ENGINEERING

EPT Mounted Bearing Technical Support

Browning Technical Services

Phone: 606-564-2093
FAX: 606-564-2079

Mounted Bearing Application Engineering

Phone: 219-465-2211
FAX: 219-465-2290
E-mail: browningbearing.eng@Emerson-EPT.com

APPLICATION CONSIDERATIONS

The proper selection and application of power transmission products and components, including the related area of product safety, is the responsibility of the customer. Operating and performance requirements and potential associated issues will vary appreciably depending upon the use and application of such products and components. The scope of the technical and application information included in this publication is necessarily limited. Unusual operating environments and conditions, lubrication requirements, loading supports, and other factors can materially affect the application and operating results of the products and components and the customer should carefully review its requirements. Any technical advice or review furnished by Emerson Power Transmission Corporation and its divisions with respect to the use of products and components is given in good faith and without charge, and Emerson assumes no obligation or liability for the advice given, or results obtained, all such advice and review being given and accepted at customer's risk.

For a copy of our Standard Terms and Conditions of Sale, Disclaimers of Warranty, Limitation of Liability and Remedy, please contact Emerson Power Transmission Customer Service at 1-800-626-2120. These terms and conditions of sale, disclaimers and limitations of liability apply to any person who may buy, acquire or use an Emerson Power Transmission Corporation product referred to herein, including any person who buys from a licensed distributor of these branded products.

See page 156 for trademark acknowledgments.

Application Consideration	Mounted Bearing Recommendation	Reference	Starting Page
Vibration	Where vibration is a concern typified by fan and blower applications BOA Concentric Ball Bearings can be used. The concentric lock keeps the shaft centered in the bearing, maintains ball path roundness, and reduces bearing induced vibration. Rubber Mounted inserts and pillow blocks are available for shock absorption.	Mounted Ball Information BOA Concentric Information Rubber Mount Information Vibration Analysis	 52 89, 95 293
Reversing	Eccentric Locking should be avoided on reversing applications. This lock may be loosened where frequent and quick reversing takes place. Set screw, BOA Concentric, tapered adapter or press fit locking is recommended.	Mounted Ball Information Set Screw Lock BOA Concentric Spherical Roller Information 1000/1100 22200/22500 Tapered Roller Information E920 970	 4 52 126 140 102 116
Thin Mounting Surface	When applying mounted ball bearings to thin framework solid base housings avoid frame bending. Controlled loose fit between insert and housing in the "AH" ball bearing provides misalignment resulting in less chance of frame flexing. Identify stock Air Handling units by noting the (AH) symbol next to the housing size on dimension pages. Other sizes may be available depending on quantities and lead time requirements.	Ball Bearing Information Set Screw Lock BOA Concentric "AH" Ball Bearing Information	 4 52 50
Tight Space Constraint	Tapped Base pillow block housings provide reduced dimensions with mounting through the base where space is at a premium. Two bolt flanges are convenient for side mounting in space restricted areas.	Tapped Base Information Set Screw Lock (200) BOA Concentric (200) Eccentric Lock (100) Two Bolt Flange Information Set Screw Lock (200) Set Screw Lock (300) Set Screw Lock (100) BOA Concentric (200) BOA Concentric (300) Eccentric Lock (200) Eccentric Lock (100)	 13 58 84 8 21 30 56 65 74 82
Specialty Shafting	When expensive shafting such as hardened or stainless steel is used Tapered Adapter and BOA Concentric bearings will provide more reliable locking and eliminate shaft marring caused by Set Screw and Eccentric lock bearings.	BOA Concentric Information Tapered Adapter Information	52 140
Frequent Bearing Removal	Eccentric Lock and BOA Concentric bearings provide easy removal from the shaft on applications that require frequent bearing adjustment or relocation on the shaft.	BOA Concentric Information Eccentric Lock Ball Bearings Eccentric Lock Tapered 900 950	52 70 112 116

See page 156 for trademark acknowledgments.

Application Consideration	Mounted Bearing Recommendation	Reference	Starting Page
High Speed	Consider Ball Bearings. Point contact between balls and bearing race has low friction. Maximum speed capacity varies by bore size. Concentric locking as available with BOA Concentric is best for very high speeds.	Mounted Ball Information Load / Speed Ratings BOA Concentric Information	 270 52
High Load	Roller Bearings have higher load capacity than ball bearings. Spherical Rollers handle higher speeds than Tapered Rollers where combinations of higher speed and higher load exist.	Load / Speed Ratings Spherical Roller Information 1000/1100 22200/22500 Tapered Roller Information 900/950 920/970	272 274 275 272 273
Thrust Load	Tapered Roller Bearing can handle higher thrust and combination loads. Spherical Bearings and Ball Bearings can handle limited thrust. An engineering review is recommended where thrust and high speed exist.	Load / Speed Ratings Tapered Roller Information 900/950 920/970	272 272 273
Shock Load	Ductile and Cast Steel Housings can be used in heavy shock environments.	Ductile Tapered Roller Bearings Ductile Shperical Roller Bearings Cast Steel Spherical Roller Bearings	116 127 144, 146
Static Misalignment	950 and 970 Tapered Roller Bearings and all Housed Mounted Ball Bearings are externally self aligning (the bearing insert can misalign with respect to the housing.) These bearings are well suited for applications with static misalignment. Misalignment limits should be considered for each specific bearing type relative to application needs.	Ball Bearing Information Set Screw Lock BOA Concentric Eccentric Lock Tapered Roller Information 950/970	 4 52 70 116
Dynamic Misalignment	All Spherical Roller Bearings are internally self aligning (the rollers can misalign with respect to the bearing races.) This design permits dynamic misalignment. Misalignment limits should be considered for each specific bearing type relative to application needs.	Spherical Bearing Information 1000/1100 22200/22500	 126 140
Vertical Shaft	Set Screw locking is generally recommended on vertical shaft applications. Considerations should be made to account for thrust loads typical on vertical shafts. Other locking types can be used if proper support is provided. Four Bolt Flanges and Flange Cartridges provide good bearing support for vertical shafts.	Mounted Ball Information Set Screw Lock Spherical Roller Information 1000/1100 Tapered Roller Information 920 970	 4 126 104 116
Noise	Where bearing noise is an issue, Ball bearings with an "AH" suffix can be used. The "AH" suffix specifies bearings with a special housing fit and 100% noise testing. Identify stock Air Handling units by noting the (AH) symbol next to the housing size on dimension pages. Other sizes may be available depending on quantities and lead time requirements.	AH Ball Bearing Information	50

See page 156 for trademark acknowledgments.

Application Consideration	Mounted Bearing Recommendation	Reference	Starting Page
Adjustable Shaft Centers	Applications requiring adjustment of shaft centers necessary for belt tensioning may require take up bearings and frames. The housings are slotted and can travel along the frame to change the location of the belt pulleys or sheaves.	Ball Bearing Take-up Information Set Screw Lock (200) Set Screw Lock (300) Set Screw Lock (100) Eccentric Lock (200) Eccentric Lock (100) Tapered Roller Take-up Information 900 E920 Spherical Roller Take-up Information 1000 Take Up Frames for Pillow Blocks Ball Bearing Spherical Roller	 6 20 28 72 80 102 102 126 15 153
Eccentric Loads	Equipment with eccentric loading may require a housing that prevents movement between the housing and the mounting surface. Piloted Flange Cartridges have a machined flange that mates with a machined opening in the equipment to maintain bearing location. For eccentric loads a technical review is recommended.	Ball Bearing Piloted Flanges Set Screw Lock (200) Set Screw Lock (300) BOA Concentric (200) BOA Concentric (300) Roller Bearing Piloted Flanges 900 1000 1100	 10 23 61 67 106 134 138
Rollers and Idlers	VER bearings are designed to be pressed into a conveyor pulley or idler roll. The cylindrical outside diameter presses into the mating part and location is controlled by a snap ring.	VER Ball Bearing Information Machining requirements	16 17
Bearing Life	Bearing life can be estimated using available formulas. Keep in mind that life varies by application and the formulas estimate metal fatigue under ideal conditions.	Life Formulas Sample Calculations	266 278
Shaft Expansion	Where shaft expansion or axial movement is caused by temperature changes or frame flexing on long shafts, a bearing with expansion capabilites should be used. Use only one fixed bearing on the drive end of the shaft.	Expansion Spherical Bearings 1000/1100 22200/22500 Expansion Tapered Bearings 950/970 Technical Information	 126 140 116 276
Bearing Installation	Bearing performance can be greatly impacted by proper installation practices. Refer to installation information included with the product or to the catalog installation instructions.	Set Screw Lock BOA Concentric Eccentric Lock	280 281 282
Bearing Lubrication	Bearing Performance relies on proper relubrication. This includes lubricant type, relubrication frequency, and good practices.	Ball Bearing Lubrication Spherical Bearing Lubrication Tapered Bearing Lubrication	288 290 289

See page 156 for trademark acknowledgments.

Application Consideration	Mounted Bearing Recommendation	Reference	Starting Page
Cartridge Replacement	All Housed Mounted Ball Bearings come with a replaceable insert. While this can save money, complete units should be purchased to avoid possible housing fit and misalignment issues. 950 and 970 series tapered roller bearings with easy to replace cartridges are also available. These provide cost effective replacements and allow bearing housings to stay mounted and in alignment with equipment.	Ball Bearing Insert Replacement Tapered RollerBearings 950/970	286 287
Corrosion	Electroless nickel plating is available as a standard option on many ball bearing sizes. Identify stock nickel plated units by noting the (NK) symbol next to the housing size on dimension pages. Other sizes may be available depending on quantities and lead time requirements.		

BEARING SYMBOLS FOR LIFE CALCULATION

C	-	Basic Dynamic Rating (lbs) 1,000,000 Revolutions	C_0	-	Static Rating (lbs)
P	-	Equivalent Radial Load (lbs)	n	-	Speed (RPM)
L10	-	Rated Life (Hours)	K	-	Geometry Factor
L_{na}	-	Adjusted Rated Life	X	-	Radial Factor
F_a	-	Applied Thrust Load (lbs)	Y	-	Thrust Factor
F_r	-	Applied Radial Load (lbs)	e	-	Geometry Ratio

Ball Bearing Life Calculation

The following formula provided by the Anti Friction Bearing Manufacturers Association (ABMA) provides a method for calculating estimated fatigue life of Ball Bearings.

$$L10 = (C/P)^3 \times \frac{16667}{n}$$

Where:

L10 = The number of hours that 90% of a group of identical bearings under ideal conditions will operate at a specific speed and load condition before fatigue failure is expected to occur.

Additionally, the ABMA provides application factors for Ball Bearings which need to be considered to determine an adjusted Rated Life (L_{na}).

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

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 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. All Browning Ball bearing races are manufactured from 52100 Vacuum Degassed Bearing steel. Therefore the a_2 factor is 1.0 for all Browning Ball Bearings. It is important to check with all manufacturers to ensure that proper adjustments are made when other bearing steels are used.

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 bearing having adequate seals and lubricant operating below 200°F and tight fitted to the shaft, the a_3 factor should be 1.0.

Mounted ball bearings are typically "slip fitted' to the shaft and rely on design features such as the inner race length and locking device for support. ABMA recommends an a_3 factor of .456 for "slip fit" ball bearings.*

Shock and Vibration—Vibration and shock loading can act as an additional loading to the steady expected applied load. When shock or vibration is present, the following a_3, Life Adjustment Factors are recommended. The shock factor is used in combination with the "slip fit" factor.

Table 2 Shock/Vibration Factor

Steady Loading	1.0
Light Shock/Vibration	.5
Moderate Shock/Vibration	.3

The a_3 factor takes into account a wide range of application and mounting conditions as well as bearing features and design. Accurate determiniation of this factor is normally achieved through testing and in-field experience. Consult EPT Mounted Bearing Tech Support for more information.

*See sample calculations on page 298.

Selection

Select an initial bearing size and calculate the expected L_{na} life. If the life is not acceptable, select another bearing size as appropriate and recalculate the L_{na} life. Continue this iterative process until an appropriate L_{na} life is obtained.

Combined Load Calculation

For applications where combined radial and thrust loads are present the equivalent radial load (P) must be calculated before applying L10 life formula.

- For applications with only a radial load present $P = F_r$
  Where F_r = Applied radial load in pounds.

-For applications with only a thrust load present
EPT Mounted Bearing Tech Support.

Calculate (P) equivalent radial Load.

1. Use Table 3 to identify the relative axial load factor (ND2).
2. Determine the relative axial load (RAL):

$$RAL = \frac{F_a}{ND_2}$$ -applied thrust load -relative axial load factor

3. Match the nearest relative axial load value in Table #3 to the corresponding "e" value. for precise calculation, linearly interpolate the values for "e" for your exact relative axial load value.
4. Calculate F_a/F_r and compare value to the "e" value found in step #3 above.
5. Choose values for "X" and "Y" based on step #3 & 4 and from Table No. 3. Linear interpolation is recommended for exact calculations.
6. Calculate equivalent radial load using the following equation: $P=XF_r+YF_a$
7. Calculate the adjusted life (L_{na}) using the life calculation formula above.

Refer to Page 304 for Relevant Disclaimer.

See page 156 for trademark acknowledgments.

For Inserts not shown in table 4:

Insert: VE-200, VB-200, VER-200, SLS-100, SLE-100, LR-100, LRS-100, VS-100, VE-100, LS-100, LE-100, RUBRE-100, RUBRS-100

Ratings: Use standard duty, 200 Series, ratings and factors for respective bore size.

Select 200 Series for highest reliability.

Insert: VS-300, VB-300

Ratings: Use medium duty, 300 Series, ratings and factors for respective bore size.

Contact EPT Mounted Bearing Tech Support at 219-465-2211 for additional details.

Table 3 Equivalent Load Calculation Data Ball Bearings

Relative Axial Load	e	Fa/Fr <= e		Fa/Fr > e	
		X	Y	X	Y
24.92	0.19	1	0	0.56	2.30
50.03	0.22	1	0	0.56	1.99
99.91	0.26	1	0	0.56	1.71
149.35	0.28	1	0	0.56	1.55
200.10	0.30	1	0	0.56	1.45
300.15	0.34	1	0	0.56	1.31
500.25	0.38	1	0	0.56	1.15
749.65	0.42	1	0	0.56	1.04
999.05	0.44	1	0	0.56	1.00

New Applicatioins:

Using variations of the life formulas and application information, it is possible to select bearings based on desired life, load applied, and shaft speed. ***This method can be applied where axial load is less than or equal to 1/2 the radial load.***

1. Determine required application hours (L_{na}).
2. Calculate L_{10} using adjustment factors:

$$L_{10} = \frac{L_{na}}{a1 \times a2 \times a3}$$

3. Calculate Basic Dynamic Radial Rating (C_{req}).

$$C_{req} = \left(\frac{L_{10}\,(N)}{16667}\right)^{1/3} P$$

4. Use Table 4, find a basic Dynamic Radial Rating Value greater than or equal to Creq calculated in step #3.
5. Select any bearing from the row in step #4 or larger. If C_{req} is greater than the largest Basic Dynamic Radial Rating Value of Table 4, go to a tapered or spherical Roller Bearing Selection on page 268, 269.

Table 4 Load Ratings - Ball Bearings

STANDARD DUTY		MEDIUM DUTY		BASIC DYNAMIC RADIAL RATING	STATIC RADIAL RATING	Relative Axial Load Factor ND^2	THRUST RATING
SHAFT SIZE	INSERT #	SHAFT SIZE	INSERT #				
1/2 5/8 3/4	VS-208 VS-210 VS-212			2611	1444	0.7056	740
13/16 7/8 15/16 1	VS-213 VS-214 VS-215 VS-216			2801	1651	0.7840	490
1-1/16 1-1/8 1-3/16 1-1/4	VS-217 VS-218 VS-219 VS-220S	1	VS-316	4381	2567	1.2996	1170
1-1/4 1-5/16 1-3/8 1-7/16	VS-220 VS-221 VS-222 VS-223	1-3/16	VS-319	5782	3493	1.7424	1700
1-1/2 1-9/16	VS-224 VS-225	1-7/16	VS-323	7340	4467	2.2500	2250
1-5/8 1-11/16 1-3/4	VS-226 VS-227 VS-228	1-1/2	VS-324	7901	5139	2.5000	2350
1-13/16 1-7/8 1-15/16 2	VS-229 VS-230 VS-231 VS-232S	1-11/16 1-3/4 1-15/16	VS-327 VS-328 VS-331	7889	5216	2.5000	2350
2 2-1/8 2-3/16	VS-232 VS-234 VS-235			9752	6601	3.3160	2880
2-1/4 2-7/16	VS-236 VS-239	2-3/16	VS-335	11789	8150	3.9690	4100
2-1/2 2-11/16	VS-240 VS-243	2-7/16 2-1/2	VS-339 VS-340	13971	10063	4.7610	4500
2-15/16	VS-247	2-11/16	VS-343	14839	11224	5.2371	5200
		2-15/16 3	VS-347 VS-348	17412	13174	6.1875	6030
3-1/2	VS-256	3-7/16	VS-355	21566	16301	7.7440	7830
		3-15/16	VS-363	29905	23553	11.2360	11090

1. See page 270-271 for load and speed capabilities.
2. See General Engineering page 276.

Tapered Roller Bearings

This section outlines the formula used to select bearing size or calculate expected bearing life for Browning Tapered Roller Bearings.

Tapered Roller Bearings are excellent for applications where radial and/or thrust load ratings exceed the capabilities of a ball bearing. *Note: Maximum speeds are lower for Tapered Roller Bearings than Ball Bearings and Spherical Roller Bearings.*

Bearing Symbols for Tapered Life Calculations

C = Basic Dynamic Rating (lbs.) 90,000,000 revolutions
P = Equivalant Radial Load (lbs.)
L10 = Rated Life (hrs.)
Fa = Applied Thrust Load
Fr = Applied Radial Load
K = Geometry Factory
n = Speed RPM
FIR = Bearing Internal Thrust

Tapered Roller Bearing Life Calculation

Use Step 1-4 at right and follow formula.

$$L10 = (C/P)^{10/3} \times \frac{3000 \text{ hours} \times 500 \text{ RPM}}{n}$$

Select an initial bearing size, and calculate the expected L10 life. If the life is not acceptable, select another bearing size as appropriate and recalculate the L10. Continue this iterative process until an appropriate L10 life is obtained.

Table 5 Shock/Vibration Factor

Steady Loading	1.0
Light Shock/Vibration	.5
Moderate Shock/Vibration	.3

Multiply the theoretical life by the above factors to determine derated theoretical life.

Combined Load Calculation

For applications where combined radial and thrust loads are present the equivalent radial load (P) must be calculated before applying the L10 life formula,

For applications with only a radial load present $P=F_r$
Where F_r = Applied radial load in pounds

For applications with only a thrust load present, Consult EPT Mounted Bearing Tech Support

Calculate (P) equivalent radial load.

1. Calculate the bearing internal thrust reaction (FIR):

$$FIR = \frac{0.6 \times F_r}{K}$$

- applied radial load
- factor K for 900/950 Series page 268
  920/970 Series page 269

2. If the thrust load (F_a) is less than or equal to FIR, then calculate the equivalent radial load as follows:

$$P = (0.5 \times F_r) + (0.83 \times K \times F_a)$$

3. If the thrust load (Fa) is greater than FIR then calculate the equivalent radial load as follows:

$$P = (0.4 \times F_r) + (K \times F_a)$$

4. Calculate the expected L10 life using the single row basic dynamic load rating. For 900/950 Series page 268.
For 920/970 Series page 269.

$$L10 = \left(\frac{\text{single row load rating}}{P}\right)^{10/3} \times \frac{3000 \times 500}{n}$$

1. See page 272, 273 for load and speed capabilities.
2. See General Engineering page 276.

Spherical Roller Bearings Life Calculations

This section outlines the formula used to select bearing size or calculate expected bearing life for Browning spherical roller bearings.

Spherical Roller Bearings

Spherical roller bearings are excellent for applications where radial loads exceed the capabilities of a ball bearing or the speed limits of a tapered roller bearing.

Bearing Symbols for Spherical Life Calculations

C = Basic Dynamic Rating (lbs) 1,000,000 revolutions
P = Equivalent Radial Load (lbs)
L10 = Rated Life (hrs)
Fa = Applied Thrust Load
Fr = Applied Radial Load
n = Speed RPM
X = Radial Factor
Y = Thrust Factor
e = Geometry Ratio

Spherical Roller Bearing Life Calculations

$$L10 = \left(\frac{C}{P}\right)^{10/3} \times \frac{16667}{n}$$

Table 6 Shock/Vibration Factor

Steady Loading	1.0
Light Shock/Vibration	.5
Moderate Shock/Vibration	.3

Multiply the theoretical life by the above factors to determine derated theoretical life.

Combined Load Calculation

1. Select an initial spherical roller type and bore size.
2. Calculate Fa/Fr and compare the value to the “e” value found in the tables 7, 8 and 9.
3. Choose values for “X” and “Y” based on Step 1 above from the appropriate table 7, 8 and 9 based on the spherical bearing type selected.
4. Calculate equivalent load using the following equation:

$$P = XFr + YFa$$

5. Calculate the expected L10 life using the life equation above.
6. Determine if the calculated L10 meets application requirements.
7. If L10 is not acceptable, select another bearing size as appropriate and recalculate the L10 life. Continue this iterative process until an acceptable L10 is obtained.

NOTE: Always use (1) fixed and (1) floating spherical roller bearing.

Table 7

1000/1100 SERIES x+y Values for Combined Loading Equation						
Shaft Size	C Basic Load	e	Fa/Fr <= e		Fa/Fr > e	
			X1	Y1	X2	Y2
1 1/8-1 1/2	16,600	0.28	1.0	2.4	0.67	3.6
1 11/16-1 3/4	17,300	0.26	1.0	2.6	0.67	3.9
1 15/16-2	19,000	0.24	1.0	2.8	0.67	4.2
2 3/16	22,400	0.24	1.0	2.8	0.67	4.2
2 7/16-2 1/2	33,300	0.24	1.0	2.8	0.67	4.2
2 11/16-3	35,500	0.22	1.0	3.0	0.67	4.6
3 3/16-3 1/2	56,900	0.23	1.0	2.9	0.67	4.4
3 11/16-4	69,900	0.24	1.0	2.8	0.67	4.2
4 7/16-4 1/2	91,700	0.25	1.0	2.7	0.67	4.0
4 15/16	123,000	0.26	1.0	2.6	0.67	3.9

Table 8

22200 & 22500 SERIES - ADAPTER MOUNT X & Y Values for Combined Loading Equation						
Shaft Size		C Basic Load	e	Fa/Fr<=e		Fa/Fr>e	
Popular	Other			x	y	x	y
2 7/16	2 1/2	47,700	0.22	1.0	3.0	0.67	4.6
2 11/16	2 3/4	53,100	0.22	1.0	3.0	0.67	4.6
2 15/16	3	55,100	0.22	1.0	3.0	0.67	4.6
3 3/16	-	73,100	0.23	1.0	2.9	0.67	4.4
3 7/16 -	3 1/2 3 11/16	95,500	0.24	1.0	2.8	0.67	4.2
3 15/16	4	105,000	0.25	1.0	2.7	0.67	4.0
4 3/16	-	121,000	0.25	1.0	2.7	0.67	4
4 7/16	4 1/2	142,000	0.26	1.0	2.6	0.67	3.9
4 15/16	5	160,000	0.26	1.0	2.6	0.67	3.9
5 3/16	-	191,000	0.26	1.0	2.6	0.67	3.9
5 7/16	5 1/2	225,000	0.26	1.0	2.6	0.67	3.9
5 15/16	6	252,000	0.27	1.0	2.7	0.67	3.7
6 7/16	6 1/2	265,000	0.26	1.0	2.6	0.67	3.9
6 15/16	7	250,000	0.26	1.0	2.6	0.67	3.9
7 3/16	7 1/2	328,000	0.26	1.0	2.6	0.67	3.9
7 15/16	8	396,000	0.27	1.0	2.7	0.67	3.7

Table 9

22200 SERIES - CYLINDRICAL BORE x+y Values for Combined Loading							
Shaft Size		C Basic Load	e	Fa/Fr <= e		Fa/Fr > e	
S2	S3			X1	Y1	X1	Y1
3 5/8	3	53,100	0.22	1.0	3.0	0.67	4.6
3 15/16	3 3/19	55,100	0.22	1.0	3.0	0.67	4.6
4 1/8	3 3/8	73,100	0.23	1.0	2.9	0.67	4.4
4 1/2	3 13/16	95,500	0.24	1.0	2.8	0.67	4.2
4 7/8	4 3/16	105,000	0.25	1.0	2.7	0.67	4
5 5/16	4 9/16	121,000	0.25	1.0	2.7	0.67	4
5 7/8	4 15/16	142,000	0.26	1.0	2.6	0.67	3.9
6 1/4	5 5/16	160,000	0.26	1.0	2.6	0.67	3.9
6 5/8	5 3/4	191,000	0.26	1.0	2.6	0.67	3.9
7	6 1/16	225,000	0.26	1.0	2.6	0.67	3.9
7 7/16	6 7/16	252,000	0.27	1.0	2.5	0.67	3.7
7 13/16	6 7/8	265,000	0.26	1.0	2.6	0.67	3.9
8 3/8	7 1/4	250,000	0.26	1.0	2.6	0.67	3.9
8 3/4	7 5/8	328,000	0.26	1.0	2.6	0.67	3.9
9 9/16	8 5/16	396,000	0.27	1.0	2.5	0.67	3.7

1. See page 269 for load and speed capabilities.
2. See General Engineering page 276.

BALL BEARING 100 SERIES RATINGS

This chart displays 100 series ball bearing load capacity for a given L10 life, speed, and shaft size. Values in the table represent loads at ideal conditions with press fit mounting to the shaft. ABMA recommends de-rating of slip fit mounted bearings. To obtain de-rated load, divide load in table by 1.3. Values in the table represent equivalent radial loads only. For combined load determination, see **THE BEARING SELECTION SECTION,** page 266. Areas designated by "-" exceed maximum speed value.

Table 10 Match Bore Size

100 Shaft Size	L10 HOURS	REVOLUTIONS PER MINUTE															
		50	150	250	500	750	1000	1500	1750	2000	2500	3000	3500	4000	45000	5000	5500
1/2	5000	315	315	315	315	315	315	275	261	250	232	218	207	198	191	184	—
5/8	10000	315	315	315	315	275	250	218	207	198	184	173	165	157	151	146	—
275	250	315	315	275	218	191	173	151	144	138	128	120	114	109	105	101	—
	50000	315	275	232	184	161	146	128	121	116	108	101	96	92	89	85	—
	100000	315	218	184	146	128	116	101	96	92	85	80	76	73	70	68	—
3/4	5000	390	390	390	390	390	390	341	324	310	287	270	257	246	—	—	—
	10000	390	390	390	390	341	310	270	257	246	228	215	204	195	—	—	—
	30000	390	390	341	270	236	215	188	178	170	158	149	141	135	—	—	—
	50000	390	341	287	228	199	181	158	150	144	133	126	119	114	—	—	—
	100000	390	270	228	181	158	144	126	119	114	106	100	95	91	—	—	—
7/8	5000	418	418	418	418	418	418	366	347	332	308	290	276	—	—	—	—
15/16	10000	418	418	418	418	366	332	290	279	264	245	230	219	—	—	—	—
1	30000	418	418	366	290	253	230	201	191	183	170	160	152	—	—	—	—
	50000	418	366	308	245	214	194	170	161	154	143	135	128	—	—	—	—
	100000	418	290	245	194	170	154	135	128	122	114	107	102	—	—	—	—
1 1/8	5000	654	654	654	654	654	654	572	543	519	482	454	—	—	—	—	—
1 3/16	10000	654	654	654	654	572	519	454	431	412	383	360	—	—	—	—	—
1 1/4	30000	654	654	572	454	396	360	315	299	286	265	250	—	—	—	—	—
	50000	654	572	482	383	334	304	265	252	241	224	211	—	—	—	—	—
	100000	654	454	383	304	255	241	211	200	191	178	167	—	—	—	—	—
1 1/4	5000	864	864	864	864	864	864	755	717	686	636	—	—	—	—	—	—
1 3/8	10000	864	864	864	864	755	686	599	569	544	505	—	—	—	—	—	—
1 7/16	30000	864	864	755	599	523	475	415	394	377	350	—	—	—	—	—	—
	50000	864	755	636	505	441	401	350	333	318	295	—	—	—	—	—	—
	100000	864	599	505	401	350	318	278	264	253	234	—	—	—	—	—	—
1 1/2	5000	1096	1096	1096	1096	1096	1096	958	910	870	808	—	—	—	—	—	—
	10000	1096	1096	1096	1096	958	870	760	722	691	641	—	—	—	—	—	—
	30000	1096	1096	958	760	664	603	527	501	479	445	—	—	—	—	—	—
	50000	1096	958	808	641	560	509	445	422	404	375	—	—	—	—	—	—
	100000	1096	760	641	509	445	404	353	335	321	298	—	—	—	—	—	—
1 11/16	5000	1180	1180	1180	1180	1180	1180	1031	979	937	—	—	—	—	—	—	—
1 3/4	10000	1180	1180	1180	1180	1031	937	818	777	744	—	—	—	—	—	—	—
	30000	1180	1180	1031	818	715	650	567	539	516	—	—	—	—	—	—	—
	50000	1180	1031	870	690	603	548	479	455	435	—	—	—	—	—	—	—
	100000	1180	818	690	548	479	435	380	361	345	—	—	—	—	—	—	—
1 15/16	5000	1178	1178	1178	1178	1178	1178	1029	978	935	—	—	—	—	—	—	—
2	10000	1178	1178	1178	1178	1029	935	817	776	742	—	—	—	—	—	—	—
	30000	1178	1178	1029	817	714	649	567	538	515	—	—	—	—	—	—	—
	50000	1178	1029	868	689	602	547	478	454	434	—	—	—	—	—	—	—
	100000	1178	817	689	547	478	434	379	360	345	—	—	—	—	—	—	—
2	5000	1457	1457	1457	1457	1457	1457	1273	1209	—	—	—	—	—	—	—	—
2 3/16	10000	1457	1457	1457	1457	1273	1156	1010	959	—	—	—	—	—	—	—	—
	30000	1457	1457	1273	1010	882	802	700	665	—	—	—	—	—	—	—	—
	50000	1457	1273	1073	852	744	676	591	561	—	—	—	—	—	—	—	—
	100000	1457	1010	852	676	591	537	469	445	—	—	—	—	—	—	—	—

See General Engineering page 276.

BALL BEARING 200 AND 300 SERIES RATINGS

This chart displays 200 and 300 series ball bearing load capacity for a given L10 life, speed, and shaft size. Values in the table represent loads at ideal conditions with press fit mounting to the shaft. ABMA recommends de-rating of slip fit mounted bearings. To obtain de-rated load, divide load in table by 1.3. Values in the table represent equivalent radial loads only. For combined load determination, see **THE BEARING SELECTION SECTION,** page 266. Areas designated by "-" exceed maximum speed value.

Table 11 Match Bore Size

SHAFT SIZES		L10	REVOLUTIONS PER MINUTE																	
200 Dia. Inches	300 Dia. Inches	HOURS	50	150	250	500	750	1000	1500	1750	2000	2500	3000	3500	4000	4500	5000	5500	6500	7500
1/2		5000	500	500	500	397	347	315	275	261	250	232	218	207	198	191	184	178	169	161
5/8		10000	500	470	397	315	275	250	218	207	198	184	173	165	157	151	146	142	134	128
		30000	470	326	275	218	191	173	151	144	138	128	120	114	109	105	101	98	93	89
		50000	397	275	232	184	161	146	128	121	116	108	101	96	92	89	85	83	78	75
		100000	315	218	184	146	128	116	101	96	92	85	80	76	73	70	68	66	62	59
3/4		5000	619	619	619	491	429	390	341	324	310	287	270	257	246	236	228	221	209	—
		10000	583	583	491	390	341	310	270	257	246	228	215	204	195	188	181	175	166	—
		30000	583	404	341	270	236	215	188	178	170	158	149	141	135	130	126	122	115	—
		50000	491	341	287	228	199	181	158	150	144	133	126	119	114	110	106	103	97	—
		100000	390	270	228	181	158	144	126	119	114	106	100	95	91	87	84	81	77	—
7/8		5000	664	664	664	527	461	418	366	347	332	308	290	276	264	253	245	237	—	—
15/16		10000	625	625	527	418	366	332	290	276	264	245	230	219	209	201	194	188	—	—
1		30000	625	433	366	290	253	230	201	191	183	170	160	152	145	139	135	130	—	—
		50000	527	366	308	245	214	194	170	161	154	143	135	128	122	118	114	110	—	—
		100000	418	290	245	194	170	154	135	128	122	114	107	102	97	93	90	87	—	—
1 1/8	1	5000	1039	1039	1039	825	720	654	572	543	519	482	454	431	412	396	—	—	—	—
1 3/16		10000	978	978	825	654	572	519	454	431	412	383	360	342	327	315	—	—	—	—
1 1/4		30000	978	678	572	454	396	390	315	299	286	265	250	237	227	218	—	—	—	—
		50000	825	572	482	383	334	304	265	252	241	224	211	200	191	184	—	—	—	—
		100000	654	454	383	304	265	241	211	200	191	178	167	159	152	146	—	—	—	—
1 1/4	1 3/16	5000	1290	1290	1290	1088	951	864	755	717	686	636	599	569	544	—	—	—	—	—
1 3/8	1 1/4	10000	1290	1290	1088	864	755	686	599	569	544	505	475	452	432	—	—	—	—	—
1 7/16		30000	1290	895	755	599	523	475	415	394	377	350	330	313	299	—	—	—	—	—
		50000	1088	755	636	505	441	401	350	333	318	295	278	264	253	—	—	—	—	—
		100000	864	599	505	401	350	318	278	264	253	234	221	210	200	—	—	—	—	—
1 1/2	1 7/16	5000	1638	1638	1638	1381	1207	1096	958	910	870	808	760	722	—	—	—	—	—	—
		10000	1638	1638	1381	1096	958	870	760	722	691	641	603	573	—	—	—	—	—	—
		30000	1638	1136	958	760	664	603	527	501	479	445	418	397	—	—	—	—	—	—
		50000	1381	958	808	641	560	509	445	422	404	375	353	335	—	—	—	—	—	—
		100000	1096	760	641	509	445	404	353	335	321	298	280	266	—	—	—	—	—	—
1 5/8	1 1/2	5000	1763	1763	1763	1487	1299	1180	1031	979	937	870	818	—	—	—	—	—	—	—
1 11/16		10000	1763	1763	1487	1180	1031	937	818	777	744	690	650	—	—	—	—	—	—	—
1 3/4		30000	1763	1222	1031	818	715	650	567	539	516	479	450	—	—	—	—	—	—	—
		50000	1487	1031	870	690	603	548	479	455	435	404	380	—	—	—	—	—	—	—
		100000	1180	818	690	548	479	435	380	361	345	320	301	—	—	—	—	—	—	—
1 15/16	1 11/16	5000	1760	1760	1760	1485	1297	1178	1029	978	935	868	817	—	—	—	—	—	—	—
2	1 3/4	10000	1760	1760	1485	1178	1029	935	817	776	742	689	649	—	—	—	—	—	—	—
		30000	1760	1221	1029	817	714	649	567	538	515	478	450	—	—	—	—	—	—	—
		50000	1485	1029	868	689	602	547	478	454	434	403	379	—	—	—	—	—	—	—
		100000	1178	817	689	547	478	434	379	360	345	320	301	—	—	—	—	—	—	—
2	1 15/16	5000	2176	2176	2176	1835	1603	1457	1273	1209	1156	1073	—	—	—	—	—	—	—	—
2 3/16	2	10000	2176	2176	1835	1457	1273	1156	1010	959	918	852	—	—	—	—	—	—	—	—
		30000	2176	1509	1273	1010	882	802	700	665	636	591	—	—	—	—	—	—	—	—
		50000	1835	1273	1073	852	744	676	591	561	537	498	—	—	—	—	—	—	—	—
		100000	1457	1010	852	676	591	537	469	445	426	395	—	—	—	—	—	—	—	—
2 1/4	2 3/16	5000	2631	2631	2631	2219	1938	1761	1538	1461	1398	1298	—	—	—	—	—	—	—	—
2 7/16	2 1/4	10000	2631	2631	2219	1761	1538	1398	1221	1160	1109	1030	—	—	—	—	—	—	—	—
		30000	2631	1824	1538	1221	1067	969	847	804	769	714	—	—	—	—	—	—	—	—
		50000	2219	1538	1298	1030	900	817	714	678	649	602	—	—	—	—	—	—	—	—
		100000	1761	1221	1030	817	714	649	567	538	515	478	—	—	—	—	—	—	—	—
2 11/16	2 7/16	5000	3118	3118	3118	2629	2297	2087	1823	1732	1656	—	—	—	—	—	—	—	—	—
	2 1/2	10000	3118	3118	2629	2087	1823	1656	1447	1375	1315	—	—	—	—	—	—	—	—	—
		30000	3118	2162	1823	1447	1264	1149	1003	953	912	—	—	—	—	—	—	—	—	—
		50000	2629	1823	1538	1220	1066	969	846	804	769	—	—	—	—	—	—	—	—	—
		100000	2087	1447	1220	969	846	769	672	638	610	—	—	—	—	—	—	—	—	—
2 15/16	2 11/16	5000	3311	3311	3311	2793	2440	2217	1936	1839	1759	—	—	—	—	—	—	—	—	—
		10000	3311	3311	2793	2217	1936	1759	1537	1460	1396	—	—	—	—	—	—	—	—	—
		30000	3311	2296	1936	1537	1343	1220	1066	1012	968	—	—	—	—	—	—	—	—	—
		50000	2793	1936	1633	1296	1332	1029	899	854	817	—	—	—	—	—	—	—	—	—
		100000	2217	1537	1296	1029	899	817	713	678	648	—	—	—	—	—	—	—	—	—
	2 15/16	5000	3885	3885	3885	3277	2863	2601	2272	2158	2064	—	—	—	—	—	—	—	—	—
	3	10000	3885	3885	3277	2601	2272	2064	1803	1713	1639	—	—	—	—	—	—	—	—	—
		30000	3885	2694	2272	1803	1575	1431	1250	1188	1136	—	—	—	—	—	—	—	—	—
		50000	3277	2272	1916	1521	1329	1207	1055	1002	958	—	—	—	—	—	—	—	—	—
		100000	2601	1803	1521	1207	1055	958	837	795	761	—	—	—	—	—	—	—	—	—
	3 7/16	5000	4812	4812	4812	4059	3546	3222	2814	2673	—	—	—	—	—	—	—	—	—	—
	3 1/2	10000	4812	4812	4059	3222	2814	2557	2234	2122	—	—	—	—	—	—	—	—	—	—
		30000	4812	3337	2814	2234	1951	1773	1549	1471	—	—	—	—	—	—	—	—	—	—
		50000	4059	2814	2374	1884	1646	1495	1306	1241	—	—	—	—	—	—	—	—	—	—
		100000	3222	2234	1884	1495	1306	1187	1037	985	—	—	—	—	—	—	—	—	—	—
	3 15/16	5000	6673	6673	6673	5628	4917	4467	3902	—	—	—	—	—	—	—	—	—	—	—
		10000	6673	6673	5628	4467	3902	3546	3097	—	—	—	—	—	—	—	—	—	—	—
		30000	6673	4627	3902	3097	2706	2458	2148	—	—	—	—	—	—	—	—	—	—	—
		50000	5628	3902	3291	2612	2282	2074	1811	—	—	—	—	—	—	—	—	—	—	—
		100000	4467	3097	2612	2074	1811	1646	1438	—	—	—	—	—	—	—	—	—	—	—

See General Engineering page 276.

TAPERED ROLLER BEARINGS 900 AND 950 SERIES

This chart displays the Browning 900 and 950 Series Tapered Roller Bearing's load capacity for a given L10 life, speed and shaft size. Values in the table represent loads at ideal conditions. The shaded areas indicate the maximum speed for the 950 series only. Select 950 Series where aligning capability is required. For combined load determination, see **THE BEARING SELECTION SECTION,** page 268. Areas designated by "-" exceed maximum speed value.

Table 12 Match Bore Size

SIZE	"K" FACTOR	"C" 2 ROW RATING	1 ROW RATING	THRUST RATING*	L10 HOURS	REVOLUTIONS PER MINUTE 50	100	150	250	500	750	1000	1500	1750	2000	2500	3000	3500
1	1.42	3700	2130	1500	5000	4179	4179	4179	3908	3174	2811	2578	2283	2180	2094	1959	1854	1771
					10000	4179	4179	3700	3174	2578	2283	2094	1854	1771	1701	1591	1506	1438
					30000	3700	3005	2611	2283	1854	1642	1506	1334	1273	1223	1144	1083	1034
					50000	3174	2578	2283	1959	1591	1409	1292	1144	1093	1050	982	929	887
					100000	2578	2094	1854	1591	1292	1144	1050	929	887	853	797	755	721
1 3/16	1.53	5130	2950	1930	5000	5794	5794	5794	5418	4401	3897	3575	3165	3022	2904	2716	2571	2455
1 1/4					10000	5794	5794	5130	4401	3575	3165	2904	2571	2455	2358	2206	2088	1944
1 3/8					30000	5130	4167	3690	3165	2571	2277	2088	1849	1766	1696	1586	1502	1434
					50000	4401	3575	3165	2716	2206	1953	1792	1586	1515	1455	1361	1289	1230
					100000	3575	2904	2571	2206	1792	1586	1455	1289	1230	1182	1106	1047	999
1 7/16	1.46	5930	3410	2330	5000	6697	6697	6697	6263	5087	4505	4132	3659	3494	3356	3139	2972	—
1 1/2					10000	6697	6697	5930	5087	4132	3659	3356	2972	2838	2726	2550	2414	—
					30000	5930	4817	4265	3659	2972	2632	2414	2138	2041	1961	1834	1736	—
					50000	5087	4132	3659	3139	2550	2258	2071	1834	1751	1682	1573	1490	—
					100000	4132	3356	2972	2550	2071	1834	1682	1490	1422	1366	1278	1210	—
1 5/8	1.37	6050	3470	2540	5000	6833	6833	6833	6390	5190	4596	4216	3733	3564	3424	3203	—	—
1 11/16					10000	6833	6833	6050	5190	4216	3733	3424	3032	2895	2781	2601	—	—
1 3/4					30000	6050	4914	4351	3733	3032	2685	2463	2181	2082	2000	1871	—	—
					50000	5190	4216	3733	3203	2601	2303	2113	1871	1786	1716	1605	—	—
					100000	4216	3424	3032	2601	2113	1871	1716	1520	1451	1394	1304	—	—
1 7/8	1.65	8550	4910	2980	5000	9656	9656	8656	9031	7335	6495	5958	5276	5037	4839	—	—	—
1 15/16					10000	9656	9656	8550	7335	5958	5276	4839	4285	4091	3931	—	—	—
2					30000	8550	6945	6149	5276	4285	3794	3481	3082	2943	2827	—	—	—
2 1/8					50000	7335	5958	5276	4526	3676	3255	2986	2644	2525	2425	—	—	—
					100000	5958	4839	4285	3676	2986	2644	2425	2148	2051	1970	—	—	—
2 3/16	1.51	9090	5220	3470	5000	10266	10266	10266	9601	7798	6905	6334	5609	5355	5145	—	—	—
					10000	10266	10266	9090	7798	6334	5609	5145	4556	4350	4179	—	—	—
					30000	9090	7383	6538	5609	4556	4034	3700	3277	3129	3006	—	—	—
					50000	7798	6334	5609	4812	3908	3461	3175	2811	2684	2579	—	—	—
					100000	6334	5145	4556	3908	3175	2811	2579	2283	2180	2095	—	—	—
2 1/4	1.45	9290	5340	3670	5000	10492	10492	10492	9812	7970	7057	6474	5732	5473	—	—	—	—
2 7/16					10000	10492	10492	9290	7970	6474	5732	5258	4656	4446	—	—	—	—
2 1/2					30000	9290	7546	6682	5732	4656	4123	3782	3349	3197	—	—	—	—
					50000	7970	6474	5732	4918	3994	3537	3245	2873	2743	—	—	—	—
					100000	6474	5258	4656	3994	3245	2873	2635	2334	2228	—	—	—	—
2 11/16	1.30	9600	5510	4260	5000	10842	10842	10842	10140	8236	7293	6690	5924	—	—	—	—	—
2 3/4					10000	10842	10842	9600	8236	6690	5924	5434	4811	—	—	—	—	—
2 15/16					30000	9600	7798	6905	5924	4811	4260	3908	3460	—	—	—	—	—
					50000	8236	6690	5924	5082	4128	3655	3353	2969	—	—	—	—	—
					100000	6690	5434	4811	4128	3353	2969	2723	2411	—	—	—	—	—
3	1.31	14500	8330	6340	5000	16376	16376	16376	15315	12440	11015	10104	—	—	—	—	—	—
3 3/16					10000	16376	16378	14500	12440	10104	8947	8207	—	—	—	—	—	—
					30000	14500	11778	10429	8947	7267	6435	5903	—	—	—	—	—	—
					50000	12440	10104	8947	7676	6235	5521	5064	—	—	—	—	—	—
					100000	10104	8207	7267	6235	5064	4484	4113	—	—	—	—	—	—
3 7/16	1.19	15300	8790	7410	5000	17279	17279	17279	16160	13126	11623	10662	—	—	—	—	—	—
3 1/2					10000	17279	17279	15300	13126	10662	9441	8660	—	—	—	—	—	—
					30000	15300	12427	11004	9441	7668	6790	6228	—	—	—	—	—	—
					50000	13126	10104	9441	8099	6579	5825	5344	—	—	—	—	—	—
					100000	10662	8207	7668	6579	5344	4732	4340	—	—	—	—	—	—
3 15/16	1.45	18400	10600	7270	5000	20780	20780	20780	19434	15786	13978	12822	—	—	—	—	—	—
4					10000	20780	20780	18400	15786	12822	11353	10415	—	—	—	—	—	—
					30000	18400	14945	13234	11353	9222	8166	7490	—	—	—	—	—	—
					50000	15786	12822	11353	9740	7912	7005	6426	—	—	—	—	—	—
					100000	12822	10415	9222	7912	6426	5690	5220	—	—	—	—	—	—
4 7/16	1.91	25200	14500	7550	5000	28460	28460	28460	26617	21620	19143	17561	—	—	—	—	—	—
4 1/2					10000	28460	28460	25200	21620	17561	15549	14264	—	—	—	—	—	—
					30000	25200	20469	18124	15549	12630	11183	10259	—	—	—	—	—	—
					50000	21620	17561	15549	13340	10835	9594	8801	—	—	—	—	—	—
					100000	17561	14264	12630	10835	8801	7793	7149	—	—	—	—	—	—
4 15/16	1.82	26600	15300	8390	5000	30041	30041	30041	28095	22821	20207	—	—	—	—	—	—	—
5					10000	30041	30041	26600	22821	18536	16413	—	—	—	—	—	—	—
					30000	26600	21606	19131	16413	13332	11805	—	—	—	—	—	—	—
					50000	22821	18536	16413	14081	11437	10127	—	—	—	—	—	—	—
					100000	18536	15056	13332	11437	9290	8226	—	—	—	—	—	—	—

See General Engineering page 276.

See page 156 for trademark acknowledgments.

TAPERED ROLLER BEARINGS 920 AND 970 SERIES

This chart displays the Browning 920 and 970 Series Tapered Roller Bearing's load capacity for a given L10 life, speed and shaft size. Values in the table represent loads at ideal conditions. The shaded areas indicate the maximum speed for the 970 series only. For combined load determination, see **THE BEARING SELECTION SECTION**, page 268. Areas designated by "-" exceed maximum speed value.

Table 13 Match Bore Size

SIZE	"K" FACTOR	"C" 2 ROW RATING	1 ROW RATING	THRUST RATING*	HOURS	REVOLUTIONS PER MINUTE 50	100	150	250	500	750	1000	1500	1750	2000	2500	3000	3500	4000
1 3/16	1.23	2975	1710	1390	5000	3360	3360	3360	3142	2552	2260	2073	1836	1753	1684	1575	1491	1424	1368
1 1/4					10000	3360	3360	2975	2552	2073	1836	1684	1491	1424	1368	1279	1211	1156	1111
					30000	2975	2416	2140	1836	1491	1320	1211	1072	1024	984	920	871	832	799
					50000	2552	2073	1836	1575	1279	1133	1039	920	878	844	789	747	714	685
					100000	2073	1684	1491	1279	1039	920	844	747	714	685	641	607	580	556
1 3/8	1.31	4760	2740	2080	5000	5376	5376	5376	5028	4084	3616	3317	2937	2804	2694	2520	2386	2278	—
1 7/16					10000	5376	5376	4760	4084	3317	2937	2694	2386	2278	2188	2047	1938	1850	—
					30000	4760	3866	3424	2937	2386	2112	1938	1716	1638	1574	1472	1394	1331	—
					50000	4084	3317	2937	2520	2047	1812	1662	1472	1406	1350	1263	1196	1142	—
					100000	3317	26741	2386	2047	1662	1472	1350	1196	1142	1097	1026	971	927	—
1 1/2	1.36	6140	3530	2600	5000	6934	6934	6934	6485	5268	4664	4279	3789	3617	3475	3250	3077	—	—
1 11/16					10000	6934	6934	6140	5268	4279	3789	3475	3077	2938	2823	2640	2500	—	—
					30000	6140	4987	4416	3789	3077	2725	2500	2213	2113	2030	1899	1798	—	—
					50000	5268	4279	3789	3250	2640	2338	2144	1899	1813	1742	1629	1542	—	—
					100000	4279	3475	3077	2640	2144	1899	1742	1542	1473	1415	1323	1253	—	—
1 3/4	1.83	8070	4640	2540	5000	9114	9114	9114	8524	6923	6130	5624	4979	4754	4568	4272	—	—	—
1 15/16					10000	9114	9114	8070	6923	5624	4979	4568	4045	3862	3710	3470	—	—	—
2					30000	8070	6555	5804	4979	4045	3581	3285	2909	2777	2668	2496	—	—	—
					50000	6923	5624	4979	4272	3470	3072	2818	2496	2383	2289	2141	—	—	—
					100000	5624	4568	4045	3470	2818	2496	2289	2027	1935	1859	1739	—	—	—
2 3/16	1.65	8570	4910	2980	5000	9679	9679	9679	9052	7352	6510	5972	5288	5049	4851	4537	—	—	—
					10000	9679	9679	8570	7352	5972	5288	4851	4295	4101	3940	3685	—	—	—
					30000	8570	6961	6164	5288	4295	3803	3489	3089	2950	2834	2650	—	—	—
					50000	7352	5972	5288	4537	3685	3263	2993	2650	2530	2431	2274	—	—	—
					100000	5972	4851	4295	3685	2993	2650	2431	2153	2055	1975	1847	—	—	—
2 1/4	1.51	9030	5220	3470	5000	10198	10198	10198	9538	7747	6860	6293	5572	5320	5111	—	—	—	—
2 7/16					10000	10198	10198	9030	7747	6293	5572	5111	4526	4321	4152	—	—	—	—
2 1/2					30000	9030	7335	6495	5572	4526	4007	3676	3255	3108	2986	—	—	—	—
					50000	7747	6293	5572	4780	3883	3438	3154	2793	2666	2562	—	—	—	—
					100000	6293	5111	4526	3883	3154	2793	2562	2268	2166	2081	—	—	—	—
2 11/16	1.30	9630	5510	4260	5000	10876	10876	10876	10171	8262	7316	6711	5942	5674	—	—	—	—	—
2 15/16					10000	10876	10876	9630	8262	6711	5942	5451	4826	4608	—	—	—	—	—
3					30000	9630	7822	6926	5942	4826	4274	3920	3471	3314	—	—	—	—	—
					50000	8262	6711	5942	5098	4141	3666	3363	2978	2843	—	—	—	—	—
					100000	6711	5451	4826	4141	3363	2978	2732	2419	2310	—	—	—	—	—
3 3/16	1.19	15320	8790	7410	5000	17302	17302	17302	16181	13143	11638	10676	9453	—	—	—	—	—	—
3 7/16					10000	17302	17302	15320	13143	10676	9453	8671	7678	—	—	—	—	—	—
3 1/2					30000	15320	12444	11018	9453	7678	6799	6273	5522	—	—	—	—	—	—
					50000	13143	10676	9453	8110	6587	5833	5351	4738	—	—	—	—	—	—
					100000	10676	8671	7678	6587	5351	4738	4346	3848	—	—	—	—	—	—
3 15/16	1.23	20980	12100	9800	5000	23694	23694	23694	22159	17999	15938	14620	12945	—	—	—	—	—	—
4					10000	23694	23694	20980	17999	14620	12945	11875	10515	—	—	—	—	—	—
					30000	20980	17041	15089	12945	10515	9311	5841	7563	—	—	—	—	—	—
					50000	17999	14620	12945	11106	9021	7988	7327	6488	—	—	—	—	—	—
					100000	14620	11875	10515	9021	7327	6488	5952	5270	—	—	—	—	—	—
4 7/16	1.13	25750	14800	13100	5000	29081	29081	29081	27198	22091	19561	17944	—	—	—	—	—	—	—
4 1/2					10000	29081	29081	25750	22091	17944	15889	14575	—	—	—	—	—	—	—
					30000	25750	20915	18520	15889	12906	11427	10483	—	—	—	—	—	—	—
					50000	22091	17944	15889	13631	11072	9804	8993	—	—	—	—	—	—	—
					100000	17944	14575	12906	11072	8993	7963	7305	—	—	—	—	—	—	—
4 15/16	1.27	35520	20400	16000	5000	40114	40114	40114	37517	30473	26983	24752	—	—	—	—	—	—	—
5					10000	40114	40114	35520	30473	24752	21917	20105	—	—	—	—	—	—	—
					30000	35520	28851	25547	21917	17802	15763	14460	—	—	—	—	—	—	—
					50000	30473	24752	21917	18803	15273	13524	12405	—	—	—	—	—	—	—
					100000	24752	20105	17802	15273	12405	10985	10076	—	—	—	—	—	—	—

See General Engineering page 276.

SPHERICAL ROLLER BEARINGS 1000 AND 1100 SERIES

This chart displays the Browning 1000 and 1100 Series Spherical Roller Bearing's load capacity for a given L10 life, speed and shaft size. Values in the table represent loads at ideal conditions. The shaded areas indicate the maximum speed for the MULTI-TRAP Seal. The maximum speed for the Contact Seal is indicated in the non-shaded areas. For combined load determination, see **THE BEARING SELECTION SECTION**, page 269. Areas designated by "-" exceed maximum speed value.

Table 14 Match Bore Size

Size	Rating	L10 Hours	REVOLUTIONS PER MINUTE												
			50	100	150	250	500	750	1000	1500	1750	2000	2500	3000	3500
1 1/8	16600	5000	4880	4880	4880	4546	3692	3269	2999	2656	2535	2436	2278	2157	2059
1 3/16		10000	4880	4860	4304	3692	2999	2656	2436	2157	2059	1979	1850	1752	1673
1 1/4		30000	4304	3496	3095	2656	2157	1910	1752	1551	1481	1423	1331	1260	1203
1 7/16		50000	3692	2999	2656	2278	1850	1639	1503	1331	1271	1221	1142	1081	1032
1 1/2		100000	2999	2436	2157	1850	1503	1331	1221	1081	1032	992	927	878	838
1 11/16	17300	5000	2999	6458	5522	4737	3848	3407	3125	2767	2642	2539	2374	2248	2146
1 3/4		10000	6458	5065	4485	3848	3125	2767	2539	2248	2146	2062	1929	1826	1743
		30000	6458	3643	3226	2767	2248	1990	1826	1617	1544	1483	1387	1313	1254
		50000	4485	3125	2767	2374	1929	1708	1566	1387	1324	1272	1190	1127	1076
		100000	3848	2539	2248	1929	1566	1387	1272	1127	1076	1033	967	915	874
1 15/16	19000	5000	3125	6925	6064	5203	4226	3742	3433	3039	2902	2788	2608	2469	2357
2		10000	6925	5563	4926	4226	3433	3039	2788	2469	2357	2265	2118	2005	1915
		30000	6925	4001	3543	3039	2469	2186	2005	1776	1695	1629	1523	1442	1377
		50000	4926	3433	3039	2608	2118	1875	1720	1523	1454	1397	1307	1237	1181
		100000	4226	2788	2469	2118	1720	1523	1397	1237	1181	1135	1062	1005	960
2 3/16	22400	5000	3433	7150	7150	6134	4982	4412	4047	3583	3421	3287	3074	2911	2779
		10000	7150	6559	5807	4982	4047	3583	3287	2911	2779	2670	2497	2364	2257
		30000	7150	4717	4177	3583	2911	2577	2364	2093	1999	1920	1796	1700	1623
		50000	5807	4047	3583	3074	2497	2211	2028	1796	1715	1647	1541	1459	1393
		100000	4982	3287	2911	2497	2028	1796	1647	1459	1393	1338	1251	1185	1131
2 7/16	33300	5000	4047	10629	10629	9119	7407	6558	6016	5327	5086	4887	4570	4327	—
2 1/2		10000	10629	9750	8633	7407	6016	5327	4887	4327	4131	3969	3712	3515	—
		30000	10629	7012	6209	5327	4327	3831	3515	3112	2971	2855	2670	2528	—
		50000	8633	6016	5327	4570	3712	3287	3015	2670	2549	2449	2290	2169	—
		100000	7407	4887	4327	3712	3015	2670	2449	2169	2071	1989	1860	1761	—
2 11/16	35500	5000	6016	11331	11331	9721	7896	6992	6413	5679	5422	5209	4872	4613	—
2 3/4		10000	11331	10394	9204	7896	6413	5679	5209	4613	4404	4231	3957	3747	—
2 15/16		30000	11331	7476	6619	5679	4613	4084	3747	3318	3168	3043	2846	2695	—
3		50000	9204	6413	5679	4872	3957	3504	3214	2846	2718	2611	2442	2312	—
		100000	7896	5209	4613	3957	3214	2846	2611	2312	2207	2121	1983	1878	—
3 3/16	56900	5000	6413	20827	18161	15581	12656	11206	10280	9102	8691	8350	—	—	—
3 7/16		10000	20827	16660	14752	12656	10280	9102	8350	7393	7059	6782	—	—	—
3 1/2		30000	20827	11982	10610	9102	7393	6547	6005	5317	5077	4878	—	—	—
		50000	14752	10280	9102	7809	6343	5616	5152	4562	4356	4185	—	—	—
		100000	12656	8350	7393	6343	5152	4562	4185	3705	3538	3399	—	—	—
3 11/16	69900	5000	10280	25854	22311	19141	15547	13767	12628	11182	10677	10257	—	—	—
3 15/16		10000	25854	20466	18122	15547	12628	11182	10257	9083	8672	8332	—	—	—
4		30000	25854	14720	13034	11182	9083	8042	7377	6532	6237	5992	—	—	—
		50000	18122	12628	11182	9593	7792	6900	6329	5604	5351	5141	—	—	—
		100000	15547	10257	9083	7792	6329	5604	5141	4552	4346	4176	—	—	—
4 7/16	91700	5000	12628	33386	29269	25110	20396	18060	16567	—	—	—	—	—	—
4 1/2		10000	33386	26849	23774	20396	16567	14669	13456	—	—	—	—	—	—
		30000	33386	19310	17099	14669	11915	10550	9678	—	—	—	—	—	—
		50000	23774	16567	14669	12585	10222	9051	8303	—	—	—	—	—	—
		100000	20396	13456	11915	10222	8303	7352	6744	—	—	—	—	—	—
4 15/16	123,000	5000	16567	45244	39259	33681	27358	24224	—	—	—	—	—	—	—
		10000	45244	36013	31889	27358	22221	19676	—	—	—	—	—	—	—
		30000	45244	25902	22935	19676	15982	14152	—	—	—	—	—	—	—
		50000	31889	22221	19676	16881	13711	12141	—	—	—	—	—	—	—
		100000	27358	18049	15982	13711	11137	9862	—	—	—	—	—	—	—

See General Engineering page 276.

SPHERICAL ROLLER BEARINGS 22200 AND 22500 SERIES

This chart displays the Browning 22200 and 22500 Series Spherical Roller Bearing's load capacity for a given L10 life, speed and shaft size. Values in the table represent loads at ideal conditions. For combined load determination, see **THE BEARING SELECTION SECTION**, page 269. Areas designated by "-" exceed maximum speed value.

Table 15 Match Bore Size

Size	Rating	L10 Hours	REVOLUTIONS PER MINUTE												
			50	100	150	250	500	750	1000	1500	1750	2000	2500	3000	3500
22215	47,700	5000	13966	13966	13966	13966	10609	9394	8618	7631	7286	7000	6546	6198	—
		10000	13966	13966	12367	10609	8618	7631	7000	6198	5918	5685	5317	5034	—
		30000	12367	10045	8894	7631	6198	5488	5034	4458	4256	4089	3824	3621	—
		50000	10609	8618	7631	6546	5317	4708	4319	3824	3652	3508	3281	3106	—
		100000	8618	7000	6198	5317	4319	3824	3508	3106	2966	2849	2665	2523	—
22216	53,100	5000	15550	15550	15550	14540	11811	10458	9593	8494	8111	7792	7288	6900	—
		10000	15550	15550	13767	11811	9593	8494	7792	6900	6588	6329	5919	5604	—
		30000	13767	11182	9901	8494	6900	6109	5604	4962	4738	4552	4257	4031	—
		50000	11811	9593	8494	7288	5919	5241	4808	4257	4065	3905	3652	3458	—
		100000	9593	7792	6900	5919	4808	4257	3905	3458	3302	3172	2967	2809	—
22217	55,100	5000	16134	16134	16134	15088	12255	10852	9954	8814	8416	8086	7562	7159	—
		10000	16134	16134	14285	12255	9954	8814	8086	7159	6836	6567	6142	5815	—
		30000	14285	11603	10274	8814	7159	6339	5815	5149	4917	4723	4418	4183	—
		50000	12255	9954	8814	7562	6142	5439	4989	4418	4218	4052	3790	3588	—
		100000	9954	8086	7159	6142	4989	4418	4052	3588	3426	3292	3078	2915	—
22218	73,100	5000	21405	21405	21405	20017	16259	14397	13206	11694	11165	10727	10032	—	—
		10000	21405	21405	18952	16259	13206	11694	10727	9498	9069	8713	8149	—	—
		30000	18952	15394	13630	11694	9498	8410	7715	6831	6523	6267	5861	—	—
		50000	16259	13206	11694	10032	8149	7215	6619	5861	5596	5376	5028	—	—
		100000	13206	10727	9498	8149	6619	5861	5376	4760	4545	4367	4084	—	—
22220	95,500	5000	27965	27965	27965	26151	21241	18808	17253	15277	14587	14014	—	—	—
		10000	27965	27965	24759	21241	17253	15277	14014	12409	11848	11383	—	—	—
		30000	24759	20111	17807	15277	12409	10988	10079	8925	8521	8187	—	—	—
		50000	21241	17253	15277	13107	10646	9427	8647	7657	7311	7024	—	—	—
		100000	17253	14014	12409	10646	8647	7657	7024	6219	5938	5705	—	—	—
22222	105,000	5000	30745	30745	30745	28752	23354	20679	18969	16797	16038	15408	—	—	—
		10000	30745	30745	27222	23354	18969	16797	15408	13643	13027	12515	—	—	—
		30000	27222	22111	19579	16797	13643	12081	11082	9813	9369	9001	—	—	—
		50000	23354	18969	16797	14410	11705	10364	9507	8418	8038	7722	—	—	—
		100000	18969	15408	13643	11705	9507	8418	7722	6838	6529	6272	—	—	—
22224	121,000	5000	35430	35430	35430	33134	26913	23831	21860	19356	18482	—	—	—	—
		10000	35430	35430	31370	26913	21860	19356	17756	15722	15012	—	—	—	—
		30000	31370	25480	22562	19356	15722	13922	12770	11308	10797	—	—	—	—
		50000	26913	21860	19356	16606	13488	11944	10956	9701	9263	—	—	—	—
		100000	21860	17756	15722	13488	10956	9701	8899	7880	7524	—	—	—	—
22226	142,000	5000	41580	41580	41580	38884	31584	27966	25654	22716	21689	—	—	—	—
		10000	41580	41580	36814	31584	25654	22716	20837	18451	17617	—	—	—	—
		30000	36814	29903	26478	22716	18451	16338	14987	13270	12671	—	—	—	—
		50000	31584	25654	22716	19488	15829	14016	12857	11385	10870	—	—	—	—
		100000	25654	20837	18451	15829	12857	11385	10443	9247	8829	—	—	—	—
22228	160,000	5000	46850	46850	46850	43813	35587	31511	28906	25595	—	—	—	—	—
		10000	46850	46850	41481	35587	28906	25595	23479	20790	—	—	—	—	—
		30000	41481	33693	29834	25595	20790	18409	16887	14952	—	—	—	—	—
		50000	35587	28906	25595	21959	17836	15793	14487	12828	—	—	—	—	—
		100000	28906	23479	20790	17836	14487	12828	11767	10420	—	—	—	—	—
22230	191,000	5000	55930	55930	55930	52302	42482	37617	34506	30554	—	—	—	—	—
		10000	55930	55930	49518	42482	34506	30554	28028	24818	—	—	—	—	—
		30000	49518	40221	35614	30554	24818	21975	20158	17850	—	—	—	—	—
		50000	42482	34506	30554	26213	21292	18853	17294	15313	—	—	—	—	—
		100000	34506	28028	24818	21292	17294	15313	14047	12438	—	—	—	—	—
22232	225,000	5000	65885	65885	65885	61612	50045	44313	40649	35993	—	—	—	—	—
		10000	65885	65885	58333	50045	40649	35993	33017	29236	—	—	—	—	—
		30000	58333	47381	41954	35993	29236	25887	23747	21027	—	—	—	—	—
		50000	50045	40649	35993	30879	25082	22209	20373	18039	—	—	—	—	—
		100000	40649	33017	29236	25082	20373	18039	16548	14653	—	—	—	—	—
22234	252,000	5000	73790	73790	73790	69006	56050	49630	45527	—	—	—	—	—	—
		10000	73790	73790	65333	56050	45527	40312	36979	—	—	—	—	—	—
		30000	65333	53067	46989	40312	32744	28994	26596	—	—	—	—	—	—
		50000	56050	45527	40312	34585	28092	24874	22817	—	—	—	—	—	—
		100000	45527	36979	32744	28092	22817	20204	18534	—	—	—	—	—	—
22236	265,000	5000	77600	77600	77600	69006	56050	49630	45527	—	—	—	—	—	—
		10000	77600	77600	65333	56050	45527	40312	36979	—	—	—	—	—	—
		30000	65333	53067	46989	40312	32744	28994	26596	—	—	—	—	—	—
		50000	56050	45527	40312	34585	28092	24874	22817	—	—	—	—	—	—
		100000	45527	36979	32744	28092	22817	20204	18534	—	—	—	—	—	—
22238	250,000	5000	73198	73198	73198	68458	55605	49237	45165	—	—	—	—	—	—
		10000	73198	73198	64814	55605	45165	39993	36686	—	—	—	—	—	—
		30000	64814	52645	46616	39993	32484	28764	26385	—	—	—	—	—	—
		50000	55605	25654	22716	19488	15829	14016	12857	—	—	—	—	—	—
		100000	45165	36686	32484	27869	22636	20044	18386	—	—	—	—	—	—
22240	328,000	5000	96045	96045	96045	89817	72954	64598	59257	—	—	—	—	—	—
		10000	96045	96045	85036	72954	59257	52470	48132	—	—	—	—	—	—
		30000	85036	69071	61160	52470	42619	37738	34617	—	—	—	—	—	—
		50000	72954	59257	52470	45015	36564	32376	29699	—	—	—	—	—	—
		100000	59257	48132	42619	36564	29699	26297	24123	—	—	—	—	—	—
22244	396,000	5000	115960	115960	115960	108437	88079	77991	—	—	—	—	—	—	—
		10000	115960	115945	102666	88079	71542	63348	—	—	—	—	—	—	—
		30000	102666	83390	73839	63348	51455	45561	—	—	—	—	—	—	—
		50000	88079	71542	63348	54347	44144	39088	—	—	—	—	—	—	—
		100000	71542	58110	51455	44144	35856	31749	—	—	—	—	—	—	—

See General Engineering page 276.

BEARING SELECTION:

Consult EPT Mounted Bearing Technical Support for

1. Moderate to High Thrust Load Applications
2. Housing Strength and Capabilities
3. High Load/High Speed Applications
4. See Bearing Dimension/Data Tables for General Bearing Capabilities

LINEAL SHAFT EXPANSION

Lineal shaft expansion is the change in length of a shaft due to a relative change in its temperature.For steel shafts, lineal expansion can be calculated using the following formula:

Expansion (Growth) = .0000063 x Length (inches) x Temperature Change °F

The following Roller Bearings can accommodate shaft lineal expansion as listed in the table below.

Table 16

Series	Lineal Expansion Capability
950, 970	.310 inched
1000, 1100, thru 1-3/4"	.050 inches
1000/1100 1-15/16 up	.080 inches
22200/22500	.080 inches

Consult EPT Mounted Bearing Tech Support for applications where lineal expansion is a factor on other types of Browning Bearing Products or the lineal expansion exceeds the capability of the Roller Bearings listed above.

BEARING ALIGNMENT CAPABILITY (IN)
ALLOWABLE ALIGNMENT ERROR (IN)

Table 17

	DISTANCE BETWEEN BEARINGS (feet)									
	1 Ft.	2 Ft.	3 Ft.	4 Ft.	5 Ft.	6 Ft.	7 Ft.	8 Ft.	9 Ft.	10 Ft.
Labyrinth (Multi-trap) 1000/1100 950/970/Ball *	.3	0.6	.9	1.3	1.6	1.9	2.2	2.5	2.8	3.63
Contact (Double Lip) 1000/1100	.25	.5	.8	1.0	1.3	1.6	1.8	2.1	2.4	2.6
22500 (LER) 22200 (LER)	.05	.1	.2	.2	.3	.3	.4	.4	.5	.5

* Ball except cylindrical O. D. inserts

SEALS

- 900/950 series bearings are designed with metal labyrinth seals. Labyrinth seals rely on frequent lubrication for full effectiveness. 920 and 970 series bearings with contact seals should be selected in moist, wet or highly contaminated environments.
- 1000/1100 series are standard with metal labyrinth seals. Labyrinth seals rely on frequent lubrication for full effectiveness. Contact seals should be specified in moist, wet or highly contaminated environments.

See page 156 for trademark acknowledgments.

Browning® Engineering

Application Worksheet

EMERSON POWER TRANSMISSION

EPT MOUNTED BEARING DIVISION

Mail To: EPT Bearing Operations - Application Engineering
909 N. Lafayette St.
Valparaiso, IN 46383

Fax to: Application Engineering 219-465-2290

Distributor Information	Customer Information
Distributor Name Contact Name	Company Name Contact Name
Street Address City/State/Zip	Street Address City/State/Zip
Phone Fax E-Mail	Phone Fax E-Mail
Is the Customer an: OEM or End User	Industry

Application Information

Is this a new application Yes or No	Complete Climate Description
Speed: (rpm) Service Life Required: (hours): Shaft Diameter:	EXPLAIN: Climate Conditions: Wet ❑ Washdown ❑ Dry ❑ Clean ❑ Dirty ❑ Chemicals ❑
Load Information (lbs.): Load Conditions: Steady ❑ Radial (lbs.): Shock ❑ Axial / Thrust (lbs.): Thrust ❑ Oscillation ❑ If loads unknown attach detailed sketch*** Other ❑	Operating Temperature (°F): Is the bearing in the elevated temp? Yes / No Is the heat coming through the shaft? Yes / No Can the bearings be re-lubricated? Yes ❑ No ❑
Complete Application Description: Horsepower (bhp):	Motor Driven Pulley Diameter (in.): Distance Between Bearings:

***PLEASE ATTACH DETAILED SKETCH OF APPLICATION.

INCLUDE ALL DIMENSIONS AND SYSTEM LOAD LOCATIONS

See page 156 for trademark acknowledgments.

Browning® Engineering

APPLICATION EXAMPLES:

EXAMPLE # 1
Pure Radial Load

Question # 1:

What is the adjusted bearing life (L_{na} hours) for an VPS-239 Browning Ball Bearing with no shock conditions and the following application criteria?

Design Load (P)	=	1300 lbs.
Speed (n)	=	1000 RPM
Shaft Size	=	$2^{7}/_{16}$ Inches
Operating Temperature	=	125°F

Solution:

1. Begin with the L_{10} life formula: $L_{10} = (C/P)^3 \times \frac{16667}{n}$

   Look up the insert of an VPS-239 on page 6. From Table 4 on page 269, the Basic Dynamic Radial Rating is 11,789 lbs.

$$L_{10} = \left(\frac{11789}{1300}\right)^3 \times \frac{16667}{1000} = 12{,}430 \text{ hours}$$

2. Apply the life adjustment factors:
   L_{na} hours = $L_{10} \times a_1 \times a_2 \times a_3$
   L_{na} hours = 12,430 x 1 x 1 x 0.456
   L_{na} hours = 5,700 hours *

Question # 2:

What is the adjusted bearing life (L_{10} hours) for an VPS-39 Browning Ball Bearing with moderate shock conditions and the same application criteria from above?

Solution:

1. From Table 2 on page 262: a_3 = 0.5 x 0.456.
2. Re-Apply the life adjustment factors to the previously calculated L10 life:
   L_{na} hours = $L_{10} \times a_1 \times a_2 \times a_3$
   L_{na} hours = 12,430 x 1 x 1 x (0.5 x 0.456)
   L_{na} hours = 2,830 hours*

Question # 3:

What is the bearing life (L_{10} hours) for an PB-970NEx 2 7/16 Tapered Roller Bearing with no shock conditions and the same application criteria from above?

Solution:

1. Begin with the L_{10} life formula: $L_{10} = (C/P)^{10/3} \times \frac{500 \times 3{,}000}{n}$
2. PB-970NEx 2 7/16 has 2 7/16" shaft size. From Table 13 x on page 269, the Radial Rating is 9,030 lbs.

$$L_{10} = \left(\frac{9030}{1300}\right)^{10/3} \times \frac{500 \times 3{,}000}{1000} = 959{,}000 \text{ hrs.}$$

For moderate shock (from table 5) L_{10} = .5* 959,000 = 480,000 hrs*

Question # 4:

What is the bearing life (L_{10} hours) for an SPB-1000NEx 2 7/16 Spherical Roller Bearing with moderate shock conditions and the same application criteria from above?

Solution:

1. From Table No. 14 on page 270:

$$L_{10} = ? \times \left(\frac{32{,}400}{1300}\right)^{10/3} \times \frac{16{,}667}{1000} = 754{,}000^* \text{ hrs.}$$

For moderate shock (from Table 6 page 269)
L10 = .5 x 754,000 = 37,000 hrs*

* Excessively high or low hours are not realistic in applications.

EXAMPLE # 2 Combined Radial and Thrust Load

Question # 1:

What is the adjusted bearing life (L_{na} hours) for an VPS-239 Browning Ball Bearing with no shock conditions and the following application criteria?

Design Radial Load (F_r)	=	500 lbs.
Design Thrust Load (F_a)	=	1000 lbs.
Speed (n)	=	1000 RPM
Shaft Size	=	$2^{7}/_{16}$ Inches
Operating Temperature	=	125°F

Solution:

1. Calculate F_a/F_r = 1000/500 = 2
2. Begin by calculating the Relative Axial Load (RAL): (From Table 3, page 267)

$$RAL = \frac{F_a}{ND^2} = \frac{1000}{3.9690} = 251 \text{ lbs.}$$

3. From Table 3 on page 263, interpolate RAL between 200.10 and 300.15 and "e" between 0.30 and 0.34 to obtain an "e" value:

$$\frac{251 - 200.10}{300.15 - 200.10} = \frac{e - 0.30}{0.34 - 0.30}$$ Therefore e=.32

4. From Table 3 on page 267, determine the value of "X" and "Y" through interpolation. Interpolate "e" between 0.30 and 0.34 and "Y" between 1.45 and 1.31 because $F_a/F_r > e$;

$$\frac{0.32 - 0.30}{0.34 - 0.30} = \frac{Y - 1.45}{1.31 - 1.45}$$

Therefore Y = 1.38

X = .56

5. Determine the equivalent radial load (P):
   P = (X F_r) + (Y F_a)
   = (0.56 x 500) + (1.38 x 1000) = 1660 lbs.
   $L_{10} = (C/P)^3 \times \frac{16667}{n}$
   Look up the insert of an VPS-239 on page 6. From Table 4 on page 267, the Basic Dynamic Radial Rating is 11,789 lbs.

$$L_{NA} = .456 \times \left(\frac{11789}{1660}\right)^3 \times \frac{16667}{1000} = 2720 \text{ hours}$$

Question # 2:

What is the bearing life (L_{10} hours) for an PB-970NEx 2 7/16 Tapered Roller Bearing with no shock conditions and the same application criteria from above?

Solution:

1. Find the K factor value from Table 13 on page 273, K = 1.51.
2. Calculate the internal thrust reaction (FIR):

$$FIR = \frac{0.6 \times F_r}{K}$$ -applied radial load; -factor K in Table 13

$$FIR = \frac{0.6 \times 500}{1.51} = 199 \text{ lbs.}$$

3. Since the thrust load is greater than the internal thrust reaction (FIR) use the following formula from page 268 to calculate the equivalent radial load.
   P = (0.4 x F_r) + (K x F_a)
   P = (0.4 X 500) + (1.51 X 1000) = 1710 lbs.
4. Caclulate the expected L_{10} life using the single row rating. Single row rating = 5,220 lbs. This is found in Table 13 on page 273.

$$L_{10} = \left(\frac{\text{single row load rating}}{P}\right)^{10/3} \times \frac{500 \times 3000}{n}$$

$$L_{10} = \left(\frac{5220}{1710}\right)^{10/3} \times \frac{3000 \times 500}{1000} = 61{,}900 \text{ hrs.}$$

See page 156 for trademark acknowledgments.

COMPUTING BEARING LOADS:

In the computation of bearing loads in any application of a Browning unit, the principal factor determining the selection of the unit is the equivalent radial load to which the bearing will be subjected. These radial loads result from any one or any combination of the following sources:

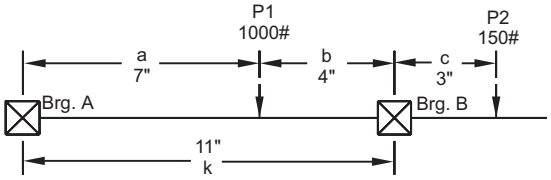
1. Weights of machine parts supported by bearings.
2. Tension due to belt or chain pull.
3. Centrifugal force from out of balance, eccentric or cam action.

The resulting load from any one, or any combination of the above sources is further determined by knowing:

1. The magnitude of the load.
2. Direction of the load.
3. The point of load application.
4. The distance between bearing centers.

Bearing loads are the result of force acting on the shaft. Direction, magnitude, and location with respect to the bearings must be considered when calculating bearing loads. The following cases are typical examples of loads encountered and methods of calculating bearing loads.

CASE # 1
Straddle Mount Fan, Cantilever Drive



$$\text{Load on Bearing A} = \frac{(P_1 \times b) - (P_2 \times c)}{k}$$

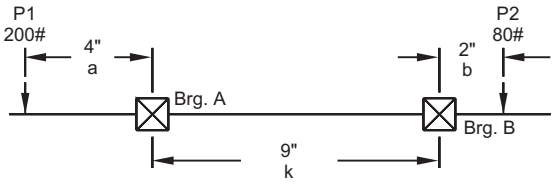
$$= \frac{(1{,}000 \times 4) - (150 \times 3)}{11} = 323 \text{ lbs.}$$

$$\text{Load on Bearing B} = \frac{(P_1 \times a) + (c + k) \times (P_2)}{k}$$

$$= \frac{(1{,}000 \times 7) + (3 + 11) \times (150)}{11}$$

$$= 827 \text{ lbs.}$$

CASE # 2
Cantilever Fan and Drive



$$\text{Load on Bearing A} = \frac{P_1 \times (a + k) - (P_2 \times b)}{k}$$

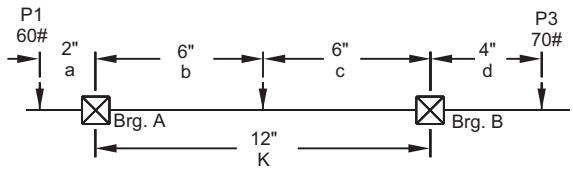
$$= \frac{200 \times (4 + 9) - (80 \times 2)}{9} = 271 \text{ lbs.}$$

$$\text{Load on Bearing B} = \frac{(P_2 \times (k + b) - (P_1 \times a)}{k}$$

$$= \frac{80 \times (9 + 2) - (200 \times 4)}{9}$$

$$= 9 \text{ lbs.}$$

CASE # 3
Straddle, Cantilever Fan, Cantilever Drive



$$\text{Load on Bearing A} = \frac{P_1 \times (k + a) + (P_2 \times c) - (P_3 \times d)}{k}$$

$$= \frac{60 \times (12 + 2) + (180 \times 6) - (70 \times 4)}{12}$$

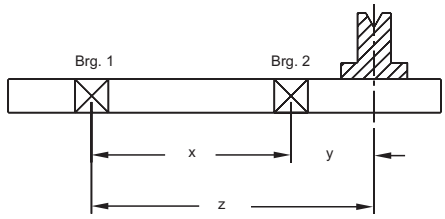
$$= 137 \text{ lbs.}$$

$$\text{Load on Bearing B} = \frac{-(P_1 \times a) + (P_2 \times b) + P_3 \times (k + d)}{k}$$

$$= \frac{-(60 \times 2) + (180 \times 6) + 70 \times (12 + 4)}{12}$$

$$= 173 \text{ lbs.}$$

CASE # 4
Drive Load Calculation



$$P = \frac{126{,}000 \times HP}{RPM \times d} \times K = \frac{126{,}000 \times 5}{2{,}400 \times 10} \times 1.5 = 39.4 \text{ lbs.}$$

HP = horsepower
RPM = revolutions per minute
d = pitch diameter of pulley in inches
K = constant for type of drive used
K = 1.5 for V-belts
K = 2 to 3 for flat transmission belts
K = 1.1 for chain drives

Apply P to Case 1, 2 or 3 if applicable

See page 156 for trademark acknowledgments.

SET SCREW LOCK

❶ INSPECT SHAFT

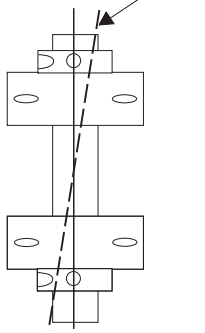
- Clean/remove burrs.
- Check diameter -Ref tables 25, 27, 35.
- Clean Mounting Surface.
- Mounting Surfaces Must be Flat.

❷ PLACE BEARING ON SHAFT

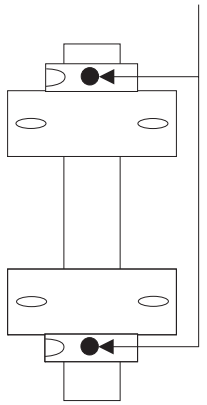
- Apply light film of oil on shaft.
- Slide, do not hammer, bearing onto shaft.

❸ BOLT HOUSING TO SUPPORT SURFACE

- Bearing and shaft must be in alignment.
  - Ball - 1 1/2 ° max
  - 1000/1100 - 1 1/2° max
  - 1000/1100 w/contact seals - 1 1/2° max
  - 920 - 1/20° max
  - 970 - 1 1/4° max
  - VER 1/20° max
- Rotate shaft to make sure it rotates.



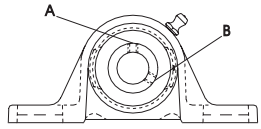
❹ ALIGN SETSCREWS ON BOTH BEARINGS IN LINE



❺ ALTERNATE TORQUING OF SETSCREWS

See Torque Specification Tables

- Step 1: Torque setscrew “A” to 1/2 recommended torque. In tables 18, 19, 20
- Step 2: Torque setscrew “B” to full recommended torque. In tables 18, 19, 20
- Step 3: Torque setscrew “A” to full recommended torque. In tables 18, 19, 20
- Double Lock: Repeat on opposite end.



Set Screw Tightening Torque

Table 18 Ball Bearings

Bearing Bore 100-200 Series (Inches)	Bore Size 300 series (Inches)	Set Screw Diameter	Hex Size Across Flats	Recommended Torque	
				(Inch Lbs.)	(Foot Lbs.)
1/2 - 5/8		10 - 32	3/32	28 - 36	
3/4 - 1 1/4	15/16 - 1	1/4 - 28	1/8	66 - 85	
1 1/4 - 1 3/4	1 3/16 - 1 1/2	5/16 - 24	5/32	126 - 164	11 - 14
1 15/16 - 2 7/16	1 11/16 - 2 3/16	3/8 - 24	3/16	228 - 296	19 - 25
2 1/2 - 3 15/16	2 7/16 - 3 15/16	7/16 - 20	7/32	348 - 452	29 - 38

Table 19 920/970 Tapered Roller

Bearing Bore	Set Screw Diameter	Recommended Torque	
(inches)	(inches)	(In-Lbs)	(Ft-Lbs)
1 3/16 to 1 11/16	5/16 - 24	108 - 144	9 - 12
1 3/4 to 2 1/2	3/8 - 24	180 - 228	15 - 19
2 11/16 to 3 1/2	1/2 - 20	408 - 540	34 - 45
3 15/16 to 4	5/8 - 18	876 - 1140	73 - 95
4 7/16 to 5	3/4 - 16	1440 - 1800	120 - 150

Table 20 1000/1100 Spherical Roller

Bearing Bore	Set Screw Diameter	Recommended Torque	
(inches)	(inches)	(In-Lbs)	(Ft-Lbs)
1 1/8 to 2 3/16	3/8 - 24	290 - 380	24 - 32
2 7/16 to 3 7/16	1/2 - 20	620 - 930	50 - 45
3 1/2 to 4 15/16	5/8 - 18	1300 - 1700	108 - 140

Monitor operating bearing during first 48 hours for unusual vibration or temperatures.

⚠WARNING
Failure to observe safety precautions could cause personal injury or equipment damage.

⚠WARNING
Do not operate without guards. Turn off power to install or service

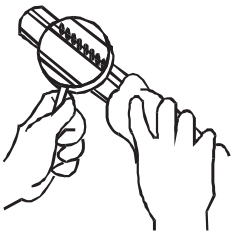
⚠CAUTION
High voltage and rotating parts may cause serious or fatal injury. Turn off power to install or service.

See page 156 for trademark acknowledgments.

BOA CONCENTRIC LOCKING

❶ INSPECT SHAFT

- Clean/remove burrs.
- Check diameter. Reference Table 25.
- Clean Mounting Surface.
- Mounting Surface Must be Flat.

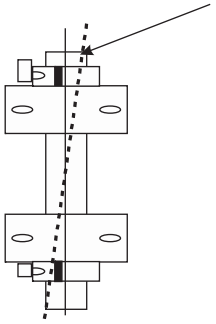


❷ PLACE BEARING ON SHAFT

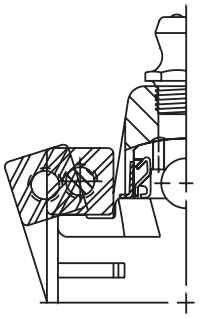
- Slide, do not hammer, bearing onto shaft.

❸ BOLT HOUSING TO SUPPORT SURFACE

- Bearing and shaft must be in alignment max 1 1/2°.
- Rotate shaft to make sure it rotates.



❹ PUSH LOCKING COLLAR TIGHTLY AGAINST INNER RING SHOULDER



❺ TORQUE CAPSCREW TO RECOMMENDED VALUE

See Torque Specification Table 21

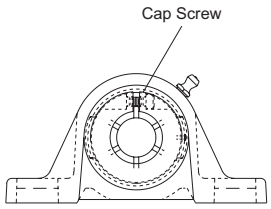


Table 21 BOA Concentric Cap Screw Tightening Torque

Bearing Bore Normal Duty (Inches)	Bearing Bore Medium Duty (inches)	Thread Size	Torx Size	Recommended Torque	
				(Inch Lbs.)	(Foot Lbs.)
3/4- 1 1/4R	15/16-1	8-32	T-25	65 - 70	-
1 1/4 - 1 3/4	1 3/16-1 1/2	10-24	T-27	90 - 100	-
1 13/16 - 2 3/16	1 11/16-1 15/16	1/4-20	T-30	220 - 240	18 - 20
2 1/4 - 2 7/16	2 3/16	5/16-18	T-45	450 - 495	37 - 41

Monitor operating bearing during first 48 hours for unusual vibration or temperatures.

⚠WARNING
Failure to observe safety precautions could cause personal injury or equipment damage.

⚠WARNING
Do not operate without guards. Turn off power to install or service

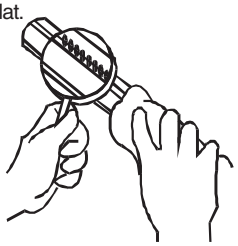
⚠CAUTION
High voltage and rotating parts may cause serious or fatal injury. Turn off power to install or service.

See page 156 for trademark acknowledgments.

ECCENTRIC LOCK

❶ INSPECT SHAFT (TABLE 1)

- Clean/remove burrs.
- Check diameter - Ref table 25, 31.
- Clean Mounting Surface.
- Mounting Surfaces Must be Flat.

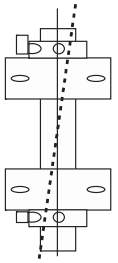


❷ PLACE BEARING ON SHAFT

- Do not hammer bearing onto shaft.
- Apply light film of oil on shaft.

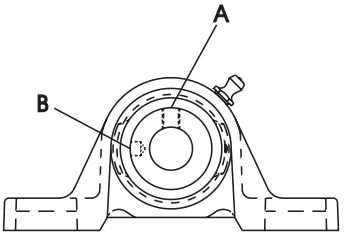
❸ BOLT HOUSING TO SUPPORT SURFACE

- Bearing and shaft must be in alignment
  - 900 - 1/20° max
  - 950 - 1 1/2° max
  - Ball - 1 1/2° max
- Rotate shaft to make sure it rotates.



❹ FASTEN UNIT TO SHAFT See Torque Specification Tables

- Step 1:
  Place collar on inner race and rotate by hand i**n direction of shaft rotation** unitl eccentrics are engaged.
- Step 2:
  Insert drift pin into the hole in the collar O.D. and lock in direction of shaft rotation with the aid of small hammer.
- Step 3:
  Torque single setscrew to recommended torque - Ref table 22, 23.



Eccentric Lock Set Screw Tightening Torque

Table 22 Ball Bearings

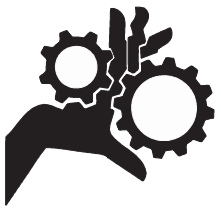
Bearing Bore (Inches)	Set Screw Diameter	Hex Size Across Flats	Recommended Torque	
			Inch Lbs.	Foot Lbs.
1/2 - 1	¼-28	1/8	66 - 85	
1 1/8 - 1 1/4	5/16-24	5/32	126 - 164	
1 1/4 - 1 15/16	3/8-24	3/16	228 - 296	19-25
2 - 2 7/16	7/16-20	7/32	348 - 452	29-38
2 11/16 - 2 15/16	½-20	1/4	504 - 655	42-55

Table 23 900/950 Tapered Roller

Bearing Bore (Inches)	Set-Screw Diameter (Inches)	Recommended Torque	
		(In-Lbs)	(Ft-Lbs)
1 3/16 to 1 11/16	5/16 - 24	108-140	9-12
1 3/4 to 2 1/2	3/8 - 24	180-230	15-19
2 11/16 to 3 1/2	1/2 - 20	408-530	34-45
3 15/16 to 5	5/8 - 18	876-1000	73-95

- **Eccentric Lock not recommended for reversing shaft rotation applications.**
- **Monitor operating bearing during first 48 hours for unusual vibration or temperatures.**

⚠WARNING
Failure to observe safety precautions could cause personal injury or equipment damage.



⚠WARNING
Do not operate without guards. Turn off power to install or service

⚠CAUTION
High voltage and rotating parts may cause serious or fatal injury. Turn off power to install or service.

See page 156 for trademark acknowledgments.

Table 24 Ball Bearings

Bore Tolerances For Ball Bearings	
Bore Size (Inches)	**Bore Tolerances (Inches)**
1/2 to 1 15/16	+.0006/-.0000
2 to 3 3/16	+.0006/-.0000
3 1/4 to 5	+.0007/-.0000

Table 25

Recommended Shaft Tolerances	
Shaft Size (Inches)	**Tolerances (Inches)**
1/2 to 1 15/16	+.0000/-.0005
2 to 3 3/16	+.0000/-.0010
3 1/4 to 5	+.0000/-.0015

Table 26 920/970 Tapered Roller Bearings

Bore Tolerance	
Bore Size (Inches)	Bore Tolerance (Inches)
1 3/16 to 3	+.001 / -.000
3 3/16 to 5	+.002 / -.000

Table 27

RECOMMENDED SHAFT TOLERANCES	
Nominal Shaft Size (Inches)	Shaft Tolerances (Inches)
1 3/16 to 1 15/16	+.0000 / -.0005
2 to 3 15/16	+.0000 / -.0010
4 to 5	+.0000 / -.0015

Table 28

HOUSING CAP BOLT TORQUES 970 SERIES PILLOW BLOCKS		
SHAFT SIZE	HOUSING CAP BOLT TORQUES	
(Inches)	(Ft-Lbs)	(In-Lbs)
1 3/8, 1 7/16, 1 1/2, 1 11/16, 1 3/4, 1 15/16, 2 2 3/16	30-35 40-45 50-55 70-75	360-400 465-515 615-680 815-900
2 1/4, 2 7/16, 2 1/2 2 11/16, 2 15/16, 3 3 3/16, 3 7/16, 3 1/2 3 15/16, 4 4 7/16, 4 1/2 4 15/16, 5	70-80 90-100 170-190 265-295 120-135 195-220	860-950 1100-1215 2040-2250 3190-3525 1470-1620 2360-2610

Table 29

HOUSING CAP BOLT TORQUES 970 SERIES FLANGED HOUSINGS		
SHAFT SIZE	HOUSING CAP BOLT TORQUES	
(Inches)	(Ft-Lbs)	(In-Lbs)
1 3/8, 1 7/16, 1 1/2, 1 11/16, 1 3/4, 1 15/16, 2 2 3/16	30-35 40-45 50-55 65-75	365-405 465-515 615-680 810-895
2 1/4, 2 7/16, 2 1/2 2 11/16, 2 15/16, 3 3 3/16, 3 7/16, 3 1/2 3 15/16, 4 4 7/16, 4 1/2 4 15/16, 5	70-80 90-100 170-190 265-295 325-360 505-560	855-945 1095-1210 2040-2255 3190-3530 3910-4320 6065-6705

Table 30 900/950 Tapered Roller Bearings

Bore Tolerance	
Bore Size (Inches)	Bore Tolerance (Inches)
1 to 3 1/2	+.001 / -.000
3 15/16 to 5	+.002 / -.000

Table 31

RECOMMENDED SHAFT TOLERANCES	
Nominal Shaft Size (Inches)	Shaft Tolerances (Inches)
1 to 1 15/16	+.0000 / -.0005
2 to 3 15/16	+.0000 / -.0010
4 to 5	+.0000 / -.0015

Table 32

HOUSING CAP BOLT TORQUES 950 SERIES PILLOW BLOCKS		
SHAFT SIZE	HOUSING CAP BOLT TORQUES	
(Inches)	(Ft-Lbs)	(In-Lbs)
1 7/16, 1 1/2 1 5/8, 1 11/16, 1 3/4 1 7/8, 1 15/16, 2, 2 1/8 2 3/16 2 1/4, 2 7/16, 2 1/2 2 11/16, 2 3/4, 2 15/16 3,3 3/16 3 7/16, 3 1/2 3 15/16, 4 4 7/16, 4 1/2 4 15/16, 5	30-35 40-45 50-55 70-75 70-80 90-100 140-150 170-190 265-295 120-135 195-220	360-400 465-515 615-680 815-900 860-950 1100-1215 1680-1800 2040-2250 3190-3525 1470-1620 2360-2610

Table 33

HOUSING CAP BOLT TORQUES 950 SERIES FLANGED HOUSINGS		
SHAFT SIZE	HOUSING CAP BOLT TORQUES	
(Inches)	(Ft-Lbs)	(In-Lbs)
1 7/16, 1 1/2 1 5/8, 1 11/16, 1 3/4 1 7/8, 1 15/16, 2, 2 1/8 2 3/16 2 1/4, 2 7/16, 2 1/2 2 11/16, 2 3/4, 2 15/16 3,3 3/16 3 7/16, 3 1/2 3 15/16, 4 4 7/16, 4 1/2 4 15/16, 5	30-35 40-45 50-55 65-75 70-80 90-100 140-150 170-190 265-295 325-360 505-560	365-405 465-515 615-680 810-895 855-945 1095-1210 1655-1825 2040-2255 3190-3530 3910-4320 6065-6705

Table 34 1000/1100 Spherical Roller Bearings

Bore Tolerances	
Bore Size	Bore Tolerances
(Inches)	(Inches)
1 1/8	+.0005 / +0
1 3/16 to 1 15/16	+.0006 / +0
2 to 3	+.0007 / +0
3 3/16 to 4 15/16	+.0009 / +0

Table 35

Recommended Shaft Tolerances	
Nominal Shaft Size	Shaft Tolerances
(Inches)	(Inches)
1 1/8 to 1 15/16	+.0000 / -.0005
2 to 3 15/16	+.0000 / -.0010
4 - 4 15/16	+.0000 / -.0015

See page 156 for trademark acknowledgments.

Mounting the Bearing and Seal Assemblies in the Housing

- Remove the nuts and lockwashers from the housing cap bolts.
- Lift off the cap and remove the stabilizing ring. **⚠CAUTION** Do not mix housing caps and bases. They are machined as a matched set and mixing the cap and bases could result in premature failure.
- Install the outward seal rings on the shaft.
- Clean the housing using an OSHA approved solvent.
- Lift the shaft assembly and place the bearings in the housings, being sure that the seal rings mate with the grooves in the housing.
- Install a stabilizing ring in one bearing housing only, making it non-expansion. Leave out the stabilizing ring for the other bearing, and then center the other bearing in the other housing so that it is free to move in both directions.
- Check the rotation of the shaft. The shaft should rotate freely. Any roughness or binding would indicate an error in assembly and/or dirt in the bearings and should be corrected before operating the bearings.
- Secure the pillow block to the mounting surface by tightening the base bolts. Torque the base bolts to the values recommended by the base bolt supplier.
- Place the corresponding housing caps into position. Tighten the nuts on the cap bolts to the specified values, using the washers included.
- Rotate the shaft again. The shaft should rotate freely.

⚠WARNING **The load rating for the 22500 series roller bearing units found in the Browning catalog assume that the bearing unit is base loaded. For any application where there is load carried through the cap of the housing, EPT Mounted Bearing Technical Support (see page 260) should be contacted.**

Table 36

Recommended Shaft Tolerance	
Nominal Shaft Size (Inches)	**Shaft Tolerance (Inches)**
2 7/16 to 2 1/2	+.000/-.003
2 9/16 to 4	+.000/-.004
4 1/16 to 6	+.000/-.005
6 1/16 to 8	+.000/-.006

Table 37

Recommended Reduction In Internal Clearance (Feeler Gage Method)		
Housing Series	**Reduction in Diametrical Clearance**	
	Min. (Inches)	**Max. (Inches)**
515	.0018	.0022
516	.0018	.0022
517	.0018	.0022
518	.0018	.0022
520	.0020	.0025
522	.0020	.0025
524	.0020	.0025
526	.0026	.0032
528	.0026	.0032
530	.0026	.0032
532	.0032	.0040
534	.0032	.0040
536	.0032	.0040
538	.0032	.0040
540	.0032	.0040
544	.0040	.0050

Table 38

Recommended Shaft Tolerance				
Shaft Dia. (Inches)	**'C' dim. (Inches)**	**'R' dim. (Inches)**	**Preferred 'L' @ 15 (Inches)**	**Preferred 'L' @ 30 (Inches)**
2 7/16 to 3 15/16	.093	.188	.313	.156
4 3/16 to 6 15/16	.125	.250	.438	.218
7 3/16 to 7 15/16	.188	.375	.702	.323

Table 39

Recommended Cap Bolt Torque		
Housing Series	**Recommended Cap Bolt Torque (Ft-Lbs)**	
	Min.	**Max.**
515	43	48
516	86	95
517	86	95
518	86	95
520	86	95
522	153	169
524	153	169
526	153	169
528	153	169
530	246	272
532	222	245
534	222	245
536	222	245
538	314	347
540	443	490
544	443	490

See page 156 for trademark acknowledgments.

Inner Seal Mounting

- Clean the shaft free of burrs. Check that shaft diameter is within specifications.
  For Standard Labyrinth Seal: Slide the seal on shaft.
  For Taconite Seal Arrangement: Coat the shaft with oil. Make sure that the end of the shaft has the proper chamfer, and slide the V-ring seal on the shaft keeping the lip of the seal towards the bearing. Apply grease to the bore of the Taconite seal assembly. Place the seal in position on the shaft.

22500 Adapter Mounting

- After installing the inner seal, coat the bore and O.D. of the Adapter Sleeve with a light film of oil. Place the adapter sleeve on the shaft at the desired location.
- Measure and record the internal clearance built into the bearing by inserting the feeler gage at the bottom of the bearing between the outer race and a roller. Do not roll over the feeler gage to get a reading, only use a sliding motion on the gage to get a reading.
- Seat the bearing hand tight on the adapter by pushing it up the taper
- Install the locknut, without washer, hand-tight against the bearing.
- Mark the location of the nut with respect to the adapter.
- Tighten the locknut until the measured internal clearance between the bottom of the bearing's outer race and roller is reduced by the amount shown in the table on the following page.
- If the measured reduction in internal clearance exceeds that recommended in the table, rotate the outer race to seat the rollers and remeasure by inserting the feeler gage between the outer race and rollers. If after several tries, you are convinced that the clearance removed in the assembly process is greater than that recommended, back off the locknut and repeat the procedure.
- If the measured reduction in internal clearance is within the recommended specifications, back off the locknut and then securely re-install it with the lockwasher in place.
- Bend the lockwasher tab into the slot in the locknut.

Press Fit Mounting

- After installing the inner seal, fit the bearing on to the shaft.
  For smaller bearings, apply a light film of oil or micronized graphite to the shaft and bore of the bearing.
    - Make sure that the bearing is square on the shaft and use either an arbor press or a hammer, in conjunction with a clean pipe pressed against the edge of the inner race, to press the bearing in to place.

  For larger bearings, bring the bearing up to a maximum temperature of 250° F. This may be accomplished by one of the following methods.
    - Place the bearing in an oil bath consisting of either clean oil or a 15% emulsion of oil which is soluble. This should last for 30 minutes to an hour.
    - Place the bearing in a temperature controlled oven for no longer than 4 hours, and preferably only long enough to assist with the size of the bore.
    - Use an induction heater long enough to bring the bore of the bearing up to the necessary size. Once again, make sure that this does not go on for more than 4 hours total time.
      (In any case, an open flame should never be used on the bearing.)
    - After getting the bearing bore up to size quickly mount the bearing on the shaft and immediately continue to the following steps.

Ball Bearing Inserts Spherical O.D.

Browning® Engineering

SPHERICAL OD BEARING INSERT REMOVAL AND REPLACEMENT
BALL BEARING UNITS

Ball bearing spherical OD Insert removal and replacement procedure. Browning inserts are selectively fit into castings, therefore Browning recommends replacing the entire housed unit.

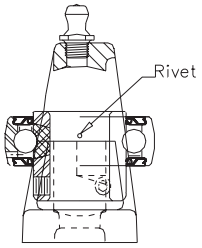
REMOVAL:

❶ REMOVE BEARING FROM SHAFT

- Loosen set screws.
- Slide bearing off shaft.
- Do not hammer bearing off of shaft.
- Use flat punch to flatten set screw marks

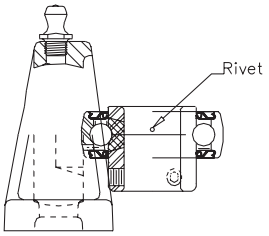
❷ ROTATE BEARING

- Rotate bearing 90° relative to housing.
- A lever can be used to aid in the insert removal.



❸ REMOVEINSERT

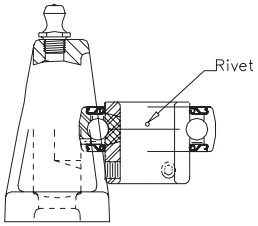
- Push bearing through load slots.



REPLACEMENT:

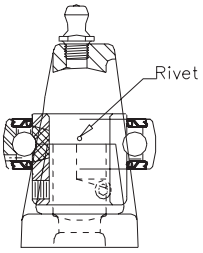
❶ LOAD INSERT

- Clean and Check Bore for Debris.
- Rotate bearing 90° relative to housing.
- With locking side pointed down, push bearing into load slots with rivet in the grease fitting side of housing (Left Hand Side).



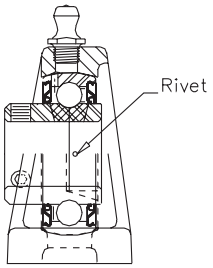
❷ ROTATE BEARING

- Rotate bearing back 90° relative to housing.
- Do not hammer bearing into housing.



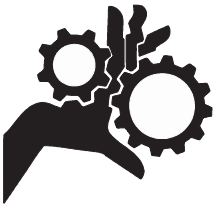
❸ ALIGN BEARING WITH HOUSING

- Align insert with housing to assure proper lubrication.



Monitor operating bearing during first 48 hours for unusual vibration or temperatures.

⚠WARNING
Failure to observe safety precautions could cause personal injury or equipment damage.



⚠WARNING
Do not operate without guards. Turn off power to install or service

⚠CAUTION
High voltage and rotating parts may cause serious or fatal injury. Turn off power to install or service.

See page 156 for trademark acknowledgments.

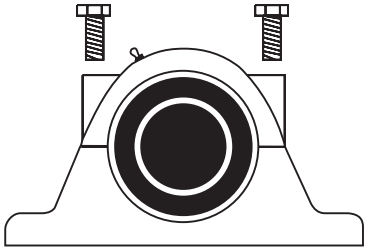
Tapered Roller Bearings

TAPERED ROLLER INSERT REMOVAL AND REPLACEMENT

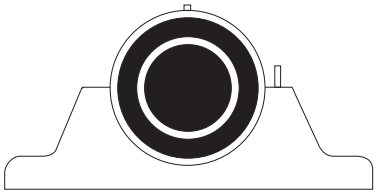
950 / 970 tapered roller insert/cartridge removal and replacement procedures.

REMOVAL

❶ REMOVE CAP BOLTS



❷ REMOVE TOP HALF OF HOUSING



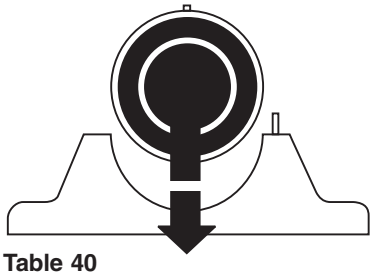
❸ REMOVE BEARING FROM SHAFT

- Loosen Set Screws.
- Slide bearing off shaft.
- Do not hammer bearing off of shaft.

REPLACEMENT

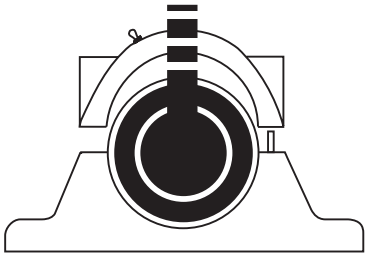
❶ LOAD NEW INSERT

- Place cartridge into housing.



❷ REPLACE TOP HOUSING HALF

- Align location pin with location hole.
- Be sure the lock pin is not put into the lubrication hole.



❸ REPLACE CAP BOLTS

- Tighten down to recommended torque (Refer to table.)

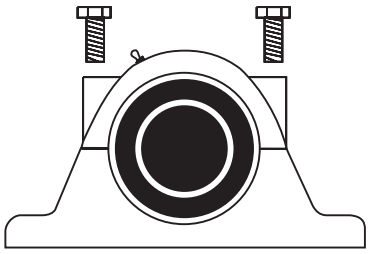


Table 40

Housing Cap Bolt Torques 950 and 970 Series Pillow Blocks		
Shaft Size (Inches)	Housing Cap Bolt Torques	
	(Ft-Lbs)	(In-Lbs)
1 3/8, 1 7/16	30-35	360-400
1 1/2, 1 11/16	40-45	465-515
1 3/4, 1 15/16, 2	50-55	615-680
2 3/16	70-75	815-900
2 1/4, 2 7/16, 2 1/2	70-80	860-950
2 11/16, 2 15/16, 3	90-100	1100-1215
3 3/16, 3 7/16, 3 1/2	170-190	2040-2250
3 15/16, 4	265-295	3190-3525
4 7/16, 4 1/2	120-135	1470-1620
4 15/16, 5	195-220	2360-2610

Table 41

Housing Cap Bolt Torques 950 and 970 Series Flanged Housings		
Shaft Size (Inches)	Housing Cap Bolt Torques	
	(Ft-Lbs)	(In-Lbs)
1 3/8, 1 7/16	30-35	365-405
1 1/2, 1 11/16	40-45	465-515
1 3/4, 1 15/16, 2	50-55	615-680
2 3/16	65-75	810-895
2 1/4, 2 7/16, 2 1/2	70-80	855-945
2 11/16, 2 15/16, 3	90-100	1095-1210
3 3/16, 3 7/16, 3 1/2	170-190	2040-2255
3 15/16, 4	265-295	3190-3530
4 7/16, 4 1/2	325-360	3910-4320
4 15/16, 5	505-560	6065-6705

⚠WARNING

Failure to observe safety precautions could cause personal injury or equipment damage.

⚠WARNING

Do not operate without guards. Turn off power to install or service

⚠CAUTION

High voltage and rotating parts may cause serious or fatal injury. Turn off power to install or service.

See page 156 for trademark acknowledgments.

Ball Bearing Lubrication

Table 42 Ball Bearing Grease

Thickener	Lithium Complex
Oil	Petroleum
Thickness	NLGI 2
Operating Temperature	-20°F to 200°F Intermittent to 250°F

Consult EPT Mounted Bearing Tech Support for current grease specification.

Grease compatibility is critical. Relubricate with a grease that is compatible with grease supplied from the factory. Consult your grease supplier for compatibility.

Frequency of Lubrication

The tables below state general lubrication recommendations based on our experience and are intended as suggested or starting points only. For best results, specific applications should be monitored regularly and lubrication intervals and amounts adjusted accordingly.

Table 43 Ball Bearings

Speed	Temperature	Cleanliness	Greasing Interval
100 RPM	-20°F to 125°F	Clean	4-10 months
500 RPM	-20°F to 150°F	Clean	1-4 months
1000 RPM	-20°F to 200°F	Clean	1 week to 1 month
1500 RPM	-20°F to 200°F	Clean	Biweekly
1500 to Maximum Catalog Rating	Up to 150°F	Dirty	Daily to 1 week
	150°F to 200°F	Dirty	Daily to 1 week
	-20°F to 200°F	Very Dirty	Daily to 1 week
	-20°F to 200°F	Extreme Conditions	Daily to 1 week

Table 44 Ball Bearings

Ball Bearings	
Shaft Size (Inches)	**Grease Charge (Ounces)**
1/2 to 3/4	0.03
7/8 to 1 3/16	0.10
1 1/4 to 1 1/2	0.15
1 11/16 to 1 15/16	0.20
2 to 2 7/16	0.30
2 1/2 to 2 15/16	0.50
3 to 3 7/16	0.85
3 1/2 to 4	1.50

See page 156 for trademark acknowledgments.

Tapered Roller Bearing Lubrication

Table 45 Tapered Roller Bearing Grease

Thickener	Lithium 12 Hydroxy Stearate
Oil	Petroleum
Thickness	NLGI 2
Operating Temperature	-20°F to 200°F Intermittent to 250°F
EP Additive	Yes

Consult EPT Mounted Bearing Tech Support for current grease specification.

Grease compatibility is critical. Relubricate with a grease that is compatible with grease supplied from the factory. Consult your grease supplier for compatibility.

Frequency of Lubrication

The tables below state general lubrication recommendations based on our experience and are intended as suggested or starting points only. For best results, specific applications should be monitored regularly and lubrication intervals and amounts adjusted accordingly.

Table 46 Tapered Roller Bearings

Speed	Temperature	Cleanliness	Greasing Interval
100 RPM	-20°F to 125°F	Clean	1-4 months
500 RPM	-20°F to 150°F	Clean	1 week to 1 month
1000 RPM	-20°F to 210°F	Clean	1-2 weeks
1500 to Maximum Catalog Rating	-20°F to 150°F	Dirty	Daily to 1 week
	150°F to 200°F	Dirty	Daily to 1 week
	-20°F to 200°F	Very Dirty *	Daily to 1 week
	-20°F to 200°F	Extreme Conditions *	Daily to 1 week

Table 47 920/970 Tapered Roller Bearings

Spherical Roller Bearings	
Shaft Size (Inches)	**Grease Charge (Ounces)**
1 3/16 to 1 1/4	0.10
1 3/8 to 1 7/16	0.22
1 1/2 to 1 11/16	0.32
1 3/4 to 2	0.50
2 to 2 3/16	0.55
2 1/4 to 2 1/2	0.65
2 11/16 to 3	0.85
3 3/16 to 3 1/2	1.25
3 15/16 to 4	2.50
4 7/16 to 4 1/2	3.10

900/950 Series Tapered Roller Bearings

900 and 950 Series tapered roller bearings utilize a labyrinth seal design which requires frequent relubrication to maintain maximum effectiveness. Grease should be added to fully purge and fill the grease cavity.

In dry, contaminated environments, daily relubrication is required for 900 and 950 series bearings. For moist, wet or contaminated environments consider 920 or 970 Series products.*

Spherical Roller Bearing Lubrication

Table 48 Tapered Roller Bearing Grease

Thickener	Lithium 12 Hydroxy Stearate
Oil	Petroleum
Thickness	NLGI 2
Operating Temperature	-20°F to 200°F Intermittent to 250°F
EP Additive	Yes

Consult EPT Mounted Bearing Tech Support for current grease specifications.

Grease compatibility is critical. Relubricate with a grease that is compatible with grease supplied from the factory. Consult your grease supplier for compatibility.

Frequency of Lubrication

The tables below state general lubrication recommendations based on our experience and are intended as suggested or starting points only. For best results, specific applications should be monitored regularly and lubrication intervals and amounts adjusted accordingly.

Table 49 Spherical Roller Bearings

Speed	Temperature	Cleanliness	Greasing Interval
100 RPM	-20°F to 125°F	Clean	1-4 months
500 RPM	-20°F to 150°F	Clean	1 week to 1 month
1000 RPM	-20°F to 210°F	Clean	1-2 weeks
1500 to Maximum Catalog Rating	Up to 150°F	Dirty	Daily to 1 week
	Over 150°F	Dirty	Daily to 1 week
	Up to 250°F	Very Dirty *	Daily to 1 week
	Up to 250°F	Extreme Conditions *	Daily to 1 week

Table 50 Spherical Roller Bearings w/Contact Seal

Spherical Roller Bearings	
Shaft Size (Inches)	**Grease Charge (Ounces)**
1 3/16 to 1 1/4	0.10
1 3/8 to 1 7/16	0.22
1 1/2 to 1 11/16	0.32
1 3/4 to 2	0.50
2 to 2 3/16	0.55
2 1/4 to 2 1/2	0.65
2 11/16 to 3	0.85
3 3/16 to 3 1/2	1.25
3 15/16 to 4	2.50
4 7/16 to 4 1/2	3.10
4 15/16 to 5	4.75

Spherical Roller Bearings w/Labyrinth Seals

1000 and 1100 series spherical roller bearings utilize a labyrinth seal design which requires frequent relubrication to maintain maximum effectiveness. Therefore, grease should be added to fully purge and fill the seal cavity.

In dry, contaminated environments, daily relubrication is required. For moist, wet or contaminated environments consider Contact Seal.*

See page 156 for trademark acknowledgments.

Fittings and Adapters

Table 51 Ball Bearings Units

BEARING UNIT SERIES	SHAFT SIZE			
	1/2 to 1 1/4S	1 1/4 to 2 15/16	1	1 3/16 to 3 15/16
VF2B - 200	1641B	1610B		
VF2B - 300			1641B	1610B
VF2E - 100, 200	1641B	1610B		
VF2E - 100M	1641B	1641B		
VF2S - 100, 200	1641B	1610B		
VF2S - 300			1641B	1610B
VF2S - 100M	1641B	1641B		
VF3E - 100M	1641B	1641B		
VF3S - 100M	1641B	1641B		
VF4B - 200	1641B	1610B		
VF4B - 300			1641B	1610B
VF4E - 100, 200	1641B	1610B		
VF4S - 100, 200	1641B	1610B		
VF4S - 300			1641B	1610B
VFCB - 200	1641B (to 2 3/16)	1610B (2 1/4 up)		
VFCB - 300			1641B	1610B
VFCS - 200	1641B (to 2S)	1610B (2 up)		
VFCS - 300			1641B (to 2)	1610B (2 3/16 up)
VPE - 100, 200	1641B	1610B		
VPE - 100M	1641B	1641B		
VPLB - 200	1641B	1610B		
VPLE - 100, 200	1641B	1610B		
VPLS - 100, 200	1641B	1610B		
VPB - 200	1641B	1610B		
VPB - 300			1641B	1610B
VPS - 100, 200	1641B	1610B		
VPS - 300			1641B	1610B
VPS - 100M	1641B	1641B		
VTBE - 200	1641B	1610B		
VTBE - 100	1641B	1610B		
VTBS - 100, 200	1641B	1610B		
VTWE - 100, 200	1911B	1613B		
VTWS - 100, 200	1911B	1613B		
VTWS - 300			1911B	1613B

Table 52 Tapered Roller and Spherical Roller Bearings Units

900	1610B - All PB, FB, FC	1612B - All TU
920	1610B - All PBE, FBE	1613B - All TUE
950	1610B - All	
970	1610B - All	
1000 - Thru 4"	1610B - All SPB, SFB	1641B - All SFC
SPB1000F - 4 7/16 - 41 5/16	1627B - 1/4 PTF	
1100	1610B - All	
22200	PLUGGED	
22500	PLUGGED	

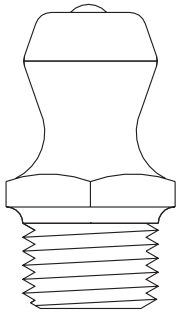
See page 156 for trademark acknowledgments.

Browning Fittings/Adapters

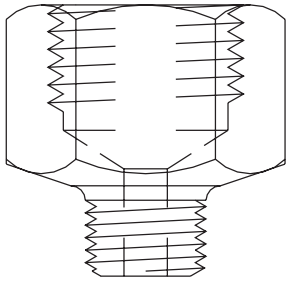
Table 53

Fitting Or Adapter		Fitting Or Adapter		Fitting	Fitting	Fitting
1641B ¼-28 NF	51942 ¼-28 Male NF to 1/8 NPT Fem	1610B 1/8 NPT THD	43761 1/8 NPT Male to 1/8 NPT Fem	1911b ¼-28 NF	1613B 1/8 PTF	1612B 1/8 PTF

1641B **Or** **51942**

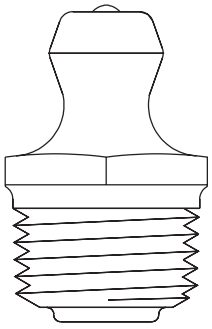


1/4-28 NF

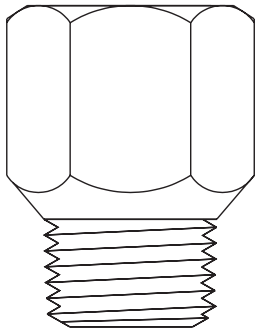


1/4-28 Male NF to 1/8 NPT Female

1610B **Or** **43761**

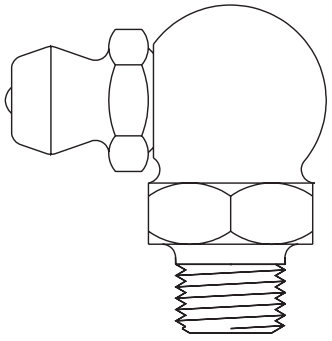


1/8 NPT THD

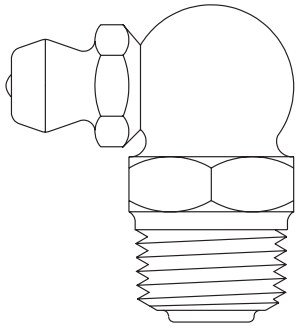


1/8 NPT Male to 1/8 NPT Female

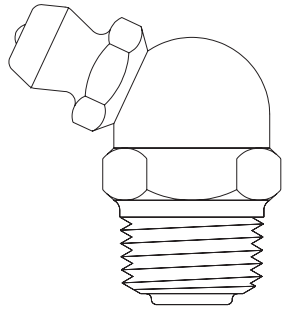
1911B **1631B** **1612B**



1/4-28 NF



1/8 PTF



1/8 PTF

See page 156 for trademark acknowledgments.

Browning Ball Bearings - Vibration Analysis

The following is the procedure to be followed in calculating the fundamental frequencies for Browning ball bearings.

1. If the Browning insert number is known, proceed to step 2. For housed units, identify the bearing insert number by looking up the unit in the Browning Catalog, then proceed to step 2.
2. Find your Browning insert number in Table 54 below and identify the series.
3. Select the vibration geometry information (O, I, B, F) from Table 54 based on bearing series.
4. Use this information to calculate the fundamental bearing frequencies by multiplying the factor in Table 55 by the shaft speed (in RPM).

Outer Ball Pass Freq. (Hz)	=	O x RPM
Inner Ball Pass Freq. (Hz)	=	I x RPM
Ball Spin Freq. (Hz)	=	B x RPM
Fundamental Train Freq. (Hz)	=	F x RPM

TABLE 54 BROWNING INSERT SERIES

SERIES	VALULINE INSERT							
L-10	X-108	X-110	X-208	X-210				
2-012	X-112	X-212						
2-015	X-114	X-115	X-116	X-214	X-215	X-216		
2-13	X-118	X-119	X-120S	X-218	X-219	X-220S	X-316	
2-17	X-120	X-122	X-123	X-220	X-222	X-223	X-319	X-320
2-19	X-124	X-224	X-323					
2-111	X-126	X-127	X-128	X-226	X-227	X-228	X-324	
2-115	X-130	X-131	X-132S	X-230	X-231	X-232S	X-327	X-328
2-23	X-132	X-134	X-135	X-232	X-234	X-235	X-331	X-332
2-27	X-236	X-239	X-335	X-336				
2-211	X-240	X-243	X-339	X-340				
2-215	X-247	X-343						
2-33	X-347	X-348						
2-38	X-355	X-356						
2-43	X-363							

Where X denotes one of: LE, LS, RUBRE, RUBRS, SLE, LRE, LRS, SLS, VB, VE, VER, VS,

Browning Ball Bearings - Vibration Analysis

TABLE 55 VIBRATION INFORMATION

SERIES	Pitch Diameter (in) dM	Number of Balls N	BallDiameter (in) D	Factor For Outer Ball Pass O	Factor For Inner Ball Pass I	Factor For Ball Spin B	Factor For Fund. Train F
L-10	1.138	9	1/4	0.0585	0.0915	0.0361	0.0065
2-012	1.345	9	9/32	0.0593	0.0907	0.0381	0.0066
2-015	1.544	10	9/32	0.0682	0.0985	0.0442	0.0068
2-13	1.812	9	3/8	0.0595	0.0905	0.0385	0.0066
2-17	2.115	9	7/16	0.0595	0.0905	0.0386	0.0066
2-19	2.362	9	1/2	0.0591	0.0909	0.0376	0.0066
2-111	2.596	10	1/2	0.0673	0.0994	0.0417	0.0067
2-115	2.763	10	1/2	0.0683	0.0984	0.0445	0.0068
2-23	3.051	10	9/16	0.0680	0.0987	0.0437	0.0068
2-27	3.356	10	5/8	0.0678	0.0989	0.0432	0.0068
2-211	3.846	10	11/16	0.0684	0.0982	0.0451	0.0068
2-215	4.045	11	11/16	0.0761	0.1072	0.0476	0.0069
2-33	4.362	11	3/4	0.0759	0.1074	0.0470	0.0069
2-37	4.627	11	25/32	0.0762	0.1071	0.0479	0.0069
2-38	4.922	10	7/8	0.0685	0.0981	0.0454	0.0069
2-43	5.808	10	1-1/16	0.0681	0.0986	0.0440	0.0068

See page 156 for trademark acknowledgments.

Browning 900 & 950 Tapered Roller Bearings - Vibration Analysis

The following is the procedure which should be followed in calculating the fundamental frequencies for Browning 900 and 950 tapered roller bearings.

1. The bore size for each bearing to be analyzed must be known.
2. Once the bore size is known the appropriate vibration factors (O,I,B and F) can be chosen from Table 56.
3. These factors can then be used to calculate the fundamental bearing frequencies as follows:

Roller Spin Frequency (Hz)	=	O	x	RPM
Inner Race Pass Frequency (Hz)	=	I	x	RPM
Outer Race Pass Frequency (Hz)	=	B	x	RPM
Fundamental Train Frequency (Hz)	=	F	x	RPM

Table 56 Vibration information

SHAFT SIZE (INCHES)	FACTOR FOR ROLLER SPIN O	FACTOR FOR INNER ROLLER PASS I	FACTOR FOR OUTER ROLLER PASS B	FACTOR FOR FUND. TRAIN F
1	0.1197	0.1794	0.1373	0.0072
1 3/16 1 1/4 1 3/8	0.1136	0.1616	0.1218	0.0072
1 7/16 1 1/2	0.1195	0.1795	0.1372	0.0072
1 5/8 1 11/16 1 3/4	0.1284	0.1873	0.1460	0.0073
1 7/8 1 15/16 2 2 1/8	0.1216	0.1792	0.1375	0.0072
2 3/16	0.1345	0.1958	0.1542	0.0073
2 1/4 2 7/16 2 1/2	0.1397	0.2043	0.1623	0.0074
2 11/16 2 3/4 2 15/16	0.1578	0.2202	0.1798	0.0075
3 3 3/16	0.1535	0.2116	0.1718	0.0075
3 7/16 3 1/2	0.1706	0.2368	0.1966	0.0076
3 15/16 4	0.2258	0.3035	0.2631	0.0077
4 7/16 4 1/2	0.2204	0.2953	0.2547	0.0077
4 15/16 5	0.2324	0.3210	0.2790	0.0078

Browning 920 & 970 Series Tapered Roller Bearings - Vibration Analysis

The following is the procedure which should be followed in calculating the fundamental frequencies for Browning 920 and 970 tapered roller bearings.

1. The bore size for each bearing to be analyzed must be known.
2. Once the bore size is known the appropriate vibration factors (O,I,B, and F) can be chosen from Table 57.
3. These factors can then be used to calculate the fundamental bearing frequencies as follows:

Roller Spin Frequency (Hz)	= O x RPM		
Inner Race Pass Frequency (Hz)	= I x RPM		
Outer Race Pass Frequency (Hz)	= B x RPM		
Fundamental Train Frequency (Hz)	= F x RPM	- shaft rotation	

Table 57 Vibration Information

SHAFT SIZE (INCHES)	FACTOR FOR ROLLER SPIN O	FACTOR FOR INNER ROLLER PASS I	FACTOR FOR OUTER ROLLER PASS B	FACTOR FOR FUND. TRAIN F
1 3/16 1 1/4	0.1258	0.1782	0.1384	0.0073
1 3/8 1 7/16	0.1173	0.1892	0.0442	0.0072
1 1/2 1 11/16	0.1132	0.1710	0.1290	0.0072
1 3/4 1 15/16 2	0.1083	0.1626	0.1207	0.0071
2 3/16	0.1216	0.1792	0.1375	0.0072
2 1/4 2 7/16 2 1/2	0.1345	0.1958	0.1542	0.0073
2 11/16 2 15/16 3	0.1578	0.2202	0.1798	0.0075
3 3/16 3 7/16 3 1/2	0.1706	0.2368	0.1966	0.0076
3 15/16 4	0.1645	0.2376	0.1958	0.0075
4 7/16 4 1/2	0.1600	0.2289	0.1878	0.0075
4 15/16 5	0.1587	0.2292	0.1875	0.0075

See page 156 for trademark acknowledgments.

Browning 1000/1100 Series Spherical Roller Bearings - Vibration Analysis

The following is the procedure which should be followed in calculating the fundamental frequencies for Browning 1000/1100 spherical roller bearings.

1. The bore size for each bearing to be analyzed must be known.
2. Once the bore size is known the appropriate vibration factors (O,I,B, and F) can be chosen from Table 58.
3. These factors can then be used to calculate the fundamental bearing frequencies as follows:

Roller Spin Frequency (Hz)	= O x RPM	
Inner Race Pass Frequency (Hz)	= I x RPM	
Outer Race Pass Frequency (Hz)	= B x RPM	
Fundamental Train Frequency (Hz)	= F x RPM	- shaft rotation

Table 58 Vibration Information

SHAFT SIZE (INCHES)	FACTOR FOR ROLLER SPIN O	FACTOR FOR INNER ROLLER PASS I	FACTOR FOR OUTER ROLLER PASS B	FACTOR FOR FUND. TRAIN F
1 1/8 1 3/16 1 1/4 1 7/16 1 1/2	0.0989	0.1548	0.1118	0.0070
1 11/16 1 3/4	0.1075	0.1628	0.1205	0.0071
1 15/16 2	0.1161	0.1803	0.1363	0.0072
2 3/16	0.1114	0.1717	0.1283	0.0071
2 7/16 2 1/2	0.1140	0.1807	0.1360	0.0072
2 11/16 2 3/4 2 15/16 3	0.1268	0.1974	0.1526	0.0073
3 3/16 3 7/16 3 1/2	0.1213	0.1889	0.1444	0.0072
3 11/16 3 15/16 4	0.1185	0.1799	0.1367	0.0072
4 7/16	0.1162	0.1803	0.1364	0.0072
4 15/16	0.1186	0.1798	0.1368	0.0072

Browning 22500 Series Spherical Roller Bearings - Vibration Analysis

The following is the procedure which should be followed in calculating the fundamental frequencies for Browning 22500 series spherical roller bearings.

1. The bore size for each bearing to be analyzed must be known.
2. Once the bore size is known the appropriate vibration factors (O,I,B and F) can be chosen from Table 59.
3. These factors can then be used to calculate the fundamental bearing frequencies as follows:

Roller Spin Frequency (Hz)	= O x RPM	
Inner Race Pass Frequency (Hz)	= I x RPM	
Outer Race Pass Frequency (Hz)	= B x RPM	
Fundamental Train Frequency (Hz)	= F x RPM	- shaft rotation

Table 59 Vibration Information

SHAFT SIZE (INCHES)	FACTOR FOR ROLLER SPIN O	FACTOR FOR INNER ROLLER PASS I	FACTOR FOR OUTER ROLLER PASS B	FACTOR FOR FUND. TRAIN F
2 7/16" 2 1/2"	0.1268	0.1786	0.1381	0.0073
2 11/16" 2 3/4"	0.1253	0.1788	0.1378	0.0073
2 15/16" 3"	0.1209	0.1701	0.1299	0.0072
3 3/16"	0.1213	0.17	0.13	0.0072
3 7/16" 3 1/2"	0.1185	0.1799	0.1366	0.0072
3 11/16" 3 15/16" 4"	0.1162	0.1803	0.1364	0.0072
4 3/16"	0.1173	0.1801	0.1366	0.0072
4 7/16" 4 1/2"	0.1186	0.1798	0.1368	0.0072
4 15/16" 5"	0.1189	0.1798	0.1369	0.0072
5 3/16"	0.1154	0.1804	0.1362	0.0072
5 7/16" 5 1/2"	0.1157	0.1804	0.1363	0.0072
5 15/16" 6"	0.1155	0.1804	0.1363	0.0072
6 7/16" 6 1/2"	0.1194	0.1892	0.1442	0.0072
6 15/16" 7"	0.1180	0.1800	0.1367	0.0072
7 3/16"	0.1155	0.1804	0.1363	0.0072
7 1/2" 7 15/16" 8"	0.1155	0.1803	0.1364	0.0072

See page 152 for trademark acknowledgments.