Life adjustment for bearing race material. Regal Power Transmission Solutions bearing races are manufactured from bearing quality steel. Therefore the a_2 factor is 1.0.

a_3 = Life Adjustment Factor for Operating Conditions. This factor should take into account the adequacy of lubricant, presence of foreign matter, conditions causing changes in material properties, and unusual loading or mounting conditions. Assuming a properly selected and mounted bearing having adequate seals and lubricant operating below 250°F and tight fitted to the shaft, the a3 factor should be 1.0.

Load Ratings and Life Continued

Vibration and shock loading can act as an additional loading to the steady expected applied load. When shock or vibration is present, an a3 Life Adjustment Factor can be applied. Shock loading has many variables which often are not easily determined.Typically, it is best to rely on one's experience with the particular application. Consult Application Engineering for assistance with applications involving shock or vibration loading.

The a3 factor takes into account a wide range of application and mounting conditions as well as bearing features and design. Accurate determination of this factor is normally achieved through testing and in-field experience. Regal Power Transmission Solutions offers a wide range of options which can maximize bearing performance. Consult
Application Engineering for more information.

Combined Load – Single Row Spherical Roller Bearings

1. Calculate Fa/Fr.

When Fa/Fr O 0.12 ; P = VFr
When Fa/Fr > 0.12 ; P = 0.4VFr + 5.0Fa

P = Equivalent radial load, lbs.
Fr = Applied radial load, lbs.
Fa = Applied thrust load, lbs.
V = Rotation factor
= 1.0 for most applications
= 1.2 for vibratory applications

For applications involving combination loads in which Fa/Fr > 0.20, consult Application Engineering.

2. Calculate the L10 life using the life equation on page D-19.

Load Ratings and Life Continued

Variable Load Formula

Root mean load (RML) is to be used when a number of varying loads are applied to a bearing for varying time limits. Maximum loading still must be considered for bearing size selection.

$$RML^{*} = \sqrt[10/3]{\frac{(L_1^{10/3} N_1) + (L_2^{10/3} N_2) + (L_3^{10/3} N_3)}{100}}$$

Where:

RML = Root Mean Load (lbs.)

L_1, L_2, etc. = Load in pounds

N_1, N_2, etc. = Percent of total time operated at loads L_1, L_2, etc.

* Apply RML to rating at mean speed to determine resultant life.

Mean Speed Formula

The following formula is to be used when operating speed varies over time.

$$\text{Mean Speed} = \frac{S_1N_1 + S_2N_2 + S_3N_3}{100}$$

S_1S_2, etc = Speeds in RPM

N_1N_2, etc = Percentage of total time operated at speeds S_1S_2, etc

Bearing Life In Oscillating Applications

The equivalent rotative speed (ERS) is used in life calculations when the bearing does not make complete revolutions during operation. The ERS is then used as the bearing operating speed in the calculation of the L10 (Rating) Life. The formula is based on sufficient angular rotation to have roller paths overlap.

ERS = Equivalent Rotative Speed

N = Total number of degrees per minute through which the bearing will rotate.

$$ERS = \frac{N}{360}$$

In the above formula, allowance is made for the total number of stress applications on the weakest race per unit time, which, in turn, determines fatigue life and the speed factors. The theory behind fretting corrosion is best explained by the fact that the rolling elements in small angles of oscillation retrace a path over an unchanging area of the inner or outer races where the lubricant is prevented by inertia from flowing in behind the roller as the bearing oscillates in one direction. Upon reversal, this small area of rolling contact is traversed by the same roller in the dry state. The friction of the two unlubricated surfaces causes fretting corrosion and produces failures which are unpredictable from a normal life standpoint.

Load Ratings and Life Continued

With a given bearing selected for an oscillating application, the best lubrication means is a light mineral oil under positive flow conditions. With a light oil, there is a tendency for all areas in the bearing load zone to be immersed in lubricant at all times. The full flow lubrication dictates that any oxidized material which may form is immediately carried away by the lubricant, and since these oxides are abrasive, further wear tends to be avoided. If grease lubrication must be used, it is best to consult with either the bearing manufacturer or the lubricant manufacturer to determine the best possible type of lubricant. Greases have been compounded to resist the detrimental effect of fretting corrosion for such applications.

Minimum Bearing Load

Skidding, or sliding, of the rolling elements on the raceway instead of a true rolling motion can cause excessive wear. Applications with high speeds and light loading are particularly prone to skidding. As a general guideline, rolling element bearings should be radially loaded at least 2% of Basic Dynamic Rating. For applications where load is light relative to the bearings dynamic load rating, consult Application Engineering for assistance.

Spherical Engineering Section

Equivalent Loads

When SPHERE-ROL® bearings operate under conditions of combined radial and thrust loads, an equivalent radial load must be calculated to determine resultant bearing life. SPHERE-ROL® bearings are not recommended for applications involving pure thrust loads; however, combination loads may be carried in accordance with the following equivalent radial load formulae:

$$\text{When } \frac{F_a}{F_r} \leq 0.12;\ P = VF_r$$

$$\text{When } \frac{F_a}{F_r} < 0.12;\ P = .4VF_r + 5.0\,F_a$$

P = Equiv. radial load, lbs.
Fr = Applied radial load, lbs.
Fa = Applied thrust load, lbs.
V = Rotation factor
= 1.0 for most applications
= 1.2 for vibratory applications
For applications involving combination loads in which Fa/Fr > .20, consult Application Engineering.

Static Load Rating

The "static load rating" is that uniformly distributed static radial bearing load which produces a maximum contact stress of 580,000 PSI, acting at the center of contact of the most heavily loaded rolling element. At this stress level, plastic deformation begins (or begins to be significant). Experience has shown that the plastic deformation at this stress level can be tolerated in most bearing applications without impairment of subsequent bearing operation. In certain applications where subsequent rotation of the bearing is slow and where smoothness and friction requirements are not too exacting, a higher static load limit can be tolerated. Where extreme smoothness is required or friction requirements are critical, a lower static load limit may be necessary.

When static bearings are subjected to both radial and thrust loads, the equivalent static radial load is defined as:

PO = 0.5 Fr + 4.0 Fa or
PO = Fr whichever is greater.

Contact Application Engineering for specific static load ratings, and applications involving pure static thrust loads.

Spherical Engineering Section continued

Matched Bearings

Where bearings are mounted so that the distance between them is less than the width of one bearing, it is recommended under heavy loading conditions to provide some degree of diametral matching in order to prevent unequal sharing of the applied load.

Matching procedures have been developed to provide super precision matching of bearings.

Bearings matched in this category are identified by "-DS" suffix for super precision.

A. O.D. and I.D., where applicable, of matched bearings same diameters within 30% of the respective O.D. or I.D. tolerance.
B. Diametral clearance, where applicable, of matched bearings same within 30% of the tolerance range.
C. Radial runout of matched bearings same within 20% of the tolerance range.
D. High point of radial runout marked on the face of each outer and inner ring.
E. Matched bearings are packaged as a unit.

Matching Factor	Matching Suffix
1.55	None
1.71	“-DS”

Multiply Matching Factor by rating of single bearing to obtain resultant rating for pair of bearings.

Diametral Clearance

SPHERE-ROL® bearings are available in four internal diametral clearance ranges identified as C2, Standard, C3 and C4. The C2 internal diametral clearance is less than the Standard, while C3 and C4 are progressively looser than Standard.

Similarly, four internal clearance ranges are available for tapered bore SPHERE-ROL® bearings. Each of these ranges is somewhat looser than the corresponding cylindrical bore bearing internal diametral clearance range, because of the need to accommodate a somewhat tighter fit with the tapered bore mounting arrangement.

The two charts below give the internal diametral clearance ranges normally available with SPHERE-ROL® bearings

Bearings having standard diametral clearance will not be identified by special marking; however, the C2, C3 and C4 clearances will be identified on the bearing inner ring face, following the basic bearing number. Consult Customer Service for availability on non-standard diametral clearances.

Spherical Engineering Section continued

Radial Clearance (inches) for "SB" Bearings with a Straight Bore

Basic Bore Diameter MM		Radial Clearance in Inches							
		C2		Standard		C3		C4	
Over	Incl.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
14	24	. 0004	. 0008	. 0008	. 0014	. 0014	. 0018	. 0018	0.002
24	30	. 0006	. 0010	. 0010	. 0016	. 0016	. 0022	. 0022	0.003
30	40	. 0006	. 0012	. 0012	. 0018	. 0018	. 0024	. 0024	0.003
40	50	. 0008	. 0014	. 0014	. 0022	. 0022	. 0030	. 0030	0.004
50	65	. 0010	. 0017	. 0017	. 0026	. 0026	. 0036	. 0036	0.005
65	80	. 0012	. 0020	. 0020	. 0032	. 0032	. 0044	. 0044	0.006
80	100	. 0014	. 0025	. 0025	. 0039	. 0039	. 0053	. 0053	0.007
100	120	. 0017	. 0031	. 0031	. 0048	. 0048	. 0064	. 0064	0.008
120	140	. 0020	. 0038	. 0038	. 0057	. 0057	. 0075	. 0075	0.010
140	160	. 0024	. 0043	. 0043	. 0065	. 0065	. 0087	. 0087	0.011
1600	180	. 0026	. 0047	. 0047	. 0071	. 0071	. 0095	. 0095	0.012

Radial Clearance (inches) for "SB" Bearings with a Tapered ("K" Type) Bore

Basic Bore Diameter MM		Radial Clearance in Inches							
		C2		Standard		C3		C4	
Over	Incl.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
14	24	. 0006	. 0010	. 0010	. 0014	. 0014	. 0018	. 0018	0.002
24	30	. 0008	. 0012	. 0012	. 0017	. 0017	. 0022	. 0022	0.003
30	40	. 0008	. 0014	. 0014	. 0020	. 0020	. 0026	. 0026	0.003
40	50	. 0012	. 0018	. 0018	. 0024	. 0024	. 0032	. 0032	0.004
50	65	. 0014	. 0022	. 0022	. 0030	. 0030	. 0039	. 0039	0.005
65	80	. 0018	. 0028	. 0028	. 0037	. 0037	. 0049	. 0049	0.006
80	100	. 0020	. 0032	. 0032	. 0044	. 0044	. 0057	. 0057	0.008
100	120	. 0025	. 0039	. 0039	. 0053	. 0053	. 0069	. 0069	0.009
120	140	. 0030	. 0047	. 0047	. 0063	. 0063	. 0081	. 0081	0.010
140	160	. 0034	. 0051	. 0051	. 0071	. 0071	. 0091	. 0091	0.012
1600	180	. 0037	. 0055	. 0055	. 0079	. 0079	. 0102	. 0102	0.013

Expansion-Type SPHERE-ROL® Bearings

A special version of the SPHERE-ROL® bearing can be provided for applications requiring the bearing to accommodate expansion (float) internally. This "expansion-type" SPHERE-ROL® bearing is specified and identified by adding the suffix letter "E" immediately following the diametral clearance specification. (For instance, SB-22319-C3E-W33.)

Most applications incorporating two bearings on a common shaft require that one of those bearings be "fixed" and that the other be free to "float," either in the housing seat bore or on the shaft seat. This float allowance, or expansion allowance, is required to compensate for variations in thermal expansion, or for linear dimension errors resulting from fabrication. In many cases, ordinary nonseparable ball or roller bearings are used for expansion but they are unsatisfactory because of housing or shaft seat diameter tolerances, the application of heavy loads or misalignment.

Spherical Engineering Section continued

Self-aligning bearings are preferred and the expansion-type SPHERE-ROL® roller bearing is the only internally self-aligning bearings having the capability of accommodating expansion or float allowance internally.

This expansion-type SPHERE-ROL® bearing is dimensionally interchangeable, size for size, with "standard" spherical roller bearings; but, because of changes in internal geometry, it does provide substantial axial play of one race ring relative to the other. The expansion allowance in this type SPHERE-ROL® bearing is normally as much as the end play or expansion allowance that would be found in a non-locating cylindrical roller bearing.

The "E" type SPHERE-ROL® bearing is available with the same sealing advantages, diametral clearance values, tapered bore and outer ring relubrication features as standard bearings shown on page D-25. The basic dynamic rating of "E" type SPHERE-ROL® bearings is 10% less than standard SPHERE-ROL® bearings. Maximum seal misalignment is limited due to increased axial play in bearing.

The expansion-type SPHERE-ROL® bearing will not operate satisfactorily if subjected to thrust loading. Therefore, the expansion-type SPHERE-ROL® bearing must not be used in "fixed" ("held") positions—it is for use only in "expansion" ("float") positions. It is recommended that the end-wise restraint of both race rings of the expansion-type bearing be provided, so that the expansion allowance intended to be available is not lost by error in installation.

Expansion-type SPHERE-ROL® bearings are not normally available from stock. Consult Customer Service for availability.

Spherical Engineering Section continued

Lubrication - SPHERE-ROL® Bearings

SPHERE-ROL® bearings as supplied are factory lubricated as follows. Consult Application Engineering regarding grease compatibility issues.

Lubricant	Bearing Type	Lubricant Temp. Limits (1)
NYLAPLATE® (-S, -SS) LAMBDA® (-YS, -YSS)	NLGI #2 EP grease, polyurea thickened	-30° to +300°F (-34° to 149°C)
High Temp. NYLAPLATE® (-TS, -TSS)	NLGI #2 high temp. grease, inorganic thickener	0° to +400°F (-18° to 204°C)
Unsealed	None, bearing coated with corrosion preventive oil	--

(1) Temperature limits are provided as a capability of the grease lubricant only.
Satisfactory bearing performance at these temperature limits can be dependent on proper lubrication maintenance, internal clearance, bearing materials and installation. Consult Application Engineering for recommendations.

Lubrication Maintenance

For most applications, due to speed, contamination or temperature conditions, some lubrication interval will be required for sealed SPHERE-ROL® bearings. As such, the sealed SPHERE-ROL® bearing can not typically be applied as a maintenance-free bearing. The “-W33” lubrication groove and holes in the outer ring outside diameter provides a means to add fresh grease or oil as applicable to the bearing through the housing. NYLAPLATE® seals have a venting feature which allows excess or old grease to purge from the bearing.

Frequency of lubrication depends primarily upon the speed of rotation of the bearing, the type of lubrication employed, the amount of contamination present and the relationship of thrust to radial loading. For continuously rotating applications, it is necessary to either provide continuous oil lubrication or else periodic grease lubrication, depending upon the severity of service. Automatic lubrication devices are ideal for intermittent lubrication, since accurate metering of grease and consistent relubrication is maintained through the use of these devices.
Best determination of relubrication interval can be made by testing or experience in the application. Contact Application Engineering for assistance in determining relubrication interval.

Spherical Engineering Section continued

Mounting Details - Spherical Roller Bearings
Cylindrical Bore

Proper mounting of SPHERE-ROL® spherical roller bearings generally requires a press fit of the ring rotating relative to the radial load. A close to loose fit is used for the ring stationary relative to the radial load. Specific shaft and housing fit selection and respective diameters are listed in the tables below and following pages. The following are some general guidelines and details to bear in mind when installing this bearing series.

1. Inspect housing and shaft.

- Clean, remove burrs and sharp edges.
- If any damage has occurred to the bearing seat in the housing or on the shaft, repair that damage to bring the seat surface back to its original condition.
- Ground shaft finishes are normally suggested. Consult Application Engineering if machined finish is to be used.
- When stationary outer rings are required to float (move axially in the housing bore to compensate for expansion), a housing bore surface finish of 65 microinches Ra is recommended.

2. Determine which member, shaft or housing has an interference fit with the bearing.

- In general, the ring rotating relative to the radial load has an interference fit.
- Refer to Shaft and Housing seat fit tables for respective fits and tolerances. For applications not covered by these tables, consult Application Engineering for recommendations.

3. Install the bearing onto the press-fitted member by applying force against the bearing ring that is press-fitted.

- For a press-fitted inner ring, apply the force required to assemble the bearing onto the shaft against the face of the bearing inner ring.
- For a press-fitted outer ring, apply the force required to assemble the bearing into the housing against the face of the bearing outer ring.
- Care should be exercised to assure that the bearing starts onto the press-fitted member as squarely as possible.
- Use arbor press whenever possible.
- Do not hammer on bearing ring face.

4. Inner rings press-fitted on the shaft may be more easily installed by heating the ring and causing it to shrink fit.

- Normally, heating the ring to 175°F to 212°F (79°C to 100°C) will be sufficient to allow the ring to slide over the interference fit shaft seat.
- Heating the ring should be accomplished with an induction heater or in a mineral oil bath. Never use a torch to heat a bearing for assembly purposes.
- Sealed bearings should not be heated in oil bath as the grease with which the bearings are filled may be affected.

Spherical Engineering Section continued

5. When outer rings are to be press-fitted into a housing, it is desirable to heat the housing to allow it to shrink fit onto the outer ring outside diameter.

- Freezing the bearing to shrink it for easy assembly into a press-fitted housing is not recommended. Water condensation can form inside the bearing upon its return to room temperature, which can lead to corrosion. Exposure to extreme cold can also affect the metallurgical structure of the bearing.

6. Proper caution should be exercised during installation to guard against axial preload of the bearing. This can be checked by:

- Endplay - Check for endwise “shake” which when present shows that the bearings as installed have endplay.
- Ease of Rotation - Rotate assembly by hand. The bearing must be free from unusual drag or noises.

CAUTION - During installation, do not misalign NYLAPLATE® sealed bearing more than 3° and LAMBDA® sealed bearings more than 1° or seal(s) may be damaged.

Mounting Details - Spherical Roller Bearings
Tapered Bore

SPHERE-ROL® bearings are available with tapered bore feature for applications utilizing tapered adapter sleeve mounting arrangements or tapered shaft seats. This feature sometimes facilitates the mounting of SPHERE-ROL® bearings and can be used to prevent the necessity for heating of bearings or to eliminate the need for complicated press fitting practices.

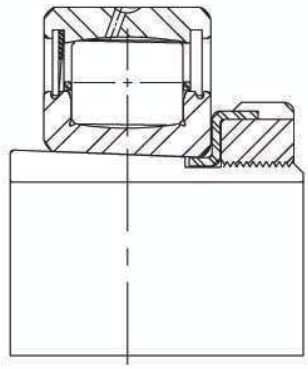
Standard tapered adapter sleeves, as well as associated lock nuts and lock washers, are tabulated on pages D-11 to D-18 and are identifiable with the appropriate bearing by the suffix number. The separate items may be called out individually by their part number or the complete tapered bore bearing and associated hardware may be identified by the suffix letter "A" following the bearing number. The standard bore taper of these bearings is 1" in 12", on the diameter, and tapered bore bearings are themselves identified by the suffix letter "K" following the basic bearing number.

In mounting, the bearing bore is forced against the taper of the split adapter sleeve or the tapered shaft seat by the action of a lock nut. A progressively tighter fit can be obtained by tightening the lock nut to increase the axial displacement of the bearing along the taper. Due to the need for greater take-up of internal clearance with this type of mounting, special internal clearances are provided. Care must be exercised to insure that the optimum take-up of internal clearance is followed. Too great a reduction of internal clearance will result in potential overheating of the bearing in many applications.

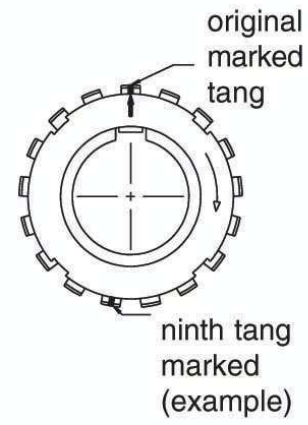
The mounting procedure for adapter mounted, tapered bore SPHERE-ROL® bearings does not require the use of feeler gauge or special gauging procedure. The basic principle of this measurement system is the use of the lock nut and lock washer as a protractor device. Because the lock nuts available for each basic bearing size are standard items, they are manufactured to specific thread pitches. Thus, the axial advancement for each revolution of the nut is predetermined, and the portions of revolutions of the lock nuts required to obtain the correct internal clearance reduction is also predetermined. Additionally, the standard lock washers have a specific number of tangs for each size, and these tangs can be used as the protractor for determining the correct portions of revolutions of the lock nuts. The basic procedure is as follows:

Spherical Engineering Section continued

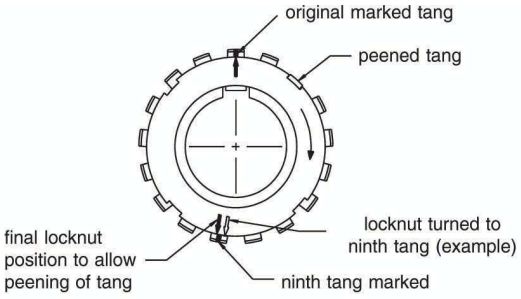
1. To reduce friction and facilitate mounting, apply a medium weight oil to the bearing bore, the outside diameter of the adapter sleeve, all threads and the face of the lock nut.



2. Mount the bearing on the tapered seat with a snug fit between the adapter bore and the shaft seat, with the lock nut and lock washer mounted snugly against the face of the bearing inner ring. (A snug fit is obtained when the adapter sleeve no longer rotates when the lock nut is tightened.) At this point, no internal clearance has been removed from the bearing and any advancement of the lock nut will result in reduction of internal clearance due to interference between the bearing bore and tapered seat.



3. Mark a lock washer tang in any suitable manner, and the adjacent, mating area of the lock nut.
4. Count in the direction of tightening, a certain number of tangs, specified at the right.
5. Mark the specified lock washer tang.



Spherical Engineering Section continued

6. Tighten the lock nut until the marked area on the lock nut is in line with the prescribed lock washer tang. (Lightly striking the face of the lock nut with a soft steel bar will reduce thread pressure and make tightening easier.)
7. If, at this point, none of the tangs line up directly with a corresponding slot in the lock nut OD, rotate the lock nut, in a tightening direction, the additional small amount required to line up the closest slot and tang.
8. The correct internal clearance has now been obtained and the lock washer tang can be peened into the slot of the lock nut, thereby locking the assembly.

The more common procedure used for determining the proper fit of spherical roller bearings on tapered seat is to measure the reduction of internal clearance of the bearing, upon mounting, through the use of feeler gauges or shim stock. This procedure can be utilized with the non-sealed SPHERE-ROL® bearing, if desired. The customer must initially measure and verify the clearance existing in the unmounted bearing, then press the bearing on the tapered seat until the specified amount of clearance has been removed, checking with the feeler gauges. The chart below gives the required diametral clearance reductions which should be used when the feeler gauging procedure is utilized.

Clearance reduction — (-K suffix)

Bearing Bore In Millimeters	Diametrical Clearance Reduction Inches	Lock Nut Turns Degrees	ABMA Lock Washer Number	Req'd No. of Lock Washer Tangs for Clearance Reduction
25	. 0009	277	W -05	10
30	. 0009	204	W -06	7
35	. 0009	204	W -07	9
40	. 0009	204	W -08	9
45	. 0010	215	W -09	10
50	. 0010	215	W -10	10
55	. 0010	215	W -11	10
60	. 0010	215	W -12	10
65	. 0010	215	W -13	11
70	. 0015	273	W -14	14
75	. 0015	146	W -15	8
80	. 0015	146	W -16	8
85	. 0015	146	W -17	8
90	. 0015	146	W -18	8
95	. 0015	146	W -19	8
100	. 0015	146	W -20	8
110	. 0020	177	W -22	9
120	. 0020	177	W -24	9
130	. 0025	207	W -26	11
140	. 0025	207	W -28	11
150	. 0030	238	W -30	13
180	. 0030	158	W -36	8